C/025/0005
Received 6/12/15

Alton Coal Tract Lease by Application
Supplemental Draft
Environmental Impact Statement

BLM

KANAB FIELD OFFICE

National System of Public Lands
U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

June 2015

DOI-BLM-UT-C040-2015-0011-EIS

United States Department of the Interior

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IN REPLY REFER TO:
DOI-BLM-UT-C040-2015-0011-EIS
UTU-081895

Dear Reader:

Enclosed is the supplemental draft environmental impact statement (SDEIS) entitled *Alton Coal Tract Lease By Application Supplemental Draft Environmental Impact Statement*. This document has been developed in accordance with the National Environmental Policy Act of 1969 and the Mineral Leasing Act of 1920, as amended. The Bureau of Land Management (BLM) prepared this document in consultation with several cooperating agencies, consisting of the Office of Surface Mining Reclamation and Enforcement (OSM), the U.S. Environmental Protection Agency (EPA), the National Park Service, the Utah Department of Natural Resources, Division of Oil, Gas, and Mining, and Kane County. The U.S. Fish and Wildlife Service (USFWS), the U.S. Army Corps of Engineers (USACE), and Garfield County were also formally offered cooperating agency status. Though no formal response from these entities was received, they contributed to this document's preparation. This document takes into account public comments received during the scoping effort as well as issues raised during the public comment period on the DEIS. The SDEIS is open for a 60-day review period beginning the date the EPA publishes the notice of availability (NOA) of the SDEIS in the *Federal Register*.

The BLM has prepared this SDEIS to analyze and disclose the potential impacts of leasing and mining the coal reserves in the Alton Coal Lease by Application (LBA) tract. The BLM's decision with respect to the LBA tract will pertain only to leasing the tract; however, the potential impacts of mining the tract are analyzed because a coal mine would be a logical extension of a lease. The LBA tract consists of approximately 3,576 acres of land in Kane County, Utah, approximately 0.10 mile south of the town of Alton and 2.9 miles east of U.S. Route 89. The tract is in the BLM Kanab Field Office planning area, which is managed under the *Kanab Field Office Record of Decision and Approved Resource Management Plan* (BLM 2008a).

The public was provided a 90-day scoping period at the beginning of the EIS process to identify potential issues and concerns associated with the Proposed Action. Scoping comments were used to help develop alternatives to the Proposed Action, to guide the analysis of potential effects from leasing and mining the tract, and to identify potential mitigations for inclusion in the DEIS.

On November 4, 2011, an NOA for the *Alton Coal Tract Lease by Application DRAFT Environmental Impact Statement* (DEIS) was published in the *Federal Register* (76: 68501–68502). Based on comments received on the DEIS, the BLM decided to prepare this SDEIS for

public review before preparing and distributing a final EIS (FEIS). Comments on the DEIS were used to produce this SDEIS.

The SDEIS analyzes three action alternatives: 1) Alternative B (the Proposed Action), 2) Alternative C (Reduced Tract Acreage and Seasonal Restrictions), and 3) Alternative K1 (Reduced Tract Acreage). Alternative C was developed in response to issues raised during the scoping period. Alternative K1 was developed in response to issues raised during the public comment period on the DEIS. This SDEIS analyzes a No Action Alternative, which would be to not offer the lease tract for leasing at this time and to maintain existing land uses in the tract area.

The SDEIS is not a decision document. Rather, it is a document that will inform the BLM's final decision on whether to hold a competitive lease sale for the tract and, in the event that the BLM decides to offer the tract for competitive leasing, what stipulations would be attached to the lease. The SDEIS is being released to inform the public and interested parties of the potential impacts associated with implementing any action alternative.

Comments will be accepted for 60 days following the EPA's publication of the NOA in the *Federal Register*. The BLM is also publishing an NOA in the *Federal Register*. All substantive comments and information submitted will be summarized and addressed in the FEIS. This is also the location where substantive comments on the DEIS will be summarized and addressed. Substantive comments are ones that, with reasonable basis, question the accuracy of the information in the SDEIS, the adequacy of, methodology for, or assumptions used for the environmental analysis; present new information relevant to the analysis; present reasonable alternatives other than those analyzed; and cause changes or revision in one or more of the alternatives. The BLM can best use your comments if received within the review period. Comments received after the end of the 60-day comment period will be considered in preparation of the FEIS as time permits. Comments may be submitted electronically to the attention of Keith Rigtrup at blm_ut_kn_altoncoal@blm.gov. Please include "Alton Coal Lease SDEIS" in the subject line of your email message. Comments may be submitted by mail to Alton Coal Tract LBA EIS, Keith Rigtrup, BLM, Kanab Field Office, 669 South Highway 89A, Kanab, Utah 84741. Comments may also be submitted by fax to (435) 644-1299.

The BLM will host public meetings in Alton, Kanab, Panguitch, Cedar City, and Salt Lake City, Utah, to provide an overview of the results of the analysis in the document and to take public comments on the SDEIS. The public meetings will be announced by the BLM at least 15 days in advance through public notices and local media news releases and mailings.

Before including your address, telephone number, email address, or other personal identifying information with your comments, please be advised that your entire comment, including your personal identifying information, may be made publicly available at any time. Although you may ask us in your comment to withhold your personal identifying information from public review, we cannot guarantee that we will be able to do so. All submissions from organizations and businesses, and from individuals identifying themselves as representatives or officials of organization or businesses, will be available for public inspection in their entirety.

Printed copies of the SDEIS are available for review at the following BLM offices:

BLM
Kanab Field Office
669 South Highway 89A
Kanab, Utah 84741

BLM
Utah State Office
440 West 200 South, Suite 500
Salt Lake City, Utah 84101

The document may also be viewed at the following public libraries:

- Kanab City Library, 374 North Main, Kanab, Utah 84741
- Panguitch Public Library, 25 South 200 East, Panguitch, Utah 84759
- Cedar City Library, 303 North 100 East, Cedar City, Utah 84720
- Salt Lake City Main Library, 210 East 400 South, Salt Lake City, Utah 84111

You may also access the document on the Internet at the BLM Utah homepage.

If you have any questions or would like to obtain an additional copy of this SDEIS in either hardcopy or PDF, please contact Keith Rigtrup at (435) 865-3063.

Sincerely,

Harry Barber
Kanab Field Office Manager

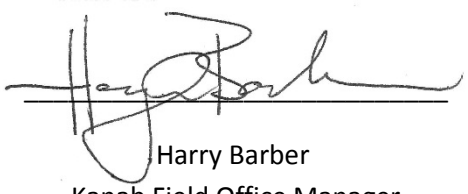
U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

ALTON COAL TRACT LEASE BY APPLICATION
SUPPLEMENTAL DRAFT ENVIRONMENTAL IMPACT STATEMENT

Bureau of Land Management
Utah State Office

Prepared by
Bureau of Land Management
Kanab Field Office

June 2015



Harry Barber
Kanab Field Office Manager

Alton Coal Tract LBA
Kane County, Utah
Supplemental Draft Environmental Impact Statement

Lead Agency: U. S. Department of the Interior, Bureau of Land Management

Type of Action:	Draft	(X)	Final	( )
	Administrative	( )	Legislative	( )

Jurisdiction: Color Country District Office, Kanab Field Office, Utah

Abstract: This supplemental draft environmental impact statement (SDEIS) analyzes and discloses the potential environmental effects of leasing and mining the coal reserves in the Alton Coal Lease by Application (LBA) Tract encompassing approximately 3,576 acres of land in Kane County near the town of Alton. The SDEIS was prepared by the Bureau of Land Management (BLM) in response to Alton Coal Development's LBA for federal coal, which would be recovered using primarily surface-mining methods.

The Proposed Action would include approximately 3,576 acres, of which approximately 2,280 acres are federal surface and mineral estate and 1,296 acres are split estate (private surface estate and federal mineral estate). Recoverable portions of in-place coal reserves would be mined over approximately 25 years using surface-mining methods where the depth of overburden is less than approximately 200 feet, and using underground methods where the depth of overburden exceeds approximately 200 feet. The choice of mining method, however, could vary from the 200-foot overburden threshold depending on the coal thickness, overburden type, overburden (highwall) stability, underground mining techniques available, operating and capital costs, and coal market economics. Approximately 2 million tons of coal per year would be mined once topsoil stockpiling and initial overburden removal have occurred. Reclamation would be concurrent with mining over the course of the estimated 25-year mine life and would be followed by a minimum 10-year reclamation and revegetation monitoring period. The proposed Alton Coal Tract would include centralized and dispersed facilities and the relocation of KFO Route 116. Under the Proposed Action, the tract would be offered for lease at a sealed-bid, competitive lease sale, subject to lease stipulations developed for the tract.

The SDEIS also analyzes a No Action Alternative (as required by the National Environmental Policy Act) that would not authorize the leasing of the tract, and two action alternatives to the Proposed Action (Alternative C and Alternative K1). Under Alternative C, the Alton Coal Tract would be modified to exclude a portion of the tract near the town of Alton. Further, certain mining activities in the southern portion of the tract would be subject to seasonal restrictions to reduce impacts to the local Greater Sage-Grouse population. Under Alternative K1, the Alton Coal Tract would be modified to exclude two portions of the tract: a portion near the town of Alton as well as a southern portion. Under Alternatives C and K1, the modified tract would be offered for lease at a sealed-bid, competitive lease sale, subject to lease stipulations developed for the tract.

Five open house public meetings will be held in Alton, Kanab, Panguitch, Cedar City, and Salt Lake City, Utah. The public meetings will be announced by the BLM at least 15 days in advance through public notices and local media news releases and mailings. The purpose of these meetings is to provide information on the proposed coal lease tract and to collect public comment on the adequacy and accuracy of the analysis in the SDEIS. Comments will be accepted for 60 days following the EPA's publication of the Notice of Availability (NOA) in the *Federal Register*, for use in development of the final EIS. Comments may be submitted to Alton Coal Tract LBA EIS, Keith

Rigtrup, BLM, Kanab Field Office, 669 South Highway 89A, Kanab, Utah 84741, or sent to blm_ut_kn_altoncoal@blm.gov. Comments may also be faxed to (435) 644-1299. For information about the proposed coal lease tract or to view the SDEIS, visit the BLM Utah homepage on the Internet.

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EXECUTIVE SUMMARY

ES.1. EXECUTIVE SUMMARY

ES.1.1. Background

In November 2004, a lease by application (LBA) was filed by Alton Coal Development, LLC (ACD) to mine federal coal, using primarily surface-mining methods, near the town of Alton, Utah (Case Number UTU 081895). This application was filed under the regulations at 43 Code of Federal Regulations (CFR) 3425, Leasing on Application. This application includes nearly 2,683 surface acres and approximately 38 million tons of recoverable coal. The Bureau of Land Management (BLM) reconfigured the tract to exclude approximately 40 acres and to include approximately 898 additional acres. Acreage added to the tract during tract reconfiguration was based on the identification of additional recoverable coal reserves not included in the original LBA and on additional surface acreage deemed necessary for mine operations. The Alton Coal Tract LBA (hereafter the Alton Coal Tract or tract), as reconfigured, contains approximately 3,581 surface acres and 44.9 million tons of recoverable coal reserves.

To process an LBA, the BLM must establish the fair market value of the coal in the tract by evaluating many factors, including the quantity and quality of the coal reserves. Any subsequent mining plan must achieve maximum economic recovery of the tract's coal resources in the context of applicable laws, regulations, and lease stipulations. In addition, before the BLM can issue a decision to offer a tract for lease, the BLM must fulfill the requirements of the National Environmental Policy Act (NEPA) by evaluating the potential environmental impacts of leasing and mining federal coal. If the tract is leased, the successful lessee would also have to obtain a permit from the Utah Division of Oil, Gas, and Mining (DOGM). The DOGM permitting process is described in the following paragraphs.

On November 28, 2006, a notice of intent (NOI) to prepare an EIS for the Alton Coal Tract was published in the *Federal Register* (*Federal Register* 71:68834–64435). This was followed on November 4, 2011, with a notice of availability (NOA) for the *Alton Coal Tract Lease by Application DRAFT Environmental Impact Statement* (DEIS) (*Federal Register* 76: 68501–68502). Based on comments received on the DEIS, the BLM decided to prepare this SDEIS for public review prior to preparing and distributing an FEIS. For a summary of comments received on the DEIS, see Section 5.1.2.1. Substantive comments received on the DEIS resulted in changes presented in this SDEIS. However, formal responses to substantive comments on the DEIS will be provided in the FEIS, along with responses to comments on this SDEIS.

This EIS has been prepared to evaluate the potential direct, indirect, and cumulative environmental impacts of leasing and recovering the federal coal included in the tract, based on ACD's preliminary plan and reasonable alternatives. The BLM will use the analysis in this EIS to decide whether to a) hold a competitive, sealed-bid lease sale for the tract; b) hold a competitive, sealed-bid lease sale for a modified tract; or c) reject the lease application and not offer the tract for sale at this time. However, the final BLM-accepted mine plans could be different. The impacts of mining the coal are considered in this EIS because mining the coal is a logical consequence of issuing a lease. A record of decision (ROD) will be issued, and if the decision is to offer the tract for lease, a sale would be held. If a lease sale is held, the bidding at the sale would be open to any qualified bidder; it would not be limited to the applicant. A lease would be issued to the highest bidder at the sale, provided that the high bid meets or exceeds the fair market value of the coal, as determined by BLM's economic evaluation and if the U.S. Department of Justice (DOJ) determines that there would be no antitrust violations.

In return for receiving a lease, the successful lessee must pay the federal government a bonus equal to the amount it bids at the time the lease sale is held (the bonus can be paid in five yearly installments), make annual rental payments to the federal government, and make royalty payments to the federal government

when the coal is sold. Federal bonus, rental, and royalty payments are nearly equally divided with the state in which the lease is located. A federal coal lease grants the lessee the exclusive right to seek a mining permit for, and to mine coal on, the leased tract. The lessee is subject to the terms of the lease, the mining permit, and applicable state and federal laws. Before a new leased tract can be mined, the lessee must have their detailed plans approved (in the permit application package) to conduct mining and reclamation operations.

Given known technology and technological and demographic trends overall, United States' demand for coal is expected to increase by approximately 0.1% per year through the year 2040 (DOE/EIA 2013a). Though coal-fired power plants are projected to account for less electricity generation in 2040 compared to 2011 (down from 42% in 2011 to 35% in 2040), in the United States, approximately 90% of coal consumption is in the electric power sector (DOE/EIA 2013b), and between 2011 and 2040, total electricity demand in the United States is expected to increase by 42% (DOE/EIA 2010). Furthermore, in Utah, approximately 82% of electrical energy is generated from coal (VandenBerg 2010). Although most (approximately 90%) coal consumption in the United States is in the electric power sector, coal is also used (approximately 10% of total demand) in the industrial sector. In the industrial sector, coal is used in the manufacture or production of cement, paper, chemicals, food, primary metals, and coal-based synthetic fuels (coal-to-liquids). It is also used in the industrial sector as a direct source of heat, as a feed stock, as boiler fuel for the production of process steam and electricity, and in the production of coke, which is used as an energy source and as a raw material in steel production. Nonelectric power sector demand for coal is expected to slightly decline by 2040, though demand for coal in the emerging coal-to-liquids industry is expected to increase. Most of the projected increase in overall United States' demand for coal, therefore, is expected from the electric power sector (DOE/EIA 2010). Additionally, coal exports are expected to increase.

According to the Utah Geological Survey (VandenBerg et al. 2012), coal production in Utah decreased by 3.8 million tons (17.3%) between 2008 and 2011 due to reserve depletion and difficult mining conditions. Utah's long-term (50 years and beyond) coal future is shifting because currently accessible coal reserves are being depleted in the Book Cliffs and Wasatch Plateau coal fields. This makes it necessary for the coal industry to look to other Utah coal fields to meet future demands for coal. Further, most Utah mining companies have leased coal reserves for approximately 10–15 years of production; however, they are having difficulty adding new leases to extend their reserves. As a result, Utah coal production is outpacing tonnage leased (Utah Geological Survey 2012b, 2012c; VandenBerg 2010).

All coal reserves in the Alton Coal Tract are federally owned, though surface ownership is mixed. Under Alternative B (the Proposed Action; discussed in greater detail in Chapter 2), approximately 2,280 surface acres of the tract are in federal (BLM) ownership and 1,296 surface acres are in private ownership (eight different private surface owners). Private surface owners may be qualified to give consent to mine federal minerals under the private surface owner's estate[1] according to 43 CFR 3400.0-5. Surface ownership under Alternative A (No Action Alternative), Alternative C, and Alternative K1 is also discussed in greater detail in Chapter 2. If this EIS process results in a competitive lease sale for the tract, a final determination of private surface-owner qualification and private surface-owner consultation would take place after a ROD is

[1] Under the regulations under 43 CFR 3400.0-5(gg)(1), (2), and (3) qualified surface owner means the natural person or persons (or corporation, the majority stock of which is held by a person or persons otherwise meeting the requirements of this section) who: 1) hold legal or equitable title to the surface of split estate lands; 2) have their principal place of residence on the land, or personally conduct farming or ranching operations upon a farm or ranch unit to be affected by surface-mining operations; or receive directly a significant portion of their income, if any, from such farming and ranching operations; and 3) have met the above conditions for a period of at least three years, except for persons who gave written consent less than three years after they met the above requirements. In computing the three-year period the authorized officer shall include periods during which title was owned by a relative of such person by blood or marriage if, during such periods, the relative would have met the requirements of this section. A qualified private surface owner is legally qualified to give consent to mine federal minerals under the private surface owner's estate.

issued, but prior to leasing. All surface owners have been notified of the Proposed Action. Further, both hardcopy and electronic versions of this EIS have been distributed to surface owners.

ES.1.2. Purpose and Need for Action

The purpose of the federal action is to respond to an LBA for federal coal reserves on up to 3,581 acres of BLM-administered and private surface in Kane County, Utah, near the town of Alton. The need for the federal action is established by the BLM's responsibilities under the Federal Land Policy and Management Act (FLPMA) and the Mineral Leasing Act (MLA), as amended by the Federal Coal Leasing Act Amendments of 1976. Private development of federal coal reserves is integral to the BLM coal leasing program under authority of the FLPMA and MLA. The MLA requires that all public lands not specifically closed to leasing be open to lease for the exploration and development of mineral resources. Further, a primary goal of the Energy Policy Act of 2005 is to add energy supplies from diverse sources, including domestic oil, gas, and coal, as well as hydropower and nuclear power.

ES.1.3. Public Involvement

ES.1.3.1. Public Scoping

The public scoping process was initiated on November 28, 2006, when the BLM published an NOI to prepare an EIS to offer the tract for competitive leasing. Five public scoping meetings followed. Each meeting was conducted in an open house format with BLM and ACD personnel present to answer questions and provide information. Other resources available at the public scoping meetings included informational display boards; one video explaining the conceptual mining and reclamation sequence; one video explaining a potential transportation route, including truck details; and comment forms on which to submit comments at the meetings. Informational display boards and comment forms are available in the *Alton Coal Tract LBA EIS Public Scoping Report* (SWCA Environmental Consultants [SWCA] 2007b), which was prepared following completion of the scoping process. Copies of the videos are available at the BLM Kanab Field Office (BLM-KFO). The 90-day scoping period closed on February 26, 2007.

ES.1.3.2. The Comment Process on the Draft Environmental Impact Statement

The comment process on the DEIS was initiated on November 4, 2011, when the BLM published an NOA of the Alton Coal Tract LBA EIS. Five public meetings, including one public hearing, followed. Each meeting was conducted in an open house format, with BLM personnel present to answer questions and provide information. Other resources available at the public meetings included informational display boards, hard copies of the DEIS, and compact disc copies of the DEIS. The Fair Market Value Hearing was conducted to comply with the BLM's coal leasing regulations at 43 CFR 3425.1. The Fair Market Value Hearing was part of the Cedar City meeting. The public comment period on the DEIS was scheduled for 60 days. However, the public requested an extension of the public comment period. Ultimately, the 85-day public comment period on the DEIS closed on January 27, 2012.

ES.1.3.3. Summary of Issues

Issues and concerns raised during the public scoping process were divided into three categories: 1) those to be addressed through implementation and documentation of certain elements of the NEPA process; 2) those to be addressed through analysis of direct, indirect, and cumulative impacts; and 3) those to be addressed through the formulation of alternatives. The substantive issues and concerns are outlined below.

The public and agencies provided substantive comments on the DEIS. Per the BLM NEPA Handbook (BLM 2008c) definition, *substantive* comments do one or more of the following:

- Question, with reasonable basis, the accuracy of information in the EIS
- Question, with reasonable basis, the adequacy of, methodology for, or assumptions used for the environmental analysis
- Present new information relevant to the analysis
- Present reasonable alternatives other than those analyzed in the EIS
- Cause changes or revisions in one or more of the alternatives

Substantive comments on the DEIS have been addressed in this SDEIS. Formal responses to comments on the DEIS will be published, along with formal responses to comments on the SDEIS, in the FEIS.

ES.1.3.3.1. LEASING TIMELINE

When is the appropriate time to begin the analysis of the EIS and consideration of leasing? Is it following submission of a detailed mining plan, or following a commitment to mine and sell coal?

ES.1.3.3.2. PREVIOUS DECISIONS AND LEGISLATION AND NEED FOR AN ENVIRONMENTAL IMPACT STATEMENT

Previous studies of coal mining at Alton have been completed. Why is additional environmental analysis required? How would the proposed lease meet the suitability requirements of Surface Mining Control and Reclamation Act (SMCRA) of 1977?

ES.1.3.3.3. BUREAU OF LAND MANAGEMENT'S ROLE AND POLICIES REGARDING PUBLIC LAND USE

What is BLM's responsibility to protect the public lands, while providing for their use and sustainability?

ES.1.3.3.4. SCOPE

Is coal mining on private lands and public (BLM) lands a connected action under NEPA, which would require an analysis in a single EIS?

ES.1.3.3.5. PURPOSE AND NEED

What are the public purposes and needs for this action and how will they affect the eventual decision to offer the tract for leasing or not? How will energy demand affect BLM's decision to lease the tract?

ES.1.3.3.6. ALTERNATIVES

What reasonable alternatives to the applicant's proposal to lease and mine federal coal reserves in the tract should BLM consider?

ES.1.3.3.7. AFFECTED ENVIRONMENT AND IMPACTS ANALYSIS

What would be the effects of the coal mine on the natural and cultural environment in and near the tract and on the human values connected to those resources and their uses?

ES.1.3.3.8. DATA AND EXPERTISE FOR IMPACTS ANALYSIS

What data and scientific literature must be collected and analyzed to ensure an adequate analysis of the effects of the Proposed Action and alternatives?

ES.1.3.3.9. COOPERATING AND CONSULTING AGENCIES

What role will BLM's partners play in the EIS analysis of the Proposed Action and the alternatives?

ES.1.3.3.10. PUBLIC INVOLVEMENT

What opportunities for public involvement should BLM provide to ensure disclosure of information and informed decision making?

ES.1.3.3.11. NATIONAL ENVIRONMENTAL POLICY ACT DECISIONS

What role will local residents play in the decision-making process? How will impacts to Bryce Canyon National Park affect the Alton LBA tract leasing decision?

ES.1.3.3.12. AESTHETIC RESOURCES

What effect would noise created by coal mining and coal truck traffic have on the relative noise levels existing in the area, including the town of Alton, adjacent public lands, and nearby parks and monuments? What effect would the coal mining operation, coal truck traffic, and dust and smoke caused by mining have on the local landscape (scenic quality) and surrounding viewshed? How would lighting for nighttime mining operations affect the darkness of the night sky from key nighttime-sky viewing points such as Bryce Canyon National Park?

ES.1.3.3.13. AIR RESOURCES

How would the development and operation (e.g., construction, heavy equipment use, and transportation of coal) of the coal mine affect local and regional air quality? What effect would deposition of dust and other pollutants produced by mining have on water, wildlife, vegetation, recreation uses, and structures in and adjacent to the mining operations? What contribution would emissions produced from the mining operation, transportation of coal, and ultimate use of the coal add to the cumulative effect of carbon emissions on global warming?

ES.1.3.3.14. CULTURAL RESOURCES

What impact would coal mining and transporting coal have on prehistoric and historic cultural resources in the tract and along transportation routes? How would coal mining and transporting coal impact existing and eligible National Register sites and traditional cultural properties?

ES.1.3.3.15. FIRE MANAGEMENT

What impact would coal mining, including truck traffic to transport coal, have on air quality; and how would those changes in air quality affect BLM's ability to conduct prescribed burning in wildland-urban interface areas to reduce threats of wildfire? What impact would revegetation required for tract reclamation have on wildland fire frequency and severity?

ES.1.3.3.16. GEOLOGY AND MINERALS

How would coal mining on the tract affect geologic and mineral resources present there? What geologic hazards exist on and near the tract and how would they be affected by mining operations and vice versa? What is the potential for underground coal fires and what are the environmental consequences of an underground fire?

ES.1.3.3.17. HAZARDOUS MATERIALS

What impact would generation, temporary storage, and disposal of hazardous materials (such as those regulated under the Comprehensive Environmental Response, Compensation, and Liability Act, the Superfund Amendments and Reauthorization Act, the Resource Conservation and Recovery Act, and the Toxic Substances Control Act) have on people and the environment?

ES.1.3.3.18. LAND USE AND ACCESS

What impact would development and operation of a coal mine have on local private property values and future development potential of those lands? What effect would coal truck traffic have on private property values along transportation routes (e.g., KFO Route 116 and U.S. Route 89 [US-89])? What impact would development and operation of a coal mine have on the town of Alton (e.g., air quality, aesthetics, water quality, and public health and safety)? How would public lands be used and managed following reclamation of the coal mine?

ES.1.3.3.19. LIVESTOCK GRAZING

How would coal development, mining, and reclamation affect grazing and pasturelands around Alton (e.g., removal of vegetation and restricted access to grazing land for ranchers), and how would that affect short-term and long-term livestock grazing and production? How would road dust and exhaust from passing coal truck traffic affect vegetation growth and palatability of the vegetation for livestock forage?

ES.1.3.3.20. PALEONTOLOGY

How would surface disturbance (e.g., surface mining, road construction, and facilities construction) created by coal mining impact fossils in the tract?

ES.1.3.3.21. PUBLIC HEALTH AND SAFETY

How would coal truck traffic through towns along potential transportation routes affect public safety in those towns and along the travel routes? What risk of injury and adverse health effects would the mine workers and local public face as a result of mine development? (Public Health and Safety issues are addressed in the socioeconomics section of Chapter 4.)

ES.1.3.3.22. SPECIAL DESIGNATIONS

How would coal mining impact the air quality, viewshed, and nighttime sky of Bryce Canyon National Park? How would coal mining impact the resources (air quality, viewsheds, recreation, etc.) of other nearby parks and monuments, including the Grand Staircase-Escalante National Monument; Arches, Canyonlands, and Zion national parks; Kodachrome State Park; and Red Canyon and other public lands? How would the noise and presence of coal truck traffic affect the visitor experience at these parks, monuments, and public lands? (Issues related to special designations are addressed in the aesthetic resources, air resources, and recreation sections of Chapter 4.)

ES.1.3.3.23. SPECIAL STATUS SPECIES

How would development and operation of a coal mine impact special status species and their habitat, including Greater Sage-Grouse (*Centrocercus urophasianus*), Utah prairie dog (*Cynomys parvidens*), Burrowing Owl (*Athene cunicularia*), Bald Eagle (*Haliaeetus leucocephalus*), Golden Eagle (*Aquila chrysaetos*), pygmy rabbit (*Brachylagus idahoensis*), Northern Goshawk (*Accipiter gentilis*), Ferruginous Hawk (*Buteo regalis*), Bonneville cutthroat trout (*Oncorhynchus clarkii utah*), and Utah Physa? What effect would noise from coal truck traffic have on special status species? How would wildlife mortality from vehicle collisions affect wildlife populations? (Special status species issues are addressed in the special status species section of Chapter 4.)

ES.1.3.3.24. SOCIOECONOMICS

What opportunities for employment would development and operation of the coal mine create? How would development and operation of a coal mine affect local businesses and tourism? How would development and operation of a coal mine affect tax revenues to Kane and Garfield counties? What, if any, additional county services (ambulance, firefighting, sheriff, etc.) would be required to support the mine? What effect would coal truck traffic have on tourism and local businesses along potential transportation routes? What are the economic benefits of development and operation of a coal mine? How would development of the tract contribute to the supply of coal available for use in the region?

ES.1.3.3.25. SOILS

What impact would development and operation of a coal mine (including final reclamation) have on productivity of soils, including biological soil crusts? How would coal mining affect farmland productivity? What impact would development and operation of a coal mine have on soil stability and rates of erosion? What effect would road and coal dust and exhaust from mine-related traffic have on soil productivity in proximity to roads in the tract and along potential transportation routes?

ES.1.3.3.26. VEGETATION

How would coal development, mining, and reclamation affect vegetation communities in the tract? What effect would coal mining, including truck traffic to transport coal, have on the introduction and spread of exotic vegetation? What effect would road and coal dust and exhaust from mine-related traffic have on the health and growth of vegetation adjacent to roads in the tract and along potential transportation routes?

ES.1.3.3.27. WATER RESOURCES

What effect would development and operation of a coal mine have on surface-water and groundwater quality and quantity? How would mining operations impact riparian areas and wetlands? How would coal mining affect the possible existence of an alluvial valley floor (AVF) near the town of Alton? How would road and coal dust and vehicle exhaust, resulting from operation of coal trucks, impact the quality of water bodies adjacent to transportation routes?

ES.1.3.3.28. WILDLIFE

What effect would development and operation of a coal mine, including reclamation and coal truck traffic, have on wildlife and their habitat, including nocturnal wildlife?

ES.1.3.3.29. ALTERNATIVES

This section summarizes the comments provided in the public scoping process and comment process on the DEIS that specifically refer to or specifically indicate the need for the development of alternatives to the Proposed Action. Issues summarized above were also considered in the alternatives development process along with past, present, and reasonably foreseeable future actions.

Chapter 2 provides a complete description of the alternatives analyzed in detail and those alternatives considered but eliminated from detailed analysis. A brief rationale for the dismissal of alternatives is provided there.

Decision to Lease

- Should the BLM delay offering the tract for lease until less-impacting extractive processes are developed?
- The BLM should consider leasing all known recoverable coal resources rather than just the tract in question for which an LBA was received.
- Based on the analyses in the DEIS, the BLM should update their coal unsuitability determinations in the KFO RMP and reconfigure the tract to match these updated determinations.

Mining Methods and Coal Production

- What are practical alternatives to surface mining in the tract?

Energy Conservation and Alternative Sources of Energy

- The BLM should consider foregoing the coal lease and instead promote energy conservation and the development of alternative forms of energy such as solar, wind, and natural gas.

Air Quality

- How would operations be designed and controlled to prevent the release of unsafe levels of nitrogen dioxide?
- How would operations be designed and controlled to ensure no violations of National Ambient Air Quality Standards (NAAQS)?

Special Designations

- Coal mining should be designed, and modified if needed, to reduce impacts to Bryce Canyon National Park.
- Is it feasible and reasonable to consider alternative locations for leasing rather than the LBA tract currently under consideration?

Transportation

- What methods of coal transportation (e.g., slurry, rail, and truck) should be considered to reduce impacts to the environment, nearby communities, and public safety?
- Construction of a power plant next to the mine should be considered as a way to eliminate impacts from coal truck traffic.
- Restrictions on coal truck traffic before sunrise and after sunset should be considered to improve public safety and reduce transportation-related impacts to wildlife.

Cultural Resources

- The BLM should consider an alternative tract configuration that excludes all cultural resources sites eligible for the National Register of Historic Places.

Wildlife and Special Status Species

- The BLM should consider an alternative that places seasonal timing restrictions on the entire tract.

ES.1.4. Alternatives

Four alternatives are analyzed in detail in this EIS: Alternative A (No Action), Alternative B (the Proposed Action), Alternative C (Reduced Tract Acreage and Seasonal Restrictions), and Alternative K1 (Reduced Tract Acreage).

Department of Interior regulations (43 CFR 46.425) suggest that departmental agencies should identify preferred alternatives in draft EISs but do not require them to do so. The BLM did not identify a preferred alternative or preferred alternatives in the Alton Coal Tract LBA DEIS published in November 2011, because no such preference existed at that time. That continues to be the case now. In developing this SDEIS, the BLM has conducted extensive consultation and coordination activities with its cooperating agencies and other agencies with special expertise (see Section 1.3 and Chapter 5). The BLM has also expanded the range of alternatives analyzed in detail, with the inclusion of Alternative K1 for detailed analysis.

ES.1.4.1. Alternative A: No Action

Under the No Action Alternative, ACD's application to lease the coal included in the Alton Coal Tract under the Proposed Action, Alternative C, or Alternative K1 would not be approved, the LBA tract would not be offered for competitive lease sale, and the coal included in the LBA tract would not be mined.

Rejection of the application would not affect mining activities on private land adjacent to the tract (i.e., the Coal Hollow Mine). The Coal Hollow Mine consists of approximately 635 acres of land and approximately 5 million short tons of recoverable coal leased from private surface and mineral owners. Average annual coal production is anticipated to be approximately 2 million tons and mining activities are expected to employ approximately 160 persons (100 at the tract and 60 for coal trucking operations); though initial operations and startup would employ much less (approximately 16 employees). Rejection of the application would also not affect an anticipated permit application from ACD to mine fee coal on private lands adjacent to the tract to the north.

To compare the economic and environmental consequences of mining these lands versus not mining them, this EIS was prepared under the assumption that the tract would not be mined in the near future if the No Action Alternative is selected. Under the No Action Alternative, the public lands within the tract would continue to be managed in accordance with the *Kanab Field Office Record of Decision and Approved Resource Management Plan* (RMP) (BLM 2008b), hereafter referred to as the KFO RMP. The area would be managed for livestock grazing, recreation (primarily hunting and off-highway vehicle [OHV] use), and wildlife habitat. Vegetation treatments (wildlife habitat treatments, watershed treatments, livestock rangeland treatments, wildland fire use, fuels treatments, and stewardship contracting) would occur in support of the BLM's Healthy Lands Initiative. Private lands within the tract would continue to be used for livestock grazing, farming, and dispersed recreation (especially hunting).

ES.1.4.2. Alternative B: Proposed Action

Under the Proposed Action, recoverable portions of in-place coal reserves would be mined over approximately 25 years using 1) surface-mining methods where the depth of overburden would be less than approximately 200 feet, and 2) underground methods (development mining, auger mining, highwall mining, longwall mining, and/or room and pillar mining) where the depth of overburden would exceed approximately 200 feet. The choice of mining method, however, can vary from the 200-foot overburden threshold depending on the coal thickness, overburden type, overburden (highwall) stability, underground mining techniques available, operating and capital costs, and coal market economics. (The analysis considers surface disturbance for surface mining up to approximately 200 feet of overburden removal.) Approximately 2 million tons of coal per year would be mined once topsoil stockpiling and initial overburden removal have occurred. Reclamation would be concurrent with mining over the course of the estimated 25-year life of the mine and would be followed by a minimum 10-year reclamation and revegetation monitoring period.

BLM independently evaluated the coal resources in the tract. BLM estimates that the tract under the Proposed Action consists of approximately 59.6 million tons of in-place coal and that an estimated 44.9 million tons of coal would be recoverable from the tract. BLM estimates that in areas where coal would be mined by surface-mining methods, approximately 90% of the estimated in-place coal reserves could be recoverable. However, in those portions of the tract that must be mined by underground mining methods, approximately 50% of the in-place coal reserves could be recoverable. These percentage recovery estimates are based on assumptions about the depth to which the use of surface-mining methods is feasible and the extent of the no-coal zone.

Details on mining methods, facilities, reclamation, and operations can be found in Chapter 2 of the EIS.

ES.1.4.3. Alternative C: Reduced Tract Acreage and Seasonal Restrictions

Under Alternative C, the Alton Coal Tract would be modified to exclude the northwest portion (Block NW) of the tract near the town of Alton. Further, certain mining activities in the southern portion of the tract (Block S) would be subject to seasonal restrictions to reduce impacts to the local Greater Sage-Grouse population. Under Alternative C, the modified tract would be offered for lease at a sealed-bid, competitive lease sale, subject to lease stipulations developed for the tract.

Consistent with the purpose and need for the federal action, the intent of Alternative C is to resolve, in part or in full, the following: issues related to the local sage-grouse population, noise, and visual impacts to the town of Alton, and issues related to conflicting land uses (agriculture versus surface mining). Alternative C may also reduce impacts to other resources such as springs and surface waters, wildlife, soils, public health and safety, paleontological resources, cultural resources, and vegetation.

Under Alternative C, the tract would be modified to exclude Block NW. The modified tract would encompass approximately 3,173 acres, of which approximately 2,280 acres are federal surface and mineral estate and 893 acres are split estate; private surface estate and federal mineral estate. As under the Proposed Action, not all surface estates, private or federal, have coal reserves underlying them.

Under Alternative C, recoverable portions of in-place coal reserves would be mined over approximately 21 years using surface-mining methods where the depth of overburden is approximately 200 feet or less, and using underground methods (development mining, auger mining, highwall mining, longwall mining, and/or room and pillar mining) where the depth of overburden exceeds approximately 200 feet. The choice of mining method, however, can vary from the 200-foot overburden threshold depending on the

coal thickness, overburden type, overburden (highwall) stability, underground mining techniques available, operating and capital costs, and coal market economics. Approximately 2 million tons of coal per year would be mined once topsoil stockpiling and initial overburden removal have occurred. Reclamation would be concurrent with mining over the course of the estimated 21-year life of the mine and would be followed by a potential 10-year reclamation and revegetation monitoring period. Although reclamation would be concurrent with mining, due to seasonal timing restrictions required under Alternative C for Block S of the tract, the length of time between initiation of the mining process and concurrently occurring reclamation activities would be extended for some pits.

BLM estimates that the tract configuration under Alternative C includes approximately 52.1 million tons of in-place coal and that an estimated 38.1 million tons of coal would be recoverable from the tract. Percentage coal recovery estimates for surface versus underground mining are the same under Alternative C as they are under the Proposed Action.

Details on mining methods, facilities, reclamation, and operations can be found in Chapter 2 of the EIS.

ES.1.4.4. Alternative K1: Reduced Tract Acreage

In the DEIS, the BLM eliminated Alternative K1 from detailed analysis. However, based on public comments on the DEIS, the BLM has decided to consider Alternative K1 in detail in this SDEIS. Under Alternative K1, the Alton Coal Tract would be modified to exclude Block NW and Block S. Under this alternative, the modified tract would be offered for lease at a sealed-bid, competitive lease sale, subject to lease stipulations developed for the tract.

Consistent with the purpose and need for the federal action, the intent of Alternative K1 is to resolve, in part or in full, the following: issues related to the local Greater Sage-Grouse population; noise and visual impacts to the town of Alton; and issues related to conflicting land uses (agriculture versus surface mining). Alternative K1 may also reduce impacts to other resources such as springs and surface waters, wildlife, soils, public health and safety, paleontological resources, cultural resources, vegetation, and air quality.

Under Alternative K1, recoverable portions of in-place coal reserves would be mined over approximately 16 years using surface-mining methods where the depth of overburden is approximately 200 feet, and using underground methods (development mining, auger mining, highwall mining, longwall mining, and/or room and pillar mining) where the depth of overburden exceeds approximately 200 feet. The choice of mining method, however, can vary from the 200-foot overburden threshold depending on the coal thickness, overburden type, overburden (highwall) stability, underground mining techniques available, operating and capital costs, and coal market economics. Approximately 2 million tons of coal per year would be mined once topsoil stockpiling and initial overburden removal have occurred. Reclamation would be concurrent with mining over the course of the estimated 16-year life of the mine and would be followed by a potential 10-year reclamation and revegetation monitoring period.

BLM estimates that the tract configuration under Alternative K1 includes approximately 40.9 million tons of in-place coal and that an estimated 30 million tons of coal would be recoverable from the tract. Percentage coal recovery estimates for surface versus underground mining are the same under Alternative K1 as they are under the Proposed Action.

ES.1.4.5. Reasonably Foreseeable Coal Loadout Location and Transportation Route

Future foreseeable transportation of mined coal reserves from the tract to market would be dictated by existing roads and market conditions at the time of sale of mined coal. The applicant (ACD) is currently planning on moving mined coal from the tract to market via development of a rail loadout at Iron Springs, approximately 11 miles west of Cedar City, Utah. To access this loadout, coal transportation would occur via KFO Route 116 continuing north through the town of Alton, north on US-89, west on State Road 20 (SR-20), and finally south on Interstate 15 exiting at exit number 59 in Cedar City. For analysis in this EIS, the construction and use of the rail loadout at Iron Springs would be the reasonably foreseeable loadout location associated with the tract, and the approximately 110-mile route would be the reasonably foreseeable transportation route linking the tract and the loadout. Map 2.6 shows the rail loadout location and the transportation route.

If the BLM decides to hold a competitive lease sale and a lease is issued to ACD, it is reasonably foreseeable that they would use this rail loadout and transportation route, as conditions dictate, to transport and market the federal coal reserves in the tract. A successful bidder other than ACD may identify a different loadout location, transportation route, or both, to move mined coal from the tract to market. Given that BLM cannot predict the plans of a successful bidder other than ACD, the following would be speculative: attempting to guess at loadout location (or locations), transportation route (or routes), or both, that may be used by a successful bidder other than ACD. Therefore this EIS gives no consideration to other potential loadout locations and transportation routes.

Though transportation of mined coal reserves would not be regulated under the leasing action, all coal haul trucks used for transporting mined coal reserves from the tract would be operated as per federal and Utah Department of Transportation (UDOT) requirements. For analysis of all actions alternatives in this EIS, it is anticipated that in addition to the operation of permitted and regulated haulage from the tract to a reasonably foreseeable rail loadout, the use of best available control measures to minimize and/or eliminate fugitive coal dust along the transportation route would be installed on all coal haul vehicles. Operation of the rail loadout facility would be regulated by DOGM (under their coal regulatory program). In addition to various federal, state, and local regulatory requirements for its operation, it is also anticipated that best available control measures for fugitive coal dust would be implemented at the associated loadout facility.

ES.1.4.6. Permits, Approvals, Regulatory Compliance, Mitigation, and Monitoring

There are certain permits, approvals, and regulatory compliance, mitigation, and monitoring measures that would be required under the action alternatives. These are related to 1) compliance with existing local, state, and federal rules and regulations with respect to surface coal mining and 2) special requirements (i.e., design features) developed for the tract. See Table 1.5.1 in Chapter 1 and Table 2.6.1 in Chapter 2 for a summary of permits, approvals, and regulatory compliance requirements for the successful bidder.

ES.1.4.7. Alternatives Eliminated from Detailed Analysis

Aside from the Proposed Action, Alternative C, and Alternative K1, 19 alternatives were considered during the course of alternatives development and following publication of the DEIS. Each of these was eliminated from detailed analysis in the EIS. Chapter 2, Section 2.7.1 provides descriptions of these alternatives along with the rationale for eliminating each of them from detailed analysis.

In addition to the alternatives eliminated, certain components of the federal action would be independent of the elements of any alternative. In the EIS, these were considered options, any one of which could be chosen in combination with any alternative and would not necessitate changes in the alternative, or vice versa. Those options that were considered but not carried forward for detailed analysis are described in Chapter 2, Section 2.7.2 of the EIS.

ES.1.5. Affected Environment

ES.1.5.1. General Setting

The tract is in Kane County, Utah, approximately 0.10 mile south of the town of Alton and 2.9 miles east of US-89. The tract occurs at approximately 6,900 feet above sea level in the semiarid foothills of the Colorado Plateau Semidesert Province (Woods et al. 2001) of south-central Utah. The tract is in the Alton Amphitheater between the Paunsaugunt Plateau to the northeast, Long Valley (Virgin River) to the west, and approximately 5.0 miles north and northwest of the Grand Staircase-Escalante National Monument. Mean annual precipitation in the town of Alton was approximately 16 inches from 1928 to 2006, and mean annual temperature for this same time period was 60.2°F (2006). The Colorado Plateau province receives most of its precipitation in the form of snow during the winter months; summers are generally hot and dry with a mid- to late-summer monsoon period when frequent thunderstorms occur (2006). The tract is characterized by a series of low-rising hills and benches cut by the north-south-running Kanab Creek and by long diagonal washes that flow from the surrounding mountain ranges. Vegetation in the tract is typical of the Great Basin and includes large open areas of bunchgrass, perennial grasses, and sagebrush interspersed with dense stands of juniper and pinyon pine (*Pinus edulis*). Tall fir trees are apparent on the more rugged mountains to the northwest of the tract. Generally, the vegetation cover is continuous across most of the tract, broken by two-track dirt roads and fence lines.

Under the Proposed Action, the tract includes approximately 3,576 acres of land. All coal resources within the tract are federally (BLM) owned and managed. Approximately 2,280 surface acres of the tract are under BLM management, and the remaining 1,296 surface acres are under private ownership. Under Alternative C and Alternative K1, the tract includes approximately 3,173 acres and 2,114 acres of land, respectively. As under the Proposed Action, all coal resources under these tract configurations are federally (BLM) owned and managed. Surface ownership under Alternative C and Alternative K1 is split between the BLM (2,280 acres under Alternative C and 1,235 acres under Alternative K1) and private owners (893 acres under Alternative C and 880 acres under Alternative K1). Coal reserves are known to occur beneath approximately 1,750, 1,454, and 869 acres of the tract under the Proposed Action, Alternative C, and Alternative K1, respectively.

The entirety of the reasonably foreseeable coal haul transportation route also occurs in southern Utah, more specifically in Kane, Garfield, and Iron counties near Alton, Hatch, Panguitch, and Cedar City. The total length of the route is approximately 115 miles. Existing vehicle traffic consists of local residents; tourists to Bryce Canyon National Park, Dixie National Forest, and BLM-administered lands; and commercial truck traffic. Transportation infrastructure associated with the tract and the coal haul transportation route includes numerous unimproved, dirt roads, KFO Route 116, US-89, SR-20, Interstate 15, and SR-56. The Union Pacific Railroad 21-mile branch to the Salt Lake City-Los Angeles line is west of Cedar City, Utah, and is the nearest railroad facility to the tract.

ES.1.6. Environmental Consequences

Table 2.8.1 in Chapter 2 of this EIS summarizes the potential impacts to each element of the environment under each alternative. Detailed descriptions of the impacts are provided in Chapter 4, along with a

discussion of potential mitigation measures, residual impacts, short-term uses versus long-term productivity, and irretrievable and irreversible commitments of resources that would result from implementation of the alternatives. Cumulative impacts to resource values and uses of the tract that would result from implementation of the alternatives are also discussed in Chapter 4. A summary describing the general conclusions of the effects analysis is presented below.

ES.1.6.1. Aesthetic Resources

Increased ambient noise levels, short-term modifications to visual resources, and perceptible increase in nighttime skyglow would occur from the implementation of the action alternatives. The town of Alton would experience the greatest increases in ambient noise levels from the mining activities in Block NW under Alternative B. An initial lumens cap of 3.15 million lumens would be applied to all action alternatives to limit nighttime skyglow effects. Full cut-off shielding would also be required under all action alternatives for fixed position lighting at centralized facilities.

ES.1.6.2. Air Resources

Under the action alternatives, emissions of criteria air pollutants (PM_{10}, $PM_{2.5}$, nitrogen oxides, volatile organic compounds, carbon monoxide, and sulfur dioxide) and hazardous air pollutants (benzene, toluene, xylenes, formaldehyde, acetaldehyde, and acrolein) would occur as a result of mining and transporting coal. Based on the near-field modeling results, all air pollutant concentrations resulting from emissions would be within NAAQS under the Proposed Action and Alternative K1 for the 200-foot overburden removal scenario. Air pollutant concentrations resulting from emissions under Alternative C would also be within NAAQS for all pollutants except PM_{10} (24-hour standard), which would be violated under the 200-foot overburden removal scenario.

Air quality impacts in the far-field (for criteria pollutants as well as visibility) would be within regulatory limits for the three action alternatives. Nitrogen and sulfur deposition would likewise be below threshold values.

ES.1.6.3. Cultural Resources

Archaeological sites eligible for the National Register would be adversely impacted from the implementation of the action alternatives due to surface-disturbing activities associated with mining operations. Underground mining may impact unidentified archaeological sites. Native American traditionally cultural properties would be subject to adverse effects for the life of the mine under the action alternatives. The Panguitch Historic District and Utah Heritage Highway 89/Mormon Pioneer Heritage Area (US-89) would be subject to adverse effects for the life of the mine under the action alternatives. Sites that are not directly impacted by surface mining or facilities construction would be subject to a greater degree of threat for vandalism, looting, or unintentional destruction due to an increased human presence in the area.

ES.1.6.4. Fire Management

Under the action alternatives, vegetation would be removed during mining and construction activities. The revegetation of the disturbed areas would lead to reduced Fire Regime Condition Class ratings. Increased movement to and from the tract by construction equipment and coal haul trucks would increase the risk of fuel leakage and/or sparking that could lead to wildfires in the tract and adjacent transportation corridors. Construction of centralized and dispersed facilities could lead to an increased risk of human-caused wildfires from construction activities in undisturbed vegetation on and adjacent to the tract

ES.1.6.5. Geology and Minerals

The action alternatives would result in long-term adverse effects to topography, physiography, and stratigraphy. Removal of coal by underground mining methods would cause subsidence on portions of the tract overlying the area of coal removal. There would be a slight fault hazard from underground mining, and a risk to structures occurring on landslide deposits. Impacts to coal resources would occur from the production of recoverable coal over the life of the mine. Oil and gas resources would be unavailable for extraction for the life of the mine.

Because most of the burnt shale deposits in the tract have been or would be mined by the time a decision is made by the BLM on this EIS, direct impacts to burnt shale resources are unlikely. However, if mining operations expose burnt shale in the tract, they would likely be lost as economically recoverable resources because they would be mixed with other overburden during reclamation. If segregated from other overburden sufficiently, they may remain usable.

Salable pediment gravels in the tract would be directly impacted under the Proposed Action due to mixing with other overburden following surface mining.

It is not known how common septarian nodules are in the tract, or if they are present in sufficient density to be economically viable for development. However, any nodules present at or near the surface in areas that would be surface mined would be at risk of burial during reclamation, and therefore may be less accessible for development. The nodules would not be removed and would therefore still be available as a resource, but their development would likely be less economically viable and their concentration in any area would likely be reduced.

ES.1.6.6. Hazardous Materials

Movement to and from the tract by service vehicles and coal haul trucks has the potential to increase the risk of fuel leakage or solid waste spills in the tract and adjacent transportation corridors. Accidental or inadvertent leakages from storage tanks would also be possible. Spills would have adverse effects on soil, water, vegetation, and wildlife resources. Potential impacts would be mitigated through standard operating procedures and through the creation of other plans and policies that relate to hazardous materials disposal, transport, and emergency response.

ES.1.6.7. Land Use and Access

Under the action alternatives, lands within the tract would be unavailable for grazing and recreation access during mining activities (life of mine). Agriculture, tourism, and recreation activities would also be prohibited or restricted during the life of the mine.

ES.1.6.8. Livestock Grazing

The action alternatives would result in the temporary loss of forage as a result of restricted access, spread of noxious weeds, and/or decreased palatability from construction dust and the temporary loss of water sources and range improvements, such as fences and cattle guards. In addition, the action alternatives would result in a loss of animal unit months within allotments over the life of the mine and reclamation period. Impacts to livestock could occur from mortality from vehicle collisions.

ES.1.6.9. Paleontology

The coal extraction process would result in the permanent removal of fossils from the Dakota Formation and from the Tropic Shale in the tract, resulting in a long-term decrease in the productivity of paleontological resources in the area. It is anticipated that a large number of significant fossils would be destroyed or removed from context, particularly in the Tropic Shale.

ES.1.6.10. Recreation

The action alternatives would have some adverse effects to recreation resources. Lands available for dispersed recreation would be lost from mining over the life of the mine. Some designated OHV routes would be temporarily removed over the life of the mine. In addition, there would be some indirect adverse effects from displacement of recreational users onto adjacent public lands, which would affect recreational experiences of users on those lands.

ES.1.6.11. Socioeconomics

Implementation of the action alternatives would result in an increase to the number of jobs, income, and additional taxes, fee, and payments. There would be an adverse impact to recreation, and adverse impacts to sense of community, social well-being, and tourism-related businesses. There would be impacts to population, housing, public health, safety, and environmental justice populations. The environmental justice impacts would result from noise and visual impacts to the town of Alton from mining activities under all action alternatives. Environmental justice impacts to the town of Alton would also occur from potential exceedances of the NAAQS for PM_{10} under Alternative C.

ES.1.6.12. Soils

Implementation of the action alternatives would result in disturbance of soil resources through large-scale removal, stockpiling, and replacement of soils during mining. The disturbance (impact) caused by removing and replacing soils would be long term. Most of the impacts (caused by facilities, some roads, etc.) would be long-term impacts, persisting for the life of the mine.

ES.1.6.13. Transportation

The action alternatives would result in an increase in commuter traffic and coal truck traffic through Cedar City, Hatch, and Panguitch. However, levels of service are not expected to change under any of the action alternatives.

ES.1.6.14. Vegetation

Vegetation would be removed for surface mining, construction, and road relocation under the action alternatives. Lands would be susceptible to weed invasion. All disturbed acres would be reclaimed and revegetated after the life of the mine.

ES.1.6.15. Water Resources

Robinson Creek would be relocated, potentially affecting stream function, the associated riparian corridor, and water quality.

The action alternatives would result in the diversion of runoff to retention ponds, and an associated loss of surface water from evaporation and infiltration would occur. There would be small sediment load into

streams from dispersed facilities and road relocation. The loss of instream dilution could increase concentrations of total dissolved solids over the state water quality standard of 1,200 milligrams per liter. Reduced instream flows could result in less water available for irrigation downstream. There would be a small risk of surface-water contamination from accidental spills on 13.8 miles of stream that are within 100 feet of the reasonably foreseeable coal haul transportation route. There would also be a small increase in fine particles in streams associated with deposition of fugitive dust and coal dust.

Groundwater would be affected by the action alternatives through the use of groundwater for dust suppression, the removal of groundwater as moisture contained in coal, and the evaporation of groundwater exposed in pits.

There would be a direct removal and loss of function of wetlands and impacts to riparian areas due to surface mining and construction of dispersed facilities. Impact to wetlands and riparian areas would include the loss of habitat, loss of water filtration, and destabilization of streambanks.

Because probable AVFs occur only within the tract's no coal zone there would be no direct impacts to these water-related features from pits. Both floodplains and AVFs would be adversely affected by the construction of dispersed facilities. Approximately 60,565 linear feet of ephemeral and intermittent drainages are within the surface-mining areas of the coal zone associated with this alternative. Approximately 17,102 linear feet of perennial (including 96 linear feet of Kanab Creek), intermittent, and ephemeral drainages are within the underground mining area. Floodplain functions that could be lost include some degree of flood storage and attenuation, groundwater recharge, and erosion prevention. Although ground disturbance would occur in probable AVFs, the essential hydrologic functions of these areas would not be impacted and the physical capability of the land to be irrigated would not be changed.

ES.1.6.16. Wildlife: General

Direct and indirect impacts from the action alternatives would include habitat fragmentation, alteration, loss, and displacement due to surface disturbance, noise, ground vibration, night lighting, and increased risk of vehicle mortality associated with coal haul trucks. Potential mule deer habitat disturbance under the action alternatives would include approximately 29 acres of crucial summer habitat and approximately 920.1–1,803.3 acres of substantial value summer habitat. Potential elk habitat disturbance under the action alternatives would include approximately 920.1–1,807.5 acres of substantial value summer habitat and approximately 24.8 acres of year-long substantial value habitat. Raptors, migratory birds, and amphibians are also expected to experience potential habitat loss under the action alternatives.

ES.1.6.17. Wildlife: Special Status Species

Direct and indirect impacts common to all action alternatives would be the same as those described above for general wildlife. Special status species that are expected to experience habitat disturbance under the action alternatives include Utah prairie-dog, pygmy rabbit, kit fox (*Vulpes macrotis*), certain bat species, certain raptor species, certain migratory bird species, certain amphibian species, Bonneville cutthroat trout, and Greater Sage-Grouse. The action alternatives would disturb approximately 1,012–1,992 acres of occupied Greater Sage-Grouse habitat. Vegetation treatments and other actions described in the *Alton Coal Tract LBA Greater Sage-Grouse Mitigation Plan* (Appendix E) are designed to mitigate impacts to Greater Sage-Grouse habitat and would be applied to all action alternatives as design features. Vegetation treatments would be required to outpace surface disturbance caused by mining activities at an acreage ratio of 4 to 1.

ES.1.6.18. Potential Mitigation Measures

Potential mitigation measures are also proposed for individual resources in Chapter 4 of the EIS. Residual impacts that would persist following implementation of mitigation measures are also addressed for each resource in Chapter 4. The selection of these proposed mitigation measures will be decided in the ROD.

ES.1.7. Consultation and Coordination

Initial involvement with respect to BLM's receipt and review of ACD's LBA and details on the public notification, public scoping process, and the cooperating agencies are described above. Chapter 5, Consultation and Coordination, provides further detail on consultation and coordination for the proposed tract and preparation of this EIS.

ES.1.8. Next Steps

The comment period on this EIS will extend for 60 days following the U.S. Environmental Protection Agency's publication of the NOA in the *Federal Register*. The BLM is also publishing an NOA in the *Federal Register*. All timely comments on the EIS will be considered in the preparation of the FEIS. All substantive comments and information submitted will be summarized and addressed in the FEIS. The FEIS will then be completed and an NOA published in the *Federal Register*. After a 30-day waiting period, a ROD will be prepared and signed. The ROD, which will be signed by the authorized officer, will document the decisions made regarding the Proposed Action and alternatives. The BLM decision will apply only to public lands.

This EIS is not a decision document. Rather, it is a document that will inform the BLM's final decision on whether to hold a competitive lease sale for the tract and, in the event that the BLM decides to offer the tract for competitive leasing, what lease stipulations would be attached to the lease. The EIS is being released to inform the public and interested parties of the potential impacts associated with implementing one of the action alternatives.

CHAPTER 1. PURPOSE AND NEED

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1.1 Introduction and Background

In November 2004, a lease by application (LBA) was filed by Alton Coal Development (ACD) to mine federal coal, using primarily surface-mining methods, near the town of Alton, Utah (Case Number UTU 081895). This application was filed under the regulations at 43 Code of Federal Regulations (CFR) 3425, Leasing on Application. This application includes nearly 2,683 surface acres and approximately 38 million tons of recoverable coal.

To process an LBA, the Bureau of Land Management (BLM) must establish the fair market value of the coal in the tract by evaluating many factors, including the quantity and quality of the coal reserves. The Division of Lands and Minerals, Solid Minerals Branch at the BLM Utah State Office reviewed the application filed by ACD and determined that it meets the regulatory requirements for an LBA. The BLM reconfigured the tract delineation within ACD's LBA to exclude approximately 40 acres and to include approximately 898 additional acres. Acreage added to the tract during tract reconfiguration was based on the identification of additional recoverable coal reserves not included in the original LBA and on additional surface acreage deemed necessary for mine operations. The Alton Coal Tract LBA (hereafter the Alton Coal Tract, tract, or as Alternative B, the Proposed Action), as reconfigured, contains approximately 3,581 surface acres[1] (Table 1.1.1) and 44.9 million tons of recoverable coal reserves. Map 1.1 in Appendix A (Maps) shows the tract in relation to the town of Alton and other area landmarks.

At the time of ACD's LBA submittal, the BLM Kanab Field Office (BLM-KFO) was operating under the *Zion Management Framework Plan*. The BLM-KFO completed a resource management plan (RMP) in October 2008 and is now operating under the KFO RMP (BLM 2008b). Currently, lands in the Alton Coal Tract are managed for wildlife habitat and livestock grazing. The grazing lands consist of agricultural pasturelands, grasslands, and mixed sagebrush and grasses.

Appendix B summarizes the federal coal LBA process. Before the BLM can issue a decision to offer a tract for lease, the agency must fulfill the requirements of the National Environmental Policy Act (NEPA) by evaluating the potential environmental impacts of leasing and reasonably foreseeable mining of federal coal. On November 28, 2006, a notice of intent (NOI) to prepare an environmental impact statement (EIS) for the Alton Coal Tract was published in the *Federal Register* (*Federal Register* 71:68834–64435). This was followed on November 4, 2011, with a notice of availability (NOA) for the *Alton Coal Tract Lease by Application DRAFT Environmental Impact Statement* (DEIS) (*Federal Register* 76:68501–68502). Based on comments received on the DEIS, the BLM decided to prepare this supplemental DEIS (SDEIS) for public review prior to preparing and distributing a final EIS (FEIS). For a summary of comments received on the DEIS, see Section 5.1.2.1. Substantive comments received on the DEIS resulted in changes presented in this SDEIS. However, formal responses to substantive comments on the DEIS will be provided in the FEIS, along with responses to comments on this SDEIS. This SDEIS has been prepared to evaluate the potential direct, indirect, and cumulative environmental impacts of leasing and recovering the federal coal included in the tract. The BLM will use the analysis in this SDEIS to decide whether to a) hold a competitive, sealed-bid lease sale for the tract; b) hold a competitive, sealed-bid lease sale for a modified tract; or c) reject the lease application and not offer the tract for sale at this time. A record of decision (ROD) will be issued and, if the decision is to offer the tract for lease, a sale would be held. If a lease sale is held, the bidding at the sale would be open to any qualified bidder; it would not be limited to the applicant. A lease would be issued to the highest bidder at the sale, provided that the high bid meets or exceeds the fair market value of the coal, as determined by BLM's economic evaluation, and if the Department of Justice (DOJ) determines that there would be no antitrust violations.

[1] The NOI identifies 3,581 acres, more or less, in the tract. However, for reasons described in Table 1.1.1 and Section 3.1.3 (Notes on Data Sources and Tract Acreage), the analysis uses a tract acreage of 3,576 acres.

Any subsequent mining of federal coal must achieve maximum economic recovery in the context of applicable laws, regulations, and leasing stipulations. The issuance of a lease for the BLM-administered lands is a prerequisite for mining, but is not the enabling action that would allow mining to commence. Under the Surface Mining Reclamation and Control Act of 1977 (SMCRA), the Office of Surface Mining Reclamation and Enforcement (OSM) has primary responsibility to administer programs that regulate the effects of surface coal mining operations. Pursuant to Section 523(c) of SMCRA, the Utah Division of Oil, Gas and Mining (DOGM) has been authorized to regulate surface coal mining operations on federal lands in the state of Utah, with primacy on the mine permitting process. After a lease has been issued by the BLM but prior to mine development, the lessee must file a permit application package (PAP) with DOGM and OSM that details proposed site-specific mining and reclamation operations on federal lands in the state. DOGM reviews the PAP to ensure that it complies with the approved State of Utah–permanent SMCRA program and other statutes. If it does comply, DOGM issues the applicant a permit to conduct site-specific surface coal mining operations. Analysis of the site-specific mining plan occurs at this time. The OSM is responsible for preparing and submitting a mining plan approval package to the Assistant Secretary of the Department of the Interior (DOI), Land and Minerals Management. DOGM is responsible for any subsequent NEPA compliance, as necessary, to support the decisions of the Assistant Secretary. The successful lessee is also required to prepare a Resource Recovery and Protection Plan (R2P2) for BLM review and approval prior to issuance of a permit to mine. The R2P2 is approved by the Assistant Secretary based on a determination by the BLM that the R2P2 achieves maximum economic recovery of the coal reserves. In addition to analysis in the PAP, the site-specific mining plan would also be analyzed in the R2P2 submittal.

All coal reserves in the Alton Coal Tract are federally owned, though surface ownership is mixed. Under Alternative B (the Proposed Action; discussed in greater detail in Chapter 2), approximately 2,280 surface acres of the tract are in federal (BLM) ownership and 1,296 surface acres are in private ownership (eight different private surface owners) (Map 1.2; see Table 1.1.1). Private surface owners may be qualified to give consent to mine federal minerals under the private surface owner's estate[2] according to 43 CFR 3400.0-5. Surface ownership under Alternative A (No Action Alternative), Alternative C, and Alternative K1 is also discussed in greater detail in Chapter 2. If this EIS process results in a competitive lease sale for the tract, a final determination of private surface-owner qualification and private surface-owner consultation would take place after a ROD is issued, but prior to leasing. All surface owners have been notified of the Proposed Action and have received hardcopy and electronic versions of the DEIS.

The BLM administers the federal coal leasing program under the Mineral Leasing Act (MLA). A federal coal lease grants the lessee the exclusive right to obtain a permit to mine coal on the leased tract subject to a) terms of the lease; b) the DOGM permit to mine coal; c) the federal MLA mine plan approval; and d) applicable local, state, and federal laws. A reasonably foreseeable mining scenario for each action alternative and impacts associated with anticipated surface and underground mining of federal coal are considered in this SDEIS. The final BLM-accepted mine plans could be different from the reasonably foreseeable mining scenarios presented in this SDEIS. A complete PAP with detailed mine plans to mine the unleased federal coal has yet to be developed. Authorities and responsibilities of the BLM and other concerned regulatory agencies are described in Section 1.5.

[2] Under the regulations of 43 CFR 3400.0-5(gg)(1), (2), and (3), *qualified surface owner* means the natural person or persons (or corporation, the majority stock of which is held by a person or persons otherwise meeting the requirements of this section) who 1) hold legal or equitable title to the surface of split estate lands; 2) have their principal place of residence on the land, or personally conduct farming or ranching operations upon a farm or ranch unit to be affected by surface-mining operations; or receive directly a significant portion of their income, if any, from such farming and ranching operations; and 3) have met the above conditions for a period of at least three years, except for persons who gave written consent fewer than three years after they met the above requirements. In computing the three-year period, the authorized officer shall include periods during which title was owned by a relative of such person by blood or marriage if, during such periods, the relative would have met the requirements of this section. A qualified private surface owner is legally qualified to give consent to mine federal minerals under the private surface owner's estate.

According to the Utah Geological Survey (VandenBerg et al. 2012), coal production in Utah decreased by 3.8 million tons (17.3%) between 2008 and 2011 due to reserve depletion and difficult mining conditions. Utah's long-term (50 years and beyond) coal future is shifting because currently accessible coal reserves are being depleted in the Book Cliffs and Wasatch Plateau coal fields. This makes it necessary for the coal industry to look to other Utah coal fields to meet future demands for coal. Further, most Utah mining companies have leased coal reserves for approximately 10–15 years of production; however, they are having difficulty adding new leases to extend their reserves. As a result, Utah coal production is outpacing tonnage leased (VandenBerg et al. 2012). The BLM's mineral leasing program encourages the development of domestic oil, gas and coal reserves, and reduction of the United States' dependence on foreign energy sources. As a result of leasing and the subsequent mining and sale of federal coal resources, the public receives lease bonus payments, lease royalty payments, rental payments, and a supply of low-cost coal for power generation.

Given known technology and technological and demographic trends overall, United States' demand for coal is expected to increase by approximately 0.1% per year through the year 2040 (DOE/EIA 2013a). Though coal-fired power plants are projected to account for less electricity generation in 2040 compared to 2011 (down from 42% in 2011 to 35% in 2040), in the United States, approximately 90% of coal consumption is in the electric power sector (DOE/EIA 2013b), and between 2011 and 2040, total electricity demand in the United States is expected to increase by 42% (DOE/EIA 2010). Furthermore, in Utah, approximately 82% of electrical energy is generated from coal (VandenBerg 2010). Although most (approximately 90%) coal consumption in the United States is in the electric power sector, coal is also used (approximately 10% of total demand) in the industrial sector. In the industrial sector, coal is used in the manufacture or production of cement, paper, chemicals, food, primary metals, and coal-based synthetic fuels (coal-to-liquids). It is also used in the industrial sector as a direct source of heat, as a feed stock, as boiler fuel for the production of process steam and electricity, and in the production of coke, which is used as an energy source and as a raw material in steel production. Nonelectric power sector demand for coal is expected to slightly decline by 2040, though demand for coal in the emerging coal-to-liquids industry is expected to increase. Most of the projected increase in overall United States' demand for coal, therefore, is expected from the electric power sector (DOE/EIA 2010). Additionally, coal exports are expected to increase (DOE/EIA 2013c).

Table 1.1.1. Alton Coal Tract Legal Description and Surface Ownership under the Proposed Action

Legal Description*	Surface Owner†	Acres
Township 39 South, Range 5 West, Salt Lake Meridian, Utah		
Section 7, SE¼SW¼ and S½SE¼	3	122
	5	7
Section 18, lots 3 and 4, E ½, E½W½	BLM	357
	3	42
	16	158
	17	3
Section 19, lots 1 through 4, NE¼, E½W½, N½SE¼, SE¼SE¼	BLM	472
	1a	120
Section 20, lots 4 and 5, N½SW¼	BLM	47
	1a	111
Section 30, lots 2 through 4, SW¼NE¼, SE¼NW¼, E½SW¼, W½SE¼	BLM	338
	1a	13
Section 31, lots 1 through 3, NE¼, E½NW¼, NE¼SW¼, N½SE¼	BLM	471
Township 39 South, Range 6 West, Salt Lake Meridian, Utah		
Section 12, SW¼, W½SE¼	Unknown	9
	3	218
	8	16
Section 13, NW¼NE¼, N½NW¼, SE¼NW¼, SE¼	BLM	160
	3	161
Section 24, NE¼, N½NW¼, SE¼NW¼, E½SW¼, N½SE¼, SE¼SE¼	BLM	159
	11	4
	12	313
Section 25, E½NE¼, SW¼NE¼, SE¼	BLM	276
Error‡		5
Total Private		**1,296**
Total BLM		**2,280**
Total LBA		**3,581**

Note: This table also appears in Chapter 2.

* Based on the BLM Status of Public Domain Land and Mineral Titles approved Coal Plats as of August 21, 2002 and July 28, 2006

† Where the BLM is the surface owner of the parcel this is explicitly noted. Private surface owners are numbered rather than identified by name due to privacy concerns.

‡ The acreages above were calculated using ESRI ArcGIS 9.2 and North American Datum (NAD) 1983 Universal Transverse Mercator (UTM) Zone 12N coordinate system. The BLM shapefile of coal ownership is georeferenced (in NAD 1983 UTM Zone 12N), but is not survey accurate. ACD provided a hardcopy map (with surface ownership and section boundaries), which was scanned and georeferenced to section corners visible on U.S. Geological Survey (USGS) 7.5-minute topographic maps. Polygons were then digitized to encompass/represent each of the legal descriptions above using the BLM shapefile, ACD's georeferenced map, and the USGS 7.5-minute topographic map as references while digitizing. All acreages are approximate and have not been verified by ground surveys. The error is largely a result of the disparate sources for boundary data. Additionally, the ownership lines from the map provided by ACD do not align well in all locales with the BLM boundary. This suggests that one or both of these datasets are approximate and is another potential source of error.

Due to shallow overburden in most of the tract, extraction of federal coal reserves would take place using primarily surface-mining methods. For one possible method of surface mining, primary surface overburden removal would be accomplished by truck and shovel methods. Scrapers, dozers, and front-end loaders would assist with bench preparation for the larger equipment and would be used for removal of surface overburden, small or relatively shallow coal areas, and topsoil. Scrapers, dozers, and front-end loaders would also be used for storage and return placement of overburden and topsoil for reclamation. Coal recovery would use underground mining methods (e.g., development mining, auger mining, highwall mining, longwall mining, and/or room and pillar mining) for coal reserves approximately 200 feet or more below the surface (depth of overburden). A summary of these underground mining methods is presented in Appendix C along with a list of references for further information.

The actual maximum depth of overburden could vary from the approximately 200 feet discussed here, depending on the actual local coal thickness found, overburden types, overburden (highwall) stability, underground techniques available, operating and capital costs, and coal market economics. However, by design feature, overburden removal would be limited to no more than approximately 200 feet (see Section 2.6 for further information on measures that would be required under any action alternative).

After mining, the land would be reclaimed to ecological site functionality suitable for use by livestock and wildlife. Roads in the tract would remain or be reestablished to support post-mining land use. The conceptual methods of mining and reclamation are discussed in greater detail in Chapter 2.

1.2 Purpose and Need for Action

The purpose of the federal action is to respond to an LBA for federal coal reserves on up to 3,581 acres of BLM-administered and private surface in Kane County, Utah, near the town of Alton. The need for the federal action is established by the BLM's responsibilities under the Federal Land Policy and Management Act (FLPMA) and MLA, as amended by the Federal Coal Leasing Act Amendments of 1976. Private development of federal coal reserves is integral to the BLM coal leasing program under authority of FLPMA and MLA. The MLA requires that all public lands not specifically closed to leasing be open to lease for the exploration and development of mineral resources. Further, a primary goal of the Energy Policy Act of 2005 is to add energy supplies from diverse sources, including domestic oil, gas, and coal, as well as hydropower and nuclear power.

1.3 Lead Agency and Cooperating Agencies

The BLM is the lead agency responsible for leasing federal coal lands under the MLA, as amended by Federal Coal Leasing Act Amendments, and the BLM is also responsible for the preparation of this EIS under NEPA. At the time of publication of the DEIS, cooperating agencies consisted of OSM and the State of Utah (including its agencies). Cooperating agencies in the development of this SDEIS consist of OSM, the State of Utah (including its agencies), the National Park Service (NPS), the Environmental Protection Agency (EPA), and Kane County. Additional information related to consultation and coordination with cooperating agencies and other entities as appropriate, including stakeholder and working groups for certain analyses, is provided in Chapter 5.

During the development of the SDEIS, the BLM invited both the U.S. Fish and Wildlife Service (USFWS) and the U.S. Army Corps of Engineers (USACE) to be cooperating agencies in the EIS process. As of publication of the SDEIS, these agencies have not formally accepted the BLM's invitation. However, the BLM has been coordinating with these agencies pertaining to matters where they have special expertise or jurisdiction by law.

1.4 Decisions to be Made

This SDEIS does not contain final decisions regarding the Proposed Action or alternatives. The primary purpose of this SDEIS is to provide a full and fair disclosure of environmental, socioeconomic, and other impacts and to inform decision makers and the public of the reasonable alternatives that would avoid or minimize adverse impacts or enhance the quality of the human environment. As the lead agency, the BLM will document its decisions in a ROD document. These decisions will pertain to actions on BLM-administered lands. OSM and the State of Utah, as cooperating agencies, will make their recommendations and decisions in separate decision documents at a later date if there is a lease sale following the BLM's ROD. These recommendations and decisions pertain to the OSM's and State of Utah's respective permitting responsibilities for actions under their jurisdiction. These agencies have public involvement processes separate from this EIS, per their respective agency policies and other pertinent laws and regulations. The USACE will also use this EIS for their permitting needs related to Clean Water Act (CWA) Section 404. Other agencies (e.g., Kane County and EPA) may also rely on this EIS for their needs as applicable.

The BLM will document the following decisions in the ROD for this EIS:

- Whether or not to hold a competitive lease sale for the tract. Variations on offering the tract for competitive leasing are described in Chapter 2 as Alternative B (Proposed Action), Alternative C (Reduced Tract Acreage and Seasonal Restrictions), and Alternative K1 (Reduced Tract Acreage). Not holding a competitive lease sale for the tract is Alternative A (the No Action Alternative).
- Based on the range of alternatives and impacts analyzed in the EIS process, it is within the BLM's decision to lease a portion of the tract under any alternative rather than leasing all of it or opting to lease none of it.
- If the decision is to hold a competitive lease sale, what special lease stipulations would be attached to the lease? Possible lease stipulations pertain mainly to air resources, cultural resources, grazing, hazardous materials, noise, soils and geology, special status species, paleontological resources, public health and safety, vegetation, visual resources, night sky, water resources, and wildlife.

Through this EIS process, the BLM will not make decisions regarding either mining activities for fee coal on adjacent lands or transportation routes that may be used by the successful bidder (in the event of a lease sale) to transport mined coal from the tract to market. Activities related to mining fee coal on lands adjacent to the tract are outside the BLM's jurisdiction and are independent of potential mining activities for federal coal reserves located on the tract, because these activities would occur regardless of BLM's decision with respect to federal coal reserves. If this EIS process results in a decision to hold a competitive lease sale for the tract, decisions related to potential transportation routes for mined coal from the tract to market would reside with the successful bidder and would be dictated by transportation routes and coal market conditions. However, the impacts of coal truck traffic on the reasonably foreseeable transportation route (see Section 1.8.2.3 Reasonably Foreseeable Future Actions section in this chapter and Section 2.6.4 Reasonably Foreseeable Coal Loadout Location and Transportation Route in Chapter 2) are assessed in Chapter 4 of this EIS.

1.5 Regulatory Authorities and Responsibilities

The Alton Coal Tract LBA was submitted and will be processed and evaluated under BLM statutory mandates and authority governing federal coal leasing and other federal authorities listed below:

- MLA of 1920, as amended by the Federal Coal Leasing Act Amendments of 1976
- Multiple-use Sustained Yield Act of 1960
- NEPA of 1969, as amended
- FLPMA of 1976 (BLM's multiple-use mandate)
- SMCRA of 1977
- Energy Policy Act of 2005

BLM regulates coal mining operations primarily to ensure that maximum economic recovery of the coal resource is achieved (43 CFR 3480) while maintaining compliance with other applicable laws and regulations. After a federal coal lease is issued, SMCRA gives OSM primary responsibility to administer programs that regulate the effects of surface coal mining operations. Pursuant to Section 503 of SMCRA, DOGM developed a permanent program authorizing DOGM to regulate surface coal mining operations on nonfederal lands in the State of Utah (30 CFR 944, Utah Program). The Secretary of the Interior approved this program in January 1981. In March 1987, pursuant to Section 523(c) of SMCRA, the Governor of Utah entered into a cooperative agreement with the Secretary of the Interior authorizing DOGM to regulate surface coal mining operations on federal lands in the State of Utah. Pursuant to the cooperative agreement concerning surface-mining operations on federal lands, a federal coal lease holder in Utah must submit a PAP to DOGM for any proposed coal mining and reclamation operations on federal lands in Utah. DOGM reviews the PAP to ensure that it complies with the permitting requirements and that the proposed coal mining operation meets the performance standards of the approved State of Utah program. OSM, BLM, and other federal agencies, as appropriate, review the PAP (provided to them by DOGM) to ensure it complies with the terms of the coal lease (which are based on the disclosures in this NEPA analysis), the MLA, and other federal laws and their attendant regulations (30 CFR 944.30). If the PAP does comply, DOGM issues the applicant a permit to conduct coal mining operations. OSM recommends approval, approval with conditions, or disapproval of the MLA mining plan to the Assistant Secretary of the DOI, Land and Minerals Management. OSM’s recommendation must be based, at a minimum, on

- the PAP, including the BLM-recommended R2P2;
- information prepared in compliance with NEPA;
- documentation assuring compliance with the applicable requirements of other federal laws, regulations, and executive orders (EO);
- comments and recommendations or concurrence of other federal agencies, as applicable, and the public;
- the findings and recommendations of the BLM with respect to the R2P2 and other requirements of the lease and the MLA;
- the findings and recommendations of DOGM with respect to the PAP and the state program; and
- the findings and recommendations of OSM with respect to the requirements under Chapter VII Subchapter D, 30 CFR 746.13 (a–g).

If a proposed LBA tract is leased next to the lessee’s existing adjacent mine, the lessee is required to revise its coal mining permit (following the processes outlined above) and obtain mining plan approval from the Assistant Secretary prior to mining the newly leased coal. As a part of that process, a detailed

new plan would be developed to outline how the newly leased lands would be mined and reclaimed. Specific impacts that would occur during the mining and reclamation of the LBA tract would be addressed in the permit approval process, and specific mitigation measures for anticipated impacts would be described in detail at that time.

DOGM enforces the performance standards and permit requirements for reclamation during a mine's operation and has primary authority in environmental emergencies (e.g., accidental spills). OSM retains oversight responsibility for this enforcement. Where federal surface or coal resources are involved, BLM has authority in environmental emergency situations if DOGM or OSM cannot act before environmental harm and damage occurs. The Mine Safety and Health Administration (MSHA) monitors and regulates all safety factors related to coal mining on federal and nonfederal lands. In preparing this EIS, BLM has a responsibility to consult with and obtain the comments and assistance of other state and federal agencies that have jurisdiction by law or that have special expertise with respect to potential environmental impacts.

Several federal, state, and local agencies are involved in the coal leasing and mine permitting process. For mining to occur on the tract, a combination of leases, permits, actions, and plans are required (Table 1.5.1).

Table 1.5.1. Federal, State, and Local Leasing and Permitting Requirements

Agency	Lease/Permit/Action/Plan
Federal	
BLM	Coal lease R2P2 Exploration drilling permit
OSM	Preparation of MLA mining plan approval document SMCRA oversight
DOI, Office of the Secretary	Approval of mining plan (the R2P2)
MSHA	Safety permit and mine ID number Ground control plan Major impoundment ID numbers (based on impoundment size criteria) Explosives use and storage permit
Bureau of Alcohol, Tobacco, and Firearms	Explosives manufacturer's license Explosives use and storage permit
Federal Communications Commission	Radio permit: ambulance Mobile relay system radio license
USACE	Authorization of impacts to wetlands and other waters of the U.S.
U.S. Department of Transportation	Hazardous waste shipment notification
USFWS	Consultation on potential impacts to federally listed species under the Endangered Species Act (ESA)
Federal Aviation Administration	Radio tower permits
State	
DOGM	Coal mine permit (compliance with the requirements of Utah Administrative Code (UAC) R645) Exploration drilling permit
Utah State Engineer's Office	Stream alteration permit
Utah Division of Air Quality (UDAQ)	Air approval order
Utah Division of Water Quality	Utah Pollutant Discharge Elimination System permit
Local	
Kane County	Conditional use permit Road relocation agreement

1.6 Relationship to Policies, Plans, and Programs

In addition to the federal acts listed under the previous section, guidance and regulations for managing and administering public lands, including the federal lands in the tract, include the following:

- 40 CFR 1500 (Protection of Environment)
- 43 CFR 1601 (Planning, Programming, Budgeting)
- 43 CFR 3400 (Coal Management; specifically, Leasing on Application Regulations, 43 CFR 3425.1)
- The KFO RMP (BLM 2008b)

Specific guidance for processing applications is provided in BLM's Manual 3420, *Competitive Coal Leasing* (BLM 1989). In developing this EIS, BLM's *National Environmental Policy Act Handbook H-1790-1*; hereafter, the BLM NEPA handbook (BLM 2008c) was used.

The Proposed Action and alternatives must be consistent with federal law and regulations. Likewise, they must also be as consistent as possible with other plans concerning the administration of the public lands in question. BLM must coordinate the Proposed Action and alternatives with the land use planning and management programs of other federal departments and agencies and of the State of Utah and affected local governments.

Other than BLM land use planning, no other federal land use plans apply to the Proposed Action and alternatives. The State of Utah does not maintain planning documents, nor do they conduct planning processes relating to the Proposed Action and alternatives. However, the Proposed Action and alternatives would be consistent with the State of Utah Public Lands Policy and Coordination Office's position on 1) uses of public lands for multiple-use, sustained-yield, natural resource extraction, 2) support of the specific plans, programs, processes, and policies of state agencies and local governments, and 3) development of the solid mineral resources of the state as an important part of the state economy and of local regions in the state (Utah Code Section 63-38d-401).

Kane County has a land use ordinance (Kane County 1998) in place that dictates allowable land uses in designated zones. According to the land use ordinance, most of the Alton Coal Tract is on lands zoned by Kane County as agricultural. The land use ordinance indicates that surface and underground mines are not allowed in agriculturally zoned areas; however, zone modifications are permitted following established procedures subject to Kane County Planning Commission approval (Kane County 1995). A zone change to permit surface and underground mining on the tract would be consistent with the position of the Kane County Commission supporting natural resource extraction in the county. Further, the Environment section of the *Kane County, Utah General Plan* (Kane County 2011:24) indicates an objective to "Promote the development of the county's mineral, water, manpower, industrial, historical, cultural, and other resources." Finally, the Kane County Commission has submitted a formal letter to ACD and DOGM expressing support for ACD's proposed operation for adjacent fee coal. The *Garfield County General Plan* and general plan amendment (2007a) indicate that the county economy is based largely on government, tourism, manufacturing, and agriculture (ranching). The county supports "aggressively pursuing coal and other mineral resource development," including "the highest economically allowable development" of the Alton Coal Field and other regional coal reserves (FCAOG 2007a).

The Town of Alton completed a master plan in 1981 (FCAOG 1981) in which development of the Alton Coal Field, including the tract analyzed in this EIS, is recognized as a likely future scenario. The plan notes that coal development could result in a significant increase in the local population and that this could have an adverse effect on the quality of life in Alton. Goals and policies described in the plan do not specifically reference coal development; although, a desire to attract light industry of a low polluting

or nonpolluting nature is expressed. Alton's current town council generally looks favorably on coal development in the area, as evidenced by a formal letter of support for mining operations on fee coal lands adjacent to the tract and by their willingness to work with ACD on implementing these mining operation plans (e.g., leasing water rights and working cooperatively on a regular basis to assist with components of the proposed operation such as road relocations and the construction of short haul routes around the Town of Alton).

1.6.1 Department of Justice Consultation

In the event of a competitive lease sale, but prior to issuance of a lease, the BLM would solicit the opinion of the DOJ on whether the planned lease issuance creates a situation inconsistent with federal antitrust laws. The DOJ is allowed 30 days to make this determination. If the DOJ does not respond in writing within 30 days, the BLM may proceed with issuance of the lease.

1.7 Conformance with Existing Land Use Plans and Bureau of Land Management Coal Planning Screening Procedures

1.7.1 Conformance with Bureau of Land Management Land use Planning

FLPMA and Federal Coal Leasing Act Amendments require that lands considered for leasing be included in a comprehensive land use plan and that leasing decisions confirm with that plan. The KFO RMP currently governs and addresses the leasing of federal coal in the BLM-KFO, including portions of Kane County and Garfield County. Coal leasing is addressed under Minerals and Energy, Areas Unsuitable for Surface Coal Mining, decisions MIN-9, MIN-10, and MIN-11. Decision MIN-9 identifies the locations and acreage determined to be unsuitable for surface mining and surface operations incident to an underground mine. Through the resource management planning process, the tract is not included in that area determined to be unsuitable. Decision MIN-10 states that additional areas could be found unsuitable based on site-specific analysis. Finally, decision MIN-11 states that mining plans for surface-mining disturbance would incorporate erosion-control stipulations as per SMCRA regulations. Decisions in the KFO RMP do not allow mining where coal unsuitability criteria apply unless the lessee can show that mining would not adversely affect the value that is to be protected. Following a federal decision to lease and securing a federal lease, the successful bidder would also be required to comply with DOGM’s coal mine permitting process.

The KFO RMP includes a *Final Coal Unsuitability Report* (BLM 2008b) indicating that the tract does not meet any of the coal unsuitability criteria under 43 CFR 3461 and is therefore made available for further coal leasing consideration (following decision MIN-9). However, site-specific unsuitability determinations for some criteria (Criteria 2, 3, 9, 15, 16, 18, and 19) were deferred until an application to lease was filed (following decision MIN-10). A summary of the coal unsuitability findings from the BLM-KFO planning process is presented below. With application of the coal unsuitability criteria and conditions to protect the environment (to be determined through this EIS), the decision to lease coal under the action alternatives analyzed in this document would be in conformance with the KFO RMP (BLM 2008b). For purposes of the analysis, it is assumed that a waiver, exception, or modification would be granted with respect to KFO RMP decisions concerning Greater Sage-Grouse (*Centrocercus urophasianus*). This is discussed in greater detail under Unsuitability Criterion Number 15 in the Application of Unsuitability Criteria section of this chapter.

1.7.1.1 GREATER SAGE-GROUSE LAND USE PLAN AMENDMENT

On March 23, 2010, the *Federal Register* published the following rule: Endangered and Threatened Wildlife and Plants; 12-Month Findings for Petitions to List the Greater Sage-Grouse (*Centrocercus urophasianus*) as Threatened or Endangered. In this rule, the USFWS concludes that listing the Greater Sage-Grouse as threatened or endangered was "warranted but precluded." A "warranted but precluded" finding indicates that immediate publication of a proposed rule to list the species is precluded by higher-priority listing proposals (i.e., listing of other species takes priority because they are more in need of protection, though listing of the species in question is warranted based on the available science). In their review of the status and threats to the Greater Sage-Grouse in relation to the five listing factors provided in Section 4(a)(1) of the ESA the USFWS, determined that Factor A ("the present or threatened destruction, modification, or curtailment of the habitat or range of the Greater Sage-Grouse") and Factor D ("the inadequacy of existing regulatory mechanisms") posed "a significant threat to the Greater Sage-Grouse now and in the foreseeable future" (*Federal Register* 75:13910). Conservation measures in land use plans were identified by the USFWS as the principal regulatory mechanism for the BLM to ensure conservation of the Greater Sage-Grouse.

As a result of this finding, the BLM is in the process of preparing land use plan amendments and associated EISs for applicable portions of BLM-managed lands in Montana, North Dakota, Wyoming, Colorado, Utah, Nevada, Oregon, Idaho, and California to incorporate Greater Sage-Grouse conservation measures into land use management plans. The *Utah Greater Sage-Grouse Draft Land Use Plan Amendment and Environmental Impact Statement* (hereafter the sage-grouse land use plan amendment/EIS) was published in October 2013 (BLM 2013c). The BLM considered five land use plan amendment alternatives in this analysis (detailed descriptions are provided in BLM 2013). These land use plan amendment alternatives consist of the following:

- Alternative A: The No Action Alternative.
- Alternative B: The National Technical Team Alternative, based on *A Report on National Greater Sage-Grouse Conservation* (BLM 2011a).
- Alternative C: This alternative is similar to Alternative B but includes additional conservation measures. This alternative is subdivided into Alternatives C1 and C2 with respect to livestock grazing and wild horse herd management. Under Alternative C1, all Greater Sage-Grouse habitat currently available for livestock grazing would become unavailable and wild horse appropriate management levels would be reduced to 25%. Under Alternative C2, permitted animal unit months would be reduced, and the season of use would be changed so that no livestock grazing would occur in Greater Sage-Grouse habitat during the growing season.
- Alternative D: This alternative was developed by the Utah BLM in cooperation with the U.S. Forest Service (USFS) and local USFWS. It includes modifications to the conservation measures considered under Alternative B and is designed to address local ecological site variability while balancing resources and resource uses.
- Alternative E: This alternative is subdivided into Alternative E1, which is based on the C*onservation Plan for Greater Sage-Grouse in Utah* (UDWR 2013) (hereafter the sage-grouse conservation plan; Utah Division of Wildlife Resources [UDWR]), and Alternative E2, which is based on the State of Wyoming's Governor's EOs. Alternative E1 applies to the Alton Coal Tract, whereas Alternative E2 does not. As a result, this discussion focuses on Alternative E1 and refers to it simply as Alternative E for simplicity.

The Alton Coal Tract is in the area to which the sage-grouse land use plan amendment/EIS applies. Alternative A in the sage-grouse land use plan amendment/EIS constitutes continuing land management activities under the existing land use plan governing activities on the tract—the KFO RMP. Conformance of the Proposed Action and other action alternatives with the decisions in the KFO RMP is discussed under Section 1.7.1 above.

Alternatives B and C in the sage-grouse land use plan amendment/EIS are the most restrictive alternatives considered in terms of coal leases associated with surface mining. The Proposed Action and action alternatives would not conform with either of these land use plan amendment alternatives because these alternatives would result in the tract being determined unsuitable for surface mining under the criteria in 43 CFR 3461.5.

Alternative D in the sage-grouse land use plan amendment/EIS was developed to balance protections for Greater Sage-Grouse and resource uses. Under Alternative D, no areas of Greater Sage-Grouse mapped occupied habitat would be considered unsuitable for surface mining under the criteria in 43 CFR 3461.5. Several restrictions would apply where coal leasing that involves surface-mining methods is considered in Preliminary Priority Management Areas. No specific stipulations are identified where coal leasing involves surface-mining methods in Preliminary General Management Areas. However, other management actions would apply in these areas, including limitations or prohibitions on activities in 1) breeding and nesting habitat from February 15 to June 15; 2) brood rearing habitat from April 15 to July 15; and 3) winter habitat from November 15 to March 15. In addition, use requirements such as meeting noise and permanent tall structure restrictions would apply in Preliminary General Management Areas. The Alton Coal Tract under all action alternatives considered in detail in this SDEIS falls in the area identified as Preliminary General Management Area in Alternative D, and in this respect, leasing the Alton Coal Tract under any action alternative would be in conformance. However, none of the action alternatives associated with the Alton Coal Tract incorporate all the seasonal timing restrictions also considered as part of Alternative D. Alternative D provides allowances for excepting, waiving, or modifying seasonal timing restrictions in Preliminary General Management Areas. However, seasonal restrictions would not be excepted, waived, or modified in exchange for successful off-site mitigation.

Alternative E in the sage-grouse land use plan amendment/EIS represents the sage-grouse conservation plan (UDWR 2013). All sage-grouse management areas (SGMAs) would be considered suitable for further coal leasing consideration, though a number of stipulations could apply to leasing areas to limit or ameliorate impacts as identified during the leasing process. Leasing of the Alton Coal Tract (located in the Panguitch SGMA) under any action alternative considered in detail in this SDEIS would be in conformance with Alternative E.

Various parts of separate alternatives considered in the draft sage-grouse land use plan amendment/EIS can be “mixed and matched” to develop a proposed plan. As such, the proposed plan could include aspects of any of the alternatives summarized above.

1.7.1.2 BUREAU OF LAND MANAGEMENT COAL PLANNING SCREENING

The major land use planning decision that the BLM must make concerning federal coal resources in the Alton area is a determination of which federal coal lands are acceptable for further consideration for leasing. There are four screening procedures that the BLM uses to identify these coal lands. These screening procedures require the BLM to

- estimate development potential of the coal lands;
- apply the unsuitability criteria listed in 43 CFR 3461;
- make multiple land use decisions that may eliminate federal coal deposits from consideration for leasing to protect other resource values; and
- consult with surface owners who meet the criteria outlined in 43 CFR 3400.0-5(gg)(1) and (2).

Only those federal coal lands that pass these screens are given further consideration for leasing. In 2007 the BLM began the process of applying the four screens to federal coal lands in Kane and Garfield counties by estimating development potential of coal lands (screening procedure 1) and applying the unsuitability criteria listed in 43 CFR 3461 (screening procedure 2). A *Final Coal Unsuitability Report* is contained in the KFO RMP (BLM 2008b). The results of this report are included as Appendix D of this SDEIS. Screening procedure 3 is being conducted as part of this EIS analysis, whereas screening procedure 4 would be conducted prior to issuing the ROD and holding a lease sale if BLM decides to hold a lease sale for the tract. Each coal planning screening procedure, as it applies to the tract, is discussed in further detail in the following four sections.

In addition to the *Final Coal Unsuitability Report* in the KFO RMP, in 1980, the Secretary of the Interior issued a decision that designated certain areas near Bryce Canyon National Park unsuitable for surface coal mining operations. The areas designated unsuitable for surface coal mining operations, including surface impacts incident to underground mining that would be visible from Bryce Canyon National Park include all federal lands in Township 40 South, Range 4 West; Township 39 South, Range 4 West; Township 38 South, Range 4 West; Township 38 South, Range 3 West; Township 37 South, Range 4 West; Township 37 South, Range 3 West; and Township 36 South, Range 3 West. Township 36 South, Range 2 West was designated unsuitable only for mining by surface methods. See Map 1.3 for a depiction of lands determined in the Secretary's decision to be unsuitable for mining by surface methods.

1.7.1.2.1 Estimate Development Potential of the Coal Lands

Under the first coal screening procedure, a coal tract must be located in an area that has been determined to have coal development potential [43 CFR 3420.1-4(e) (1)]. The tract meets this criterion and is in the area identified as having coal development potential—as noted by the BLM in the *Final Coal Unsuitability Report* in the KFO RMP (BLM 2008b).

1.7.1.2.2 Application of Unsuitability Criteria

The second coal screening procedure requires the application of the 20 unsuitability criteria listed in 43 CFR 3461.5. These coal unsuitability criteria have been applied to the known recoverable coal resource areas for the Alton, Kaiparowits, and Kolob coal fields. No lands included in or adjacent to the tract were found to be unsuitable for mining during the application of the unsuitability criteria as part of the KFO RMP (BLM 2008b); however, as indicated above, site-specific unsuitability determinations for Criteria 2, 3, 9, 15, 16, 18, and 19 were deferred until receipt of an LBA.

Unsuitability Criterion Number 2 states that federal lands in rights-of-way (ROWs) or easements, or federal lands in surface leases for residential, commercial, industrial, or other public purposes, on federally owned surface shall be considered unsuitable. At this time, no acres are determined to be unsuitable based on this criterion. Further, a lease may be issued for areas where this unsuitability criterion applies if the surface management agency determines that the type of coal development in question would not interfere with the purpose of the ROW or easement; or if the ROW or easement was issued for a purpose for which it is not being used; or if the parties involved in the ROW or easement agree, in writing, to leasing; or if it is impractical to exclude the area due to the location of coal and method of mining and the area or use can be protected through stipulations. The ROW (held by Kane County) for KFO Route 116 overlies the tract. Kane County has indicated that they would agree, in writing, to leasing. As a result, this criterion does not apply and the tract remains suitable.

Unsuitability Criterion Number 3 states that lands within 100 feet of the outside line of the ROW of a public road shall be considered unsuitable for surface coal mining, with certain exceptions. One of the exceptions allows surface coal mining in the ROW and buffer zone for a public road if a) the regulatory

authority (or the appropriate public road authority designated by the regulatory authority) allows the public road to be relocated or closed after providing public notice and opportunity for a public hearing, and b) after finding in writing that the interests of the affected public and landowners would be protected [30 CFR 761.11(d) and 43 CFR 4361.5(c) (iii)].

As shown on Map 1.2, portions of KFO Route 116 traverse the tract. At this time, Kane County has not given formal approval to relocate this road; therefore, the exception does not yet apply in this case. Consequently, the BLM has determined that the portions of the tract that include KFO Route 116 and a 100-foot buffer zone on either side of the road are considered unsuitable for mining at this time under Unsuitability Criterion Number 3; however, an exception is likely, as explained below. Although lands in the KFO Route 116 ROW and associated buffer zone are now determined to be unsuitable for mining, they are included in the tract. If the tract is leased, but relocation of KFO Route 116 is not approved and the unsuitability determination remains in place, including these lands in the tract would allow recovery of all the mineable coal adjacent to and outside of the KFO Route 116 buffer zone. It would also comply with the coal leasing regulations, which do not allow leasing in less than 10-acre aliquot parts. Coal recovery in the tract would be reduced in the event that KFO Route 116 was not relocated.

If the decision (as a result of this EIS) is to offer the tract for competitive leasing, the successful bidder, Kane County, and the BLM would work on a plan to relocate KFO Route 116, which would allow recovery of the coal underlying the road and the buffer zone. If the road relocation is approved, the exception to Unsuitability Criterion Number 3 would be applicable and the unsuitability determination for the coal underlying KFO Route 116 and the associated buffer zone could be reconsidered. If a permit to relocate the road is approved, including these lands in the tract would allow recovery of the coal underlying KFO Route 116 and its associated buffer zone. A stipulation stating that “no mining activity may be conducted in the KFO Route 116 100-foot buffer zone until a permit to move the road is approved” would be attached if a lease is issued for the tract. The exclusion of the coal underlying KFO Route 116 and its associated buffer zone from mining activity by lease stipulation honors the finding of unsuitability for mining under Unsuitability Criterion Number 3.

Other public roads, in addition to KFO Route 116, exist in the tract. These roads include K3150, K3115, K3120, K3125, K3135, K3140, K3145, and K3155 (Map 1.4). Unsuitability Criterion Number 3 would apply to these roads in the same way that it applies to KFO Route 116 once a determination of road status (public or not) is made. Likewise, if the decision is to offer the tract for competitive leasing, the successful bidder, Kane County, and the BLM would work out an agreement to close or relocate the roads, as appropriate, to facilitate mining. The lessee would be responsible for the costs of any road relocations.

The BLM recognizes that it is important to coordinate with Kane County related to matters concerning the relocation and/or temporary closure of KFO Route 116 and other roads on the tract. The state of Utah and Kane County may hold valid existing ROWs in the tract pursuant to Revised Statute (RS) 2477 codified at 43 United States Code (USC) 932. On October 21, 1976, U.S. Congress repealed RS 2477 through passage of FLPMA. This EIS analysis does not adjudicate, analyze, or otherwise determine the validity of claimed ROWs. However, nothing in this EIS analysis extinguishes any valid ROW, or alters in any way the legal rights the State of Utah and Kane County have to assert and protect RS 2477 rights. Also, nothing in this EIS analysis restricts the rights of the State of Utah and Kane County to challenge in federal court or other appropriate venue any use restrictions imposed by the BLM’s decisions regarding leasing that they believe are inconsistent with their rights.

Unsuitability Criterion Number 9 states that the following are of essential value: a) federally designated and proposed critical habitat for listed, threatened, or endangered plant and animal species, and b) habitat for threatened or endangered plant and animal species (as determined by the USFWS and the surface management agency). This criterion then states that areas where threatened and endangered plant and animal species have been scientifically documented shall be considered unsuitable. However, a lease may be issued and mining operations may be approved if, after consultation with the USFWS, the USFWS determines that the mining activity is not likely to jeopardize the continued existence of the listed species, its critical habitat, or both. According to the *Final Coal Unsuitability Report* contained in the KFO RMP (BLM 2008b), the BLM would inventory coal areas for threatened and endangered species as part of any leasing-related EIS analysis. Based on the analyses conducted and documented in this EIS, the conditions necessary to meet this unsuitability criterion are not present, and the area, therefore, remains suitable (see Sections 3.18.1, 3.18.2, 4.18.1.4, 4.18.1.5, and Appendix D).

Unsuitability Criterion Number 15 states that the following shall be considered unsuitable: federal lands that the surface management agency and the state jointly agree are habitat for resident species of fish, wildlife, and plant species also of high interest to the state and that are essential for maintaining these high interest species. Examples of lands that serve a critical function for these species include but are not limited to 1) active dancing and strutting grounds for Greater Sage-Grouse, Sharp-tailed Grouse (*Tympanuchus phasianellus*), and Prairie Chicken (*T. cupido*); 2) winter ranges crucial for mule deer (*Odocoileus heminonus*), pronghorn antelope (*Antilocapra americana*), and Rocky Mountain elk (*Cervus canadensis*); 3) migration corridors for elk; and 4) extremes of range for plant species.

Greater Sage-Grouse dancing and strutting grounds exist adjacent to the tract. Sage-grouse have also been seen strutting on portions of the tract during the past couple of years (Petersen 2013a). Thus, there is not a single lekking location, but a lekking complex that exists both on and off the tract. Greater Sage-Grouse nesting/brood rearing habitat exists on nearly the entire tract. Also, although current UDWR habitat maps do not identify Greater Sage-Grouse winter habitat on the tract, birds have been documented wintering on the tract. The KFO RMP (BLM 2008b) includes the following decisions with regard to Greater Sage-Grouse habitat management:

- SSS-54: All surface-disturbing activities would be prohibited within 0.5 mile of Greater Sage-Grouse leks on a year-round basis. Oil and gas leasing would be open subject to major constraints (no surface occupancy).
- SSS-55: Allow no surface disturbing or otherwise disruptive activities within 2.0 miles of Greater Sage-Grouse leks from March 15 to July 15 to protect nesting and brood rearing habitat. Oil and gas leasing would be open subject to controlled surface use and timing stipulations.
- SSS-56: Allow no surface disturbing or otherwise disruptive activities in Greater Sage-Grouse winter habitat from December 1 to March 14. Oil and gas leasing would be open subject to controlled surface use and timing stipulations.
- SSS-57: Exceptions, modifications, or waivers to decisions SSS-54, SSS-55, and SSS-56 may be granted on a case-by-case basis.

As a result of decisions SSS-54, SSS-55, and SSS-56, a decision to lease would not be in conformance with the KFO RMP. However, for purposes of analysis in this EIS, it is assumed that an exception, modification, or waiver would be granted in the event of a lease per decision SSS-57. Appendix 3 of the KFO RMP describes the mechanisms by which exceptions, waivers, or modifications would occur (Table 1.7.1). In the ROD following this EIS, it remains in the BLM's decision space not to except, waive, or modify based on the analyses conducted.

Table 1.7.1. Conditions for Exceptions, Waivers, or Modifications with Respect to Decisions SSS-54 through SSS-56 in the Kanab Field Office Resource Management Plan

KFO RMP Decision	Applicable Area	Conditions for Exceptions, Waivers, or Modifications
SSS-54	Within 0.5 mile of a Greater Sage-Grouse lek	**Exception**: An exception may be granted by the field manager if the operator submits a plan that demonstrates that impacts from the Proposed Action can be adequately mitigated.
		Waiver: A waiver may be granted if there are no active lek sites in the leasehold and it is determined the lek sites have been completely abandoned or destroyed or occur outside the current defined area, as determined by the BLM.
		Modification: The field manager may modify the boundaries of the stipulation area if 1) portions of the area do not include lek sites, 2) the lek sites have been completely abandoned or destroyed, or 3) occupied lek sites occur outside the current defined area, as determined by the BLM.
SSS-55	Within 2.0 miles of a Greater Sage-Grouse lek in the nesting and brood-rearing habitat from March 15 to July 15	**Exception**: An exception could be granted if surveys determine that the Greater Sage-Grouse leks in nesting and brood-rearing habitat are not occupied. An exception may also be granted by the field manager if the operator submits a plan that demonstrates that impacts from the Proposed Action can be adequately mitigated or it is determined the lek sites are not active.
		Waiver: A waiver may be granted if it is determined the habitat no longer exists or has been destroyed.
		Modification: The field manager may modify the boundaries of the stipulation area if portions of the area do not include habitat or are outside the current defined area, as determined by the BLM.
SSS-56	In Greater Sage-Grouse winter habitat from December 1 to March 14	**Exception**: An exception could be granted if surveys determine that the Greater Sage-Grouse leks in winter habitat are not occupied, and that snow depths in the area allow continued sage-grouse use. An exception may also be granted by the field manager if the operator submits a plan that demonstrates that impacts from the Proposed Action can be avoided, sufficiently minimized, or adequately mitigated.
		Waiver: A waiver may be granted if it is determined the habitat no longer exists or has been destroyed.
		Modification: The field manager may modify the boundaries of the stipulation area if portions of the area do not include habitat or are outside the current defined area, as determined by the BLM.

Further, in 2011 (following publication of the NOA for the DEIS), the BLM published two instruction memoranda (IMs) addressing Greater Sage-Grouse management. IM 2012-043 was published in December 2011 and establishes Greater Sage-Grouse interim management policies and procedures. IM 2012-044 was also published in December 2011 and establishes a national Greater Sage-Grouse land use planning strategy. In response to these IMs, Unsuitability Criterion Number 15, the KFO RMP, and other concerns that were raised regarding the tract's potential impacts on Greater Sage-Grouse, the BLM, with the involvement and input of stakeholders (see Section 5.2.7), developed the *Alton Coal Tract LBA Greater Sage-Grouse Mitigation Plan* (hereafter the sage-grouse mitigation plan, included as Appendix E).

The sage-grouse mitigation plan complies with IM 2012-043's requirement to "cumulatively maintain and enhance Greater Sage-Grouse habitat" by instituting the following requirements:

- 4:1 ratio of mitigation acres to disturbance acres
- Reclaiming in-tract sagebrush habitats to vegetation standards that would provide sage-grouse habitat

- Establishing practicable "limited-touch" areas in no-coal areas of the tract with intact or restored sagebrush habitats
- Marking or removing all fences within 2 miles of a known lek in the mitigation plan area (see Section 4.18.2.1.2.3)
- Funding road kill carcass removal
- Funding predator control measures

As discussed above in Unsuitability Criterion Number 15, Greater Sage-Grouse active dancing and strutting grounds are adjacent to the tract, sage-grouse have been observed dancing and strutting on the tract, and sage-grouse nesting and brood-rearing habitat, as well as winter habitat, exists on the tract. In total, the tract includes approximately 3,550 acres of sage-grouse habitat. As indicated above, the tract is in the Panguitch SGMA in the State of Utah's sage-grouse conservation plan. Because SGMAs are the focal point of the state's conservation efforts for sage-grouse, inclusion of the tract in the Panguitch SGMA indicates that the habitat it contains is essential. The tract is also part of the Panguitch Management Area, as identified in the *Greater Sage-grouse (*Centrocercus urophasianus*) Conservation Objectives: Final Report* (USFWS 2013a). The sage-grouse mitigation plan addresses impacts to sage-grouse habitat through the measures listed above, which mitigate impacts by avoiding, minimizing, rectifying, and/or reducing those impacts over time. The mitigation measures required in the sage-grouse mitigation plan address the existing KFO RMP restrictions on disturbance to sage-grouse habitat. Before any final decision on the LBA, the BLM would have to re-evaluate the measures in the sage-grouse mitigation plan to confirm that they remain consistent with the applicable requirements of the KFO RMP, because it may be amended by the pending sage-grouse land use plan amendments.

The tract also includes known pygmy rabbit habitat, and individuals have been observed on the tract. The KFO RMP includes the following decisions with regard to the management of pygmy rabbit habitat:

- SSS-60: Apply restrictions (e.g., avoidance or mitigation) to surface-disturbing and disruptive activities on a case-by-case basis in occupied and potential pygmy rabbit habitat for protection of this species and its associated habitat. Site-specific NEPA documentation would address restrictions around pygmy rabbit habitat.

In conformance with the KFO RMP, Section 4.18 of this analysis addresses impacts to and restrictions around pygmy rabbit habitat. Because sage-grouse and pygmy rabbit prefer similar habitats, the sage-grouse mitigation plan also addresses impacts to pygmy rabbit habitat. Both species prefer sagebrush/grassland and rabbitbrush habitats. Because any impacts to this type of habitat would be mitigated for using a 4:1 ratio under the sage-grouse mitigation plan, any impacts to pygmy rabbit habitat would be addressed concurrently with sage-grouse habitat. Section 4.18.3 also lists a potential mitigation measure that would, prior to disturbing an area, identify any pygmy rabbit individuals and translocate them to appropriate habitat in areas not planned for disturbance.

The tract includes approximately 138 acres of crucial mule deer summer range, as well as approximately 3,439 acres of substantial value summer habitat for mule deer. The tract also includes approximately 3,506 acres of substantial value summer habitat for elk, as well as approximately 71 acres of year-long substantial value habitat for Rocky Mountain elk. Crucial winter range does not exist on the tract for either mule deer or elk, nor do migration corridors for elk.

Based on the data and information above, the BLM determined that the tract is unsuitable for surface mining and surface effects from subsurface mining under Criterion 15 (43 CFR 3461.5(o)(1)). However, Criterion 15 indicates that "A lease may be issued if, after consultation with the state, the surface management agency determines that all or certain stipulated methods of coal mining will not have a significant long-term impact on the species being protected" (43 CFR 3461.5(o)(1)). "Certain stipulated methods" of mining refer to "activities conducted on the surface of lands in connection with a surface coal mine or surface operations and surface impacts incident to an underground mine" (43 CFR 3400.0-5(mm)). The effects of the design features and mitigation measures that would apply to any action alternative contemplated in the SDEIS are described in the analysis in Chapters 3 and 4. The BLM will use this analysis to determine whether the potential impacts to these species can be adequately addressed such that "coal mining will not have a significant long-term impact on the species being protected," namely sage-grouse, and whether "[a] lease may be issued."

The BLM has been consulting with the State of Utah throughout the NEPA process on this and other issues. Specifically related to potential impacts to Greater Sage-Grouse and unsuitability, the BLM provided a letter to the State of Utah on March 6, 2015, explaining the BLM's determination as summarized above. On March 27 and April 9, 2015, the State of Utah provided written responses indicating the state's desire that the BLM withdraw its proposed determination that the tract is unsuitable under Criterion 15 and proceed with the determination that the area is not unsuitable for leasing under this criterion. After giving careful consideration to the information provided by the state, the BLM determined that the determination of unsuitability summarized above should remain in this SDEIS and that the BLM will continue to consider the Alton Coal Tract for competitive leasing based on the proposed design features and mitigation measures, which would apply to any action alternative contemplated in the SDEIS. As previously stated, these measures provide a means by which potential impacts to these species may be adequately addressed such that "coal mining will not have a significant long-term impact on the species being protected" and "[a] lease may be issued."

Unsuitability Criterion Number 16 states that the following shall be considered unsuitable for all or certain stipulated methods of coal mining: federal lands in riverine, coastal, and special floodplains (100-year floodplains) on which the surface management agency determines that mining could not be undertaken without a substantial threat or loss of life or property. Section 4.17 of this analysis indicates that mining on the tract could be undertaken without a substantial threat or loss of life or property, and therefore the area remains suitable for mining under this criterion.

Unsuitability Criterion Number 18 states that federal lands with National Resource Waters, as identified by states in their water quality management plans ("High Quality Waters" in the State of Utah), and a buffer zone on federal lands 0.25 mile from the outer edge of the far banks of the water, shall be considered unsuitable. However, the buffer zone may be eliminated or reduced in size where the surface management agency determines that it is not necessary to protect the National Resource Waters. According to the *Final Coal Unsuitability Report* contained in the KFO RMP (BLM 2008b) Kanab Creek and tributaries from the irrigation diversion at the confluence with Reservoir Canyon to its headwaters are designated Category 1 High Quality Waters. These waters are located upstream of the tract and would not be affected by mining activities on the tract. The analyses in Section 4.17 indicate that Kanab Creek and Lower Robinson Creek are the only waterways in the tract. Neither of these is considered High Quality Waters in this location and therefore the area remains suitable for mining under this criterion.

Unsuitability Criterion Number 19 states that the following shall be considered unsuitable where mining would interrupt, discontinue, or preclude farming: federal lands identified by the surface management agency (in consultation with the state in which they are located) as alluvial valley floors (AVFs) according to the definition in Section 3400.0-5(a) of this title, the standards in 30 CFR 822, the final AVF guidelines of OSM when published, and approved state programs under SMCRA. Also, when

mining federal land outside an AVF would materially damage the quantity or quality of water in surface or groundwater systems that would supply AVFs, the land shall be considered unsuitable. The presence of an AVF in or near the tract would not necessarily preclude mining. According to the regulations at 30 CFR 822 the operator of a surface coal mine must

- minimize disturbances to the hydrologic balance by preserving throughout the mining and reclamation process the essential hydrologic functions of an AVF not in the tract, and
- minimize disturbances to the hydrologic balance in the tract by reestablishing throughout the mining and reclamation process the essential hydrologic functions of AVFs.

Further, statutory exclusions listed in 30 CFR 822.12 for surface-mining prohibitions where surface mining would interrupt, discontinue, or preclude farming include

- where the pre-mining land use of an AVF is undeveloped rangeland…not significant to farming;
- where farming on the AVF that would be affected by the surface coal mining operation is of such small acreage as to be of negligible impact on the farm's agricultural production;
- any surface coal mining and reclamation operation that, in the year preceding August 3, 1977, (i) produced coal in commercial quantities and was located in or adjacent to an AVF; or (ii) obtained specific permit approval by the State [state] regulatory authority to conduct surface coal mining and reclamation operations in an AVF; and
- any land that is the subject of an application for renewal or revision of a permit issued pursuant to the Act [SMCRA] which is an extension of the original permit, insofar as (i) the land was previously identified in a reclamation plan submitted under either part 780 or 784 of this chapter [30 CFR], and (ii) the original permit area was excluded from…[the protection of surface-mining prohibitions because the land was in operation before 1977].

Though initial, reconnaissance-level mapping of AVFs has occurred in the Alton area, according to the *Final Coal Unsuitability Report* contained in the KFO RMP (BLM 2008b), a more detailed investigation became necessary following the submittal of the Alton Coal Tract LBA and the initiation of this EIS process. This investigation includes an additional reconnaissance-level study (Appendix F) to determine potential AVFs according to OSM regulations and guidance. Impacts to potential AVFs, as identified in this reconnaissance study, are discussed in Chapter 4. If BLM decides to offer the tract for competitive leasing and a lease is issued, a more detailed study of potential AVFs would be required as part of the permitting process under SMCRA and State of Utah coal mine permitting requirements.

All potential AVFs (57 acres) present on the tract occur in the no-coal zone (an area of the tract where no coal is present; additional discussion of the no-coal zone is provided in subsequent sections of the EIS) and would not be directly affected by pit disturbance. However, direct impacts would result from construction of dispersed facilities and relocation of KFO Route 116. Potential AVFs make up 5% of the total no-coal zone available for dispersed facilities (1,131 acres). Assuming that impacts from dispersed facilities (160 acres) are proportional, 8 acres of potential AVFs would be impacted due to the temporary loss of unconsolidated deposits suitable to flood-irrigated agriculture. The 8 acres affected by dispersed facilities and roads would be rehabilitated upon completion of mining, restoring the function of the potential AVF. Thus, due to the absence of coal, small acreage affected, and temporary nature of the disturbance, at this time none of the tract would be considered unsuitable for surface mining under this criterion.

1.7.1.2.3 Multiple Land Use Conflict Analysis

The third coal screening procedure, a multiple land use conflict analysis, must be completed to identify and "eliminate additional coal deposits from further consideration for leasing to protect resource values of a locally important or unique nature not included in the unsuitability criteria," in accordance with 43 CFR 3420.1-4(e)(3). The KFO RMP (BLM 2008b) addresses seven types of multiple land use conflicts: recreational conflicts, wildlife conflicts, livestock grazing conflicts, water resource conflicts, air resource conflicts, cultural resource conflicts, and paleontological resource conflicts. The land use conflict analysis, largely contained in the KFO RMP, did not result in the proposed elimination of coal deposits in the tract from further consideration for leasing. The impacts analyses in this EIS represent an additional multiple land use conflict analysis addressing, but not limited to, the seven types of multiple land use conflicts included in the KFO RMP. If the multiple land use conflict analysis results in the elimination of additional coal deposits from further consideration for leasing to protect certain resource values, those decisions would be documented in the ROD that follows this EIS.

1.7.1.2.4 Surface Owner Consultation

The fourth coal screening procedure requires consultation with surface owners who meet the criteria outlined in 43 CFR 3400.0-5(gg)(1), (2), and (3) (See footnote on page 1-2). No federal coal lands in the tract have been eliminated from further consideration for leasing due to qualified surface owner conflicts at this time. If the decision is to hold a lease sale for the tract, the BLM will review the surface ownership in the tract prior to issuing the ROD and holding the lease sale, and qualified, private, surface owners will be provided the opportunity to express their preference for or against surface mining of federal coal under their private surface estate. All surface owners have been notified of the Proposed Action and offered the opportunity to participate in the preparation of this EIS. Further, both hardcopy and electronic versions of this EIS have been distributed to surface owners.

1.8 Scope of this Environmental Impact Statement

This EIS analyzes and discloses the environmental impacts of the Proposed Action (Alternative B), a No Action Alternative (Alternative A), and a reasonable range of alternatives to the Proposed Action (i.e., Alternative C and Alternative K1). It does so at a level of detail that allows the lead agency decision maker to make an informed decision regarding implementation of any one of the alternatives. This EIS also serves to disclose the potential impacts of these alternatives to the public, other agencies, and interested stakeholders (e.g., nonprofit organizations representing interests of local and nonlocal constituents, businesses interested in or affected by the Proposed Action and alternatives, and nonprofit trade associations interested in or affected by the Proposed Action and alternatives). Accordingly, this EIS assesses the direct, indirect, and cumulative impacts of each alternative. The analysis identifies potential mitigation measures to reduce or eliminate impacts. Throughout this EIS process, the BLM will continue to solicit and incorporate public input into the alternatives formulation and analysis process. This EIS provides additional analysis required for conformance with the KFO RMP (BLM 2008b) and meets the requirements of the DOI secretarial decision document, *Petition to Designate Certain Federal Lands in Southern Utah Unsuitable for Surface Coal Mining* (1980a).

The scope of this EIS is largely characterized by the issues raised during the public and agency (BLM internally, as well as other state and federal agencies) scoping process, by substantive comments received on the DEIS, and by past, present, and reasonably foreseeable future actions. The issues and past, present, and reasonably foreseeable future actions are summarized below in Section 1.8.1 and Section 1.8.2, respectively.

1.8.1 Issues Raised During Public Scoping and the Comment Process on the Draft Environmental Impact Statement

Issues were identified through consideration of comments from the public and from federal, state, and local agencies interested in and/or potentially affected by the Proposed Action and alternatives. Public comments were solicited during the public scoping process and during the comment process on the DEIS, both of which are described below.

1.8.1.1 THE PUBLIC SCOPING PROCESS

The public scoping process was initiated on November 28, 2006, when the BLM published an NOI to prepare an EIS to offer the tract for competitive leasing. Five public scoping meetings followed. These were held at the locations and on the dates identified in Table 1.8.1. Each meeting was conducted in an open house format with BLM and ACD personnel present to answer questions and provide information. Other resources available at the public scoping meetings included informational display boards; one video explaining the conceptual mining and reclamation sequence; one video explaining a potential transportation route, including truck details; and comment forms on which to submit comments at the meetings. Informational display boards and comment forms are available in the *Alton Coal Tract LBA EIS Public Scoping Report* (SWCA 2007a) prepared following completion of the scoping process. Copies of the videos are available at the BLM-KFO. The 90-day scoping period closed on February 26, 2007.

Table 1.8.1. Public Scoping Meeting Dates, Times, and Locations

Date	Time	City	Address
January 30, 2007	5:00–8:00 p.m.	Alton	Alton Town Hall 11 South 100 West, Alton, Utah 84710
January 31, 2007	5:00–8:00 p.m.	Kanab	Kanab City Library 374 North Main Street, Kanab, Utah 84741
February 1, 2007	5:00–8:00 p.m.	Panguitch	Triple C Arena 50 East 900 North, Panguitch, Utah 84759
February 6, 2007	5:00–8:00 p.m.	Cedar City	Cedar City Library 303 North 100 East, Cedar City, Utah 84720
February 7, 2007	5:00–8:00 p.m.	Salt Lake City	Salt Lake City Public Library 210 East 400 South, Salt Lake City, Utah 84111

1.8.1.2 THE COMMENT PROCESS ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT

The comment process on the DEIS was initiated on November 4, 2011, when the BLM published an NOA of the Alton Coal Tract LBA EIS. Five public meetings, including one public hearing, followed. These were held at the locations and on the dates identified in Table 1.8.2. Each meeting was conducted in an open house format, with BLM personnel present to answer questions and provide information. Other resources available at the public meetings included informational display boards, hard copies of the DEIS, and compact disc copies of the DEIS. The Fair Market Value Hearing was conducted to comply with the BLM's coal leasing regulations at 43 CFR 3425.1. The Fair Market Value Hearing was part of the Cedar City meeting. The public comment period on the DEIS was scheduled for 60 days. However, the public requested an extension of the public comment period. Ultimately, the 85-day public comment period on the DEIS closed on January 27, 2012.

Table 1.8.2. DEIS Public Comment Meeting Dates, Times, and Locations

Date	Time	City	Address
November 29, 2011	6:00–8:00 p.m.	Alton	Alton Town Hall 11 South 100 West, Alton, Utah 84710
November 30, 2011	6:00–8:00 p.m.	Kanab	Kanab City Library 374 North Main Street, Kanab, Utah 84741
December 1, 2011	6:00–8:00 p.m.	Panguitch	Panguitch City Hall and Library 25 South 200 East, Panguitch, Utah 84759
December 6, 2011 (Included hearing)	6:00–8:00 p.m.	Cedar City	Festival Hall Convention Center 96 North Main, Cedar City, Utah 84720
December 7, 2011	6:00–8:00 p.m.	Salt Lake City	Salt Lake City Public Library 210 East 400 South, Salt Lake City, Utah 84111

1.8.1.3 SUMMARY OF ISSUES

Issues and concerns raised during the public scoping process were divided into three categories: 1) those to be addressed through implementing and documenting certain elements of the NEPA process; 2) those to be addressed through analysis of direct, indirect, and cumulative impacts; and 3) those to be addressed through the formulation of alternatives. The substantive issues and concerns, along with the chapter (or chapters) of the document in which they are addressed, are outlined below. A complete list of comments received during the scoping period (and their dispositions) can be found in the *Alton Coal Tract LBA EIS Public Scoping Report* (2007a).

There were substantive comments on the DEIS provided by the public and agencies. Per the BLM NEPA handbook (BLM 2008c) definition, *substantive* comments do one or more of the following:

- Question, with reasonable basis, the accuracy of information in the EIS
- Question, with reasonable basis, the adequacy of, methodology for, or assumptions used for the environmental analysis
- Present new information relevant to the analysis
- Present reasonable alternatives other than those analyzed in the EIS
- Cause changes or revisions in one or more of the alternatives

Substantive comments on the DEIS have been addressed in this SDEIS. Formal responses to comments on the DEIS will be published, along with formal responses to comments on the SDEIS, in the FEIS.

1.8.1.3.1 National Environmental Policy Act Process

This section summarizes the substantive issues and concerns (i.e., those that require analysis in the NEPA process) related to the NEPA process that were identified through the public scoping process. These issues underscore the importance of implementing and documenting (in this document and/or in the administrative record) certain elements of the NEPA process to ensure full public disclosure. The chapter (or chapters) of the document where each issue is (or are) addressed is (are) provided in italics following each bullet.

1.8.1.3.1.1 Leasing Timeline

- When is the appropriate time to begin the analysis of the EIS and consideration of leasing? Following submission of a detailed mining plan? Following a commitment to mine and sell coal? (*Chapter 1 Purpose and Need, Chapter 2 Proposed Action and Alternatives*)

1.8.1.3.1.2 Previous Decisions and Legislation and Need for an Environmental Impact Statement

- Previous studies of coal mining at Alton have been completed. Why is additional environmental analysis required? (*Chapter 1 Purpose and Need, Chapter 2 Proposed Action and Alternatives*)
- How would the proposed lease meet the suitability requirements of SMCRA? (*Chapter 1 Purpose and Need, Chapter 2 Proposed Action and Alternatives*)

1.8.1.3.1.3 Bureau of Land Management's Role and Policies Regarding Public Land Use

- What is BLM's responsibility to protect the public lands, while providing for their use and sustainability? (*Chapter 1 Purpose and Need, Chapter 2 Proposed Action and Alternatives*)

1.8.1.3.1.4 Scope

- Is coal mining on private lands and public (BLM) lands a connected action under NEPA requiring analysis in a single EIS? (*Chapter 1 Purpose and Need, Chapter 2 Proposed Action and Alternatives*)

1.8.1.3.1.5 Purpose and Need

- What are the public purposes and needs for this action and how will they affect the eventual decision to offer the tract for leasing or not? (*Chapter 1 Purpose and Need*)
- How will energy demand affect BLM's decision to lease the tract (*Chapter 1 Purpose and Need*)?

1.8.1.3.1.6 Alternatives

- What reasonable alternatives to the applicant's proposal to lease and mine federal coal reserves in the tract should BLM consider? (*Chapter 2 Proposed Action and Alternatives*)

1.8.1.3.1.7 Affected Environment and Impacts Analysis

- What would be the effects of the coal mine on the natural and cultural environment in and near the tract, and the human values connected to those resources and their uses? (*Chapter 4 Environmental Consequences*)

1.8.1.3.1.8 Data and Expertise for Impacts Analysis

- What data and scientific literature must be collected and analyzed to ensure an adequate analysis of the effects of the Proposed Action and alternatives? (*Chapter 4 Environmental Consequences*)

1.8.1.3.1.9 Cooperating and Consulting Agencies

- What role will BLM's partners play in the EIS analysis of the Proposed Action and the alternatives? (*Chapter 1 Purpose and Need, Chapter 5 Consultation and Coordination*)

1.8.1.3.1.10 Public Involvement

- What opportunities for public involvement should BLM provide to ensure disclosure of information and informed decision making? (*Chapter 1 Purpose and Need, Chapter 5 Consultation and Coordination*)

1.8.1.3.1.11 National Environmental Policy Act Decisions

- What role will local residents play in the decision-making process? (*Chapter 1 Introduction*)
- How will impacts to Bryce Canyon National Park affect the LBA tract leasing decision at Alton? (*Chapter 2 Proposed Action and Alternatives, Chapter 4 Environmental Consequences*)

1.8.1.3.2 Direct, Indirect, and Cumulative Impacts from the Proposed Action and Alternatives

This section summarizes the substantive issues and concerns related to impacts analysis that were identified through the public scoping process. These issues were used to determine which resources to address in the EIS and to what level of analysis. Past, present, and reasonably foreseeable future actions (summarized in Section 1.8.2) were also used in determining resources to address and at what level of analysis. Substantive issues and concerns related to impacts analysis are listed below.

1.8.1.3.2.1 Resources and Uses Covered by Supplemental Authorities

Potential impacts to resources and uses addressed by supplemental authorities are of concern during the NEPA process (BLM 2008c). For the Alton Coal EIS scoping process, the BLM considered potential impacts to 17 resources and uses covered by supplemental authorities:

- Water Quality (surface and ground)
- Wetlands and riparian zones
- Farmlands, prime and unique
- Air quality
- Rangeland standards
- Cultural resources
- Threatened and endangered species
- Paleontological resources
- Wild and scenic rivers
- Hazardous material and waste
- Migratory birds
- Floodplains
- Areas of critical environmental concern
- Wilderness areas and wilderness study areas (WSA)
- Native American trust resources
- Environmental justice (EJ)
- Native American religious concerns

Wild and scenic rivers, wilderness areas and WSAs, Native American trust resources, and areas of critical environmental concern would not be affected by the Proposed Action and alternatives and are therefore not analyzed in detail in this EIS. Impacts on the remaining 13 resources and uses covered by supplemental authorities are analyzed in this EIS. Impacts on rangeland health standards are analyzed under the components of the standards (e.g., vegetation, soil, water, and air) but are not discussed in a section under that heading. The issues and concerns listed below are addressed in Chapter 4 Environmental Consequences.

1.8.1.3.2.2 Issues and Concerns Regarding Impacts on Resources and Uses

Aesthetic Resources

- What effect would noise created by coal mining and coal truck traffic have on the relative noise levels existing in the area, including the town of Alton, adjacent public lands, and nearby parks and monuments?
- What effect would the coal mining operation, coal truck traffic, and dust and smoke caused by mining have on the local landscape (scenic quality) and surrounding viewshed?
- How would lighting for nighttime mining operations affect the darkness of the night sky from key nighttime-sky viewing points such as Bryce Canyon National Park?

Air Resources

- How would development and operation (i.e., construction, heavy equipment use, transportation of coal, etc.) of the coal mine affect local and regional air quality?
- What effect would deposition of dust and other pollutants produced by mining have on water, wildlife, vegetation, recreation uses, and structures in and adjacent to the mining operations?
- What contribution would emissions produced from the mining operation, transportation of coal, and ultimate use of the coal add to the cumulative effect of carbon emissions on global warming?

Cultural Resources

- What impact would coal mining and transporting coal have on prehistoric and historic cultural resources in the tract and along transportation routes?
- How would coal mining and transporting coal impact existing and eligible National Register sites and traditional cultural properties (TCPs)?

Fire Management

- What impact would coal mining, including truck traffic to transport coal, have on air quality; and how would those changes in air quality affect BLM's ability to conduct prescribed burning in wildland-urban interface (WUI) areas to reduce threats of wildfire?
- What impact would revegetation required for tract reclamation have on wildland fire frequency and severity?

Geology and Minerals

- How would coal mining on the tract affect geologic and mineral resources present there?
- What geologic hazards exist on and near the tract and how would they be affected by mining operations and vice versa?
- What is the potential for underground coal fires and what are the environmental consequences of an underground fire?

Hazardous Materials

- What impact would generation, temporary storage, and disposal of hazardous materials (such as those regulated under the Comprehensive Environmental Response, Compensation, and Liability Act, the Superfund Amendments and Reauthorization Act, the Resource Conservation and Recovery Act, and the Toxic Substances Control Act) have on people and the environment?

Land Use and Access

- What impact would development and operation of a coal mine have on local private property values and future development potential of those lands?
- What effect would coal truck traffic have on private property values along transportation routes (KFO Route 116, U.S. Highway 89 [US-89], etc.)?
- What impact would development and operation of a coal mine have on the town of Alton (e.g., air quality, aesthetics, water quality, and public health and safety)?
- How would public lands be used and managed following reclamation of the coal mine?

Livestock Grazing

- How would coal development, mining, and reclamation impact grazing and pasturelands around Alton (i.e., removal of vegetation, restricted access to grazing land for ranchers, etc.), and how would that affect short-term and long-term livestock grazing and production?
- How would road dust and exhaust from passing coal truck traffic affect vegetation growth and palatability of the vegetation for livestock forage?

Paleontology

- How would surface disturbance (i.e., surface mining, road construction, facilities construction, etc.) created by coal mining impact fossils in the tract?

Public Health and Safety (Discussed under Socioeconomics in Chapter 4)

- How would coal truck traffic through towns along potential transportation routes affect public safety in those towns, and along the travel routes?
- What risk of injury and adverse health effects would the mine workers and local public face as a result of mine development?

Special Designations (Discussed under Aesthetic Resources, Air Resources, and Recreation in Chapter 4)

- How would coal mining impact the air quality, viewshed, and nighttime sky of Bryce Canyon National Park?
- How would coal mining impact the resources (air quality, viewsheds, recreation, etc.) of other nearby parks and monuments, including the Grand Staircase-Escalante National Monument; Arches, Canyonlands, and Zion national parks; Kodachrome State Park; and Red Canyon and other public lands?
- How would the noise and presence of coal truck traffic affect the visitor experience at these parks, monuments, and public lands?

Special Status Species (Discussed under Wildlife and Special Status Species in Chapter 4)

- How would development and operation of a coal mine impact special status species and their habitat, including Greater Sage-Grouse, Utah prairie dog (*Cynomys parvidens*), Burrowing Owl (*Athene cunicularia*), Bald Eagle (*Haliaeetus leucocephalus*), Golden Eagle (*Aquila chrysaetos*), pygmy rabbit, Northern Goshawk (*Accipiter gentilis*), Ferruginous Hawk (*Buteo regalis*), Bonneville cutthroat trout (*Oncorhynchus clarki utah*), and Utah *Physa*?
- What effect would noise from coal truck traffic have on special status species? How would wildlife mortality from vehicle collisions affect wildlife populations?

Socioeconomics

- What opportunities for employment would development and operation of the coal mine create?
- How would development and operation of a coal mine affect local businesses and tourism?
- How would development and operation of a coal mine affect tax revenues to Kane and Garfield counties? What, if any, additional county services (ambulance, firefighting, sheriff, etc.) would be required to support the mine?
- What effect would coal truck traffic have on tourism and local businesses along potential transportation routes?
- What are the economic benefits of development and operation of a coal mine?
- How would development of the tract contribute to the supply of coal available for use in the region?

Soils

- What impact would development and operation of a coal mine (including final reclamation) have on productivity of soils, including biological soil crusts?
- How would coal mining affect farmland productivity?
- What impact would development and operation of a coal mine have on soil stability and rates of erosion?
- What effect would road and coal dust and exhaust from mining-related traffic have on soil productivity in proximity to roads in the tract and along potential transportation routes?

Transportation

- What effect would coal truck traffic for transporting coal to market have on traffic conditions along the transportation route?

Vegetation

- How would coal development, mining, and reclamation affect vegetation communities in the tract?
- What effect would coal mining, including truck traffic to transport coal, have on the introduction and spread of exotic vegetation?
- What effect would road and coal dust and exhaust from mining-related traffic have on the health and growth of vegetation adjacent to roads in the tract and along potential transportation routes?

Water Resources

- What effect would development and operation of a coal mine have on surface-water quality and quantity?
- What effect would development and operation of a coal mine have on groundwater quality and quantity?
- How would mining operations impact riparian areas and wetlands?
- How would coal mining affect the possible existence of an AVF near the town of Alton?
- How would road and coal dust and vehicle exhaust, resulting from operation of coal trucks, impact the quality of water bodies adjacent to transportation routes?

Wildlife

- What effect would development and operation of a coal mine, including reclamation and coal truck traffic, have on wildlife and their habitat, including nocturnal wildlife?

1.8.1.3.3 Alternatives Formulation

This section summarizes the comments provided in the public scoping process and comment process on the DEIS that specifically refer to or specifically indicate the need for the development of alternatives to the Proposed Action. Issues summarized above (Sections 1.8.1.3.1 and 1.8.1.3.2) were also considered in the alternatives development process along with past, present, and reasonably foreseeable future actions discussed in Section 1.8.2.

Chapter 2 provides a complete description of the alternatives analyzed in detail, and those alternatives considered but eliminated from detailed analysis. A brief rationale for the dismissal of alternatives is provided there.

1.8.1.3.3.1 Decision to Lease

- Should the BLM delay offering the tract for lease until less-impacting extractive processes are developed?
- The BLM should consider leasing all known recoverable coal resources rather than just the tract in question for which an LBA was received.
- Based on the analyses in the DEIS, the BLM should update their coal unsuitability determinations in the KFO RMP (BLM 2008b) and reconfigure the tract to match these updated determinations.

1.8.1.3.3.2 Mining Methods and Coal Production

- What are practical alternatives to surface mining in the tract?

1.8.1.3.3.3 Energy Conservation and Alternative Sources of Energy

- The BLM should consider foregoing the coal lease and instead promote energy conservation and the development of alternative forms of energy such as solar, wind, and natural gas.

1.8.1.3.3.4 Air Quality

- How would operations be designed and controlled to prevent the release of unsafe levels of nitrogen dioxide (NO_2)?
- How would operations be designed and controlled to ensure no violations of National Ambient Air Quality Standards (NAAQS)?

1.8.1.3.3.5 Special Designations

- Coal mining should be designed, and modified if needed, to reduce impacts to Bryce Canyon National Park.
- Is it feasible and reasonable to consider alternative locations for leasing rather than the LBA tract currently under consideration?

1.8.1.3.3.6 Transportation

- What methods of coal transportation (e.g., slurry, rail, and truck) should be considered to reduce impacts to the environment, nearby communities, and public safety?

- Construction of a power plant next to the mine should be considered as a way to eliminate impacts from coal truck traffic.
- Restrictions on coal truck traffic before sunrise and after sunset should be considered to improve public safety and reduce transportation-related impacts to wildlife.

1.8.1.3.3.7 Cultural Resources

- The BLM should consider an alternative tract configuration that excludes all cultural resources sites eligible for the National Register of Historic Places (NRHP).

1.8.1.3.3.8 Wildlife and Special Status Species

- The BLM should consider an alternative that places seasonal timing restrictions on the entire tract.

1.8.2 Past, Present, and Reasonably Foreseeable Future Actions

This section lists past, present, and reasonably foreseeable future actions in and near the tract. These past, present, and reasonably foreseeable future actions will be used to guide the analysis of cumulative impacts of the Proposed Action and alternatives. A more detailed discussion of these actions can be found in Section 4.19, Cumulative Impacts.

1.8.2.1 PAST ACTIONS

- Historical uses of tract lands and surrounding lands (such as livestock grazing, hunting, coal exploration and production, mineral material extraction, paleontological prospecting, and coalbed methane [CH_4] exploration)
- Vegetation treatments
- ROWs for roads and utilities and road and utility construction
- Construction of the Jackson Flat Reservoir

1.8.2.2 PRESENT ACTIONS

- Sand and gravel development
- Livestock grazing
- Big game hunting operations
- Road relocations and utility ROWs
- Tourist and local traffic use of Johnson Canyon Alton Amphitheater Scenic Backway
- Surface-mining operations at the Coal Hollow Mine for private fee coal (approximately 5 million tons) on 636 acres of privately owned land adjacent to the tract (see Maps 1.1 and 1.2)
- Construction and use of haul roads for transporting coal from the Coal Hollow Mine to KFO Route 116 north of the town of Alton
- Use of an existing transportation route US-89 to State Road 20 (SR-20) to Interstate 15 (I-15) to Iron Springs along U.S. Route 56 for transporting coal from the Coal Hollow Mine to market
- Dispatch, fueling, and washing facilities related to coal haulage for the Coal Hollow Mine
- Construction of a Garkane Energy 138-kilovolt transmission line in Garfield County, Utah, between the towns of Tropic and Hatch

1.8.2.3 REASONABLY FORESEEABLE FUTURE ACTIONS

- Surface-mining operations for private fee coal on approximately 378 acres of private, surface-owned land adjacent to the tract to the north (see Maps 1.1 and 1.2)
- Future energy corridor development related to the *Programmatic Environmental Impact Statement, Designation of Energy Corridors on Federal Land in the 11 Western States*
- Development of wind energy
- Construction of the Lake Powell pipeline
- Vegetation treatments including but not limited to prescribed fire, herbicide applications, and mechanical thinning and grubbing
- Coalbed CH_4 exploration
- Oil and gas exploration (seismic exploration) and development
- Mining alabaster and Septarian nodules
- Sand and gravel production
- Building stone collection
- Motorized travel on existing roads and trails
- Clay development
- Exploration and possible underground coal mining operations on state-owned coal, Section 36, Township 39 South, Range 5 West and Section 2, Township 40 South, Range 5 West, Kane County, Utah, pursuant to Exploration Agreement and Option to Lease between ACD and Utah State Institutional and Trust Lands Administration (SITLA)
- Implementation of the sage-grouse land use plan amendment/EIS

1.9 Consultation and Coordination

Initial involvement with respect to BLM's receipt and review of ACD's LBA and details on the public notification, public scoping process, and the cooperating agencies are described above. Chapter 5, Consultation and Coordination, provides further detail on consultation and coordination for the proposed tract and preparation of this EIS.

CHAPTER 2. PROPOSED ACTION AND ALTERNATIVES

CHAPTER 2 PROPOSED ACTION AND ALTERNATIVES

2.1 Introduction

NEPA requires the consideration and evaluation of a practical range of reasonable alternatives that meet the federal action's purpose and need while minimizing or avoiding environmental impacts. A practical range of reasonable alternatives is formulated to address issues and concerns raised by the public and agencies during scoping. The alternatives represent other means (methods, processes, locations, times, sequences, etc.), besides the Proposed Action, of satisfying the stated purpose and need for the federal action. Reasonable alternatives are defined by the Council on Environmental Quality (CEQ) as those that are technically, economically, and environmentally practical and feasible. NEPA also requires the evaluation of a No Action Alternative. If unreasonable alternatives or alternatives that do not meet purpose and need are suggested, a detailed analysis of these alternatives is not required. However, the rationale for eliminating them from detailed analysis must be explained.

In this EIS, four alternatives are analyzed in detail: Alternative B (Proposed Action Alternative), Alternative C (Reduced Tract Acreage and Seasonal Restrictions), Alternative K1 (Reduced Tract Acreage), and Alternative A (No Action). Several other alternatives were identified and considered but were eliminated from detailed analysis. These alternatives are described in Section 2.7 along with the rationale for eliminating them from detailed analysis. Alternative K1 was eliminated from detailed analysis in the DEIS. However, as a result of public comments received on the DEIS, Alternative K1 is analyzed in detail in this SDEIS.

Department of Interior regulations (43 CFR 46.425) suggest that departmental agencies should identify preferred alternatives in draft EISs, but they do not require them to do so. The BLM did not identify a preferred alternative or preferred alternatives in the Alton Coal Tract LBA DEIS published in November 2011, because no such preference existed at that time. That continues to be the case now. In developing this SDEIS, the BLM has conducted extensive consultation and coordination activities with its cooperating agencies and other agencies with special expertise (see Section 1.3 and Chapter 5). The BLM has also expanded the range of alternatives analyzed in detail, with the inclusion of Alternative K1 for detailed analysis.

As explained in Chapter 1, the BLM has determined that although the tract is unsuitable under Unsuitability Criterion 15, the BLM can nevertheless continue to consider the tract for leasing because, as stated under Criterion 15, "[a] lease may be issued if, after consultation with the state, the surface management agency determines that certain stipulated methods of coal mining will not have a significant long-term impact on the species being protected." A number of measures intended to address the potential impacts of the alternatives on sage-grouse are included in the analysis in this SDEIS. These measures would apply to the tract under any action alternative. The BLM has opted not to select a preferred alternative at this time because it is interested in receiving additional agency and public input on this analysis and on the efficacy of those measures relative to the impacts of leasing and mining the tract under the action alternatives. The BLM will identify its preferred alternative in the FEIS after all comments received on this SDEIS are considered.

LBA tracts are nominated for leasing by companies with an interest in acquiring a lease. As described in Chapter 1, the LBA process is, by law and regulation, an open, public, competitive sealed-bid process. If the Alton Coal Tract LBA is offered for lease, the applicant for that tract may or may not be the highest bidder when the lease sale is held, and therefore may not be the successful bidder. Further, if a decision is made to hold a competitive lease sale and a lease is issued, the lessee must obtain mine plan approval and a permit to conduct coal mining operations, including a detailed mining and reclamation plan (MRP), before mining can begin on the tract. A detailed MRP is not developed at the time the BLM processes an LBA

primarily because of the uncertainty regarding who the successful lessee might be in the event the tract is leased. As discussed in Chapter 1, the MRP and overall PAP would be developed and would undergo a detailed review by state and federal agencies as part of the approval process to mine, which occurs after the tract is leased. The approval of a PAP requires that reclamation be completed such that the post-mining land use achieves a higher and better use requirement (30 CFR 715.13). The detailed MRP of any successful bidder, the applicant or otherwise, would be required to conform to the stipulations and conditions attached to the lease through the land use plan and to conform to the decisions following this EIS. The conceptual MRPs described in this EIS for the Proposed Action, Alternative C, and Alternative K1 are not final plans, but represent reasonably foreseeable development (RFD) for use in analyzing the potential environmental consequences of issuing a lease for the tract.

The Alton Coal Tract is in Kane County, Utah, approximately 0.10 mile south of the town of Alton and 2.9 miles east of US-89. A map of the tract in relation to surrounding towns, highways, existing and potential fee coal areas, and other area landmarks is presented in Map 1.1. Under the Proposed Action, Alternative C, and Alternative K1, tract configurations contain a mix of federal surface and mineral estate and split estate (private surface and federal minerals) lands. Private surface owners with lands included in the tract under either tract configuration may meet the requirements listed under 43 CFR 3400.0-5(gg)(1), (2), and (3) to be qualified surface owners[1] and are therefore considered to be legally qualified to give consent to mine federal minerals under their private estates. A final determination of surface-owner status and qualified surface-owner consultation would occur after issuance of the ROD, but prior to leasing, if the tract is offered for leasing. In the event that one or more of the qualified surface owners would not consent to leasing, the related land (or lands) would be removed from the tract prior to holding a lease sale. However, based on patent records (available through the BLM Utah State Office), some surface owners may not have the authority, based on the congressional act[2] under which land was transferred from federal to private ownership, to refuse access to their private surface for purposes of coal mining. A final determination of surface-owner rights to refuse access to coal resources under their private surface estates would occur after a ROD is issued, but prior to leasing, if the tract is offered for leasing. For purposes of the EIS analysis it is assumed that, in the event of a lease sale, all private surface estates under which coal deposits are present would be mined.

As indicated in Chapter 1, some of the coal reserves in the tract under the Proposed Action, Alternative C, and Alternative K1 are not currently considered recoverable because KFO Route 116 traverses the proposed tract. Under SMCRA, the approval of surface-mining operations on lands within 100 feet of the outside line of the ROW for a public road requires a process resulting in a final decision by DOGM or the public road authority (43 CFR 3461; Unsuitability Criterion Number 3). As discussed in Chapter 1, Section 1.7.1.2.2, the coal underlying KFO Route 116 and underlying a buffer zone extending 100 feet on either side of the outer edges of the road is currently considered unsuitable for mining. However, if the decision is to offer the tract for competitive leasing, the successful bidder would be responsible for any road relocation, as required for mining of the tract. The successful bidder, Kane County, and the BLM would work on a plan that conforms to DOGM's responsibility and leasing criteria to relocate KFO Route

[1] Under the regulations under 43 CFR 3400.0-5(gg)(1), (2), and (3) qualified surface owner means the natural person or persons (or corporation, the majority stock of which is held by a person or persons otherwise meeting the requirements of this section) who: 1) hold legal or equitable title to the surface of split estate lands; 2) have their principal place of residence on the land, or personally conduct farming or ranching operations upon a farm or ranch unit to be affected by surface-mining operations; or receive directly a significant portion of their income, if any, from such farming and ranching operations; and 3) have met the above conditions for a period of at least three years, except for persons who gave written consent less than three years after they met the above requirements. In computing the three year period the authorized officer shall include periods during which title was owned by a relative of such person by blood or marriage if, during such periods, the relative would have met the requirements of this section. A qualified private surface owner is legally qualified to give consent to mine federal minerals under the private surface owner's estate.

[2] Private surface estates within the tract were originally granted to private surface owners under either 35 Stat., 844 (March 3, 1909), 36 Stat., 583 (June 22, 1910), or 39 Stat., 862 (December 29, 1916).

116 to allow recovery of the coal underlying the road and its buffer zone. The action alternatives assume that an agreement to relocate the road would be reached (KFO Route 116 relocation is discussed under each resource section in Chapter 4). Other roads traversing private land and BLM-administered land are also present on the tract. The EIS analysis assumes that these roads would be closed for the duration of active mining operations and that they would be replaced following completion of successful mining and reclamation activities. The successful lessee would be responsible for reestablishment of these roads based on private landowner and BLM direction at the time of final reclamation. Temporary roads, which would be reclaimed following mining, may be constructed during active mining operations to allow access as necessary for private landowners and permittees (see Section 2.6.2). The estimated cost to a successful bidder for relocating KFO Route 116 and for replacing roads on private land and BLM-administered land would be considered by the BLM in the fair market value determination for the tract. To be successful, a bidder must pay fair market value for the tract.

The Alton Coal Tract under all action alternative configurations also includes an area where no coal is present due to erosion or past natural coal fires (Powell 2008). This is known as the no-coal zone. Although these lands would not be mined, they are included in each tract configuration to 1) allow maximum economic recovery of all the mineable coal that lies adjacent to the no-coal zone, 2) comply with the coal leasing regulations that do not allow leasing of fewer than 10-acre aliquot parts, 3) provide additional surface acreage deemed by the BLM to be reasonably necessary to conduct mine operations, and 4) allow for habitat enhancement in the tract close to areas that would be mined.

In the analysis, different areas of the tract under each action alternative have been assigned identifiers based on their locations. Block NW is the northwest portion of the tract closest to the town of Alton. Block C is the central portion of the tract that includes the centralized facilities and the area that would be underground mined due to overburden exceeding approximately 200 feet in thickness. The central-west north (Block SWN) and central-west south (Block CWS) portions of the tract, respectively, consist of coal reserves that are essentially disconnected from other portions of the tract. Blocks S and Sa make up the south portion of the tract, with Block Sa being the area of the tract in the no-coal zone where sage-grouse habitat enhancement would be required under any action alternative other than Alternative K1, which does not include Block S or Block Sa (see Table 2.5.1). The approximate boundaries of each of these blocks of the tract are depicted on Map 2.1.

Under the Proposed Action, Alternative C, or Alternative K1, coal would be mined from one coal seam, referred to as the Smirl Coal Zone. The Smirl Coal Zone has an average thickness of 15.3 feet based on 25 cored drill holes over the tract. Coal quality and thickness are both variable over the tract. Some coal quality information is included in Section 3.6 of this document. The Bald Knoll Coal Zone is also present in the tract but is not proposed for mining in the lease application. The quality and quantity of coal in the Bald Knoll Coal Zone in the tract are insufficient to be recoverable.

2.2 Alternative A: No Action

Under the No Action Alternative, the application to lease the coal included in the Alton Coal Tract under the Proposed Action, Alternative C, or Alternative K1 would not be approved, the LBA tract would not be offered for competitive lease sale, and the coal included in the LBA tract would not be mined.

Rejection of the application would not affect mining activities on private land adjacent to the tract (i.e., the Coal Hollow Mine). The Coal Hollow Mine consists of approximately 635 acres of land and approximately 5 million short tons of recoverable coal leased from private surface and mineral owners. Average annual coal production is anticipated to be approximately 2 million tons and mining activities are expected to employ approximately 160 persons (100 at the tract and 60 for coal trucking operations); though initial operations and startup would employ much less (approximately 16 employees). Rejection

of the application would also not affect an anticipated permit application from ACD to mine fee coal on private lands adjacent to the tract to the north. These fee coal areas are depicted in relation to the tract under the Proposed Action in Map 1.2, under Alternative C in Map 2.2, and under Alternative K1 in Map 2.3.

To compare the economic and environmental consequences of mining these lands versus not mining them, this EIS was prepared under the assumption that the tract would not be mined in the near future if the No Action Alternative is selected. Under the No Action Alternative, the public lands in the tract would continue to be managed in accordance with the KFO RMP (BLM 2008b).The area would be managed for livestock grazing, recreation (primarily hunting and off-highway vehicle [OHV] use), and wildlife habitat. Vegetation treatments (wildlife habitat treatments, watershed treatments, livestock rangeland treatments, wildland fire use, fuels treatments, and stewardship contracting) would occur in support of the BLM's Healthy Lands Initiative. Private lands in the tract would continue to be used for livestock grazing, farming, and dispersed recreation (especially hunting).

Selection of the No Action Alternative would not preclude leasing and mining of this tract sometime in the future. To consider leasing and mining this tract in the future, another LBA would have to be submitted and another NEPA process would need to be conducted.

2.3 Alternative B: Proposed Action

Under the Proposed Action, the Alton Coal Tract would be offered for lease at a sealed-bid, competitive lease sale, subject to lease stipulations developed for the tract. The boundaries of the tract would be reasonably consistent with the tract reconfiguration completed by the BLM after ACD's original LBA submittal (see Map 1.2).

2.3.1 Location and Overview

The tract under the Proposed Action encompasses approximately 3,576 acres[3], of which approximately 2,280 acres are federal surface and mineral estate and 1,296 acres are split estate; private surface estate and federal mineral estate (Map 1.2 depicts private and BLM surface in the tract under the Proposed Action). However, not all surface estates, private or federal, have coal reserves underlying them (Map 1.2 also depicts the approximate extent of the coal line in the tract). The legal description of the tract under the Proposed Action is contained in Table 2.3.1. The land description and acreages are based on the BLM Status of Public Domain Land and Mineral Titles approved Coal Plats as of August 21, 2002, and July 28, 2006.

[3] The NOI identifies 3,581 acres, more or less, in the tract. However, for reasons described in Table 1.1.1 and Section 3.1.3 (Notes on Data Sources and Tract Acreage), the analysis uses a tract acreage of 3,576 acres.

Table 2.3.1. Alton Coal Tract Legal Description and Surface Ownership under the Proposed Action

Legal Description*	Surface Owner†	Acres
Township 39 South, Range 5 West, Salt Lake Meridian, Utah		
Section 7, SE¼SW¼ and S½SE¼	3	122
	5	7
Section 18, lots 3 and 4, E ½, E½W½	BLM	357
	3	42
	16	158
	17	3
Section 19, lots 1 through 4, NE¼, E½W½, N½SE¼, SE¼SE¼	BLM	472
	1a	120
Section 20, lots 4 and 5, N½SW¼	BLM	47
	1a	111
Section 30, lots 2 through 4, SW¼NE¼, SE¼NW¼, E½SW¼, W½SE¼	BLM	338
	1a	13
Section 31, lots 1 through 3, NE¼, E½NW¼, NE¼SW¼, N½SE¼	BLM	471
Township 39 South, Range 6 West, Salt Lake Meridian, Utah		
Section 12, SW¼, W½SE¼	Unknown	9
	3	218
	8	16
Section 13, NW¼NE¼, N½NW¼, SE¼NW¼, SE¼	BLM	160
	3	161
Section 24, NE¼, N½NW¼, SE¼NW¼, E½SW¼, N½SE¼, SE¼SE¼	BLM	159
	11	4
	12	313
Section 25, E½NE¼, SW¼NE¼, SE¼	BLM	276
Error‡		5
Total Private		**1,296**
Total BLM		**2,280**
Total LBA		**3,581**

Note: This table also appears in Chapter 1.

* Based on the BLM Status of Public Domain Land and Mineral Titles approved Coal Plats as of August 21, 2002 and July 28, 2006.

† Where the BLM is the surface owner of the parcel this is explicitly noted. Private surface owners are numbered rather than identified by name due to privacy concerns.

‡ The acreages above were calculated using ESRI ArcGIS 9.2 and NAD 1983 UTM Zone 12N coordinate system. The BLM shapefile of coal ownership is georeferenced (in NAD 1983 UTM Zone 12N), but is not survey accurate. ACD provided a hardcopy map (with surface ownership and section boundaries), which was scanned and georeferenced to section corners visible on USGS 7.5-minute topographic maps. Polygons were then digitized to encompass/represent each of the legal descriptions above using the BLM shapefile, ACD's georeferenced map, and the USGS 7.5-minute topographic map as references while digitizing. All acreages are approximate and have not been verified by ground surveys. The error is largely a result of the disparate sources for boundary data. Additionally, the ownership lines from the map provided by ACD do not align well in all locales with the BLM boundary. This suggests that one or both of these datasets are approximate and is another potential source of error.

Under the Proposed Action, recoverable portions of in-place coal reserves would be mined over approximately 25 years using 1) surface-mining methods where the depth of overburden would be less than approximately 200 feet, and 2) underground methods (development mining, auger mining, highwall mining, longwall mining, and/or room and pillar mining; see Appendix C) where the depth of overburden would exceed approximately 200 feet. The choice of mining method, however, can vary from the 200-foot overburden threshold depending on the coal thickness, overburden type, overburden (highwall) stability, underground mining techniques available, operating and capital costs, and coal market economics. (The analysis considers surface disturbance for surface mining up to approximately 200 feet of overburden removal.) Approximately 2 million tons of coal per year would be mined once topsoil stockpiling and initial overburden removal have occurred. Reclamation would be concurrent with mining over the course of the estimated 25-year life of the mine and would be followed by a minimum 10-year reclamation and revegetation monitoring period.

BLM independently evaluated the coal resources in the tract. BLM estimates that the tract under the Proposed Action consists of approximately 59.6 million tons of in-place coal and that an estimated 44.9 million tons of coal would be recoverable from the tract. BLM estimates that in areas where coal would be mined by surface-mining methods, approximately 90% of the estimated in-place coal reserves could be recoverable. However, in those portions of the tract that must be mined by underground mining methods, approximately 50% of the in-place coal reserves could be recoverable. These percentage recovery estimates are based on assumptions about the depth to which the use of surface-mining methods is feasible and the extent of the no-coal zone.

2.3.2 Preliminary Mine Plan

This section describes, on a conceptual level, the MRPs that would be used to mine and reclaim lands in the tract under the Proposed Action. The conceptual MRPs described here are not final plans but represent RFD for use in analyzing the potential environmental consequences of issuing a lease for the tract. As described in Section 1.1, the successful lessee would file a PAP with the DOGM and OSM for a surface-mining permit and approval of an actual mining plan after a lease has been issued by the BLM. Analysis of the site-specific permit application and mining plan occurs at this time.

2.3.2.1 MINING METHODS AND MINE FACILITIES[4]

It is anticipated that approximately 1,993 acres of surface disturbance would occur in the tract under the Proposed Action. Of this, 1,750 acres would be the result of surface-mining operations (pit disturbance). Centralized facilities associated with mining activities on the tract would be located for the life of the mine on approximately 36 acres of BLM-administered land in the tract's no-coal zone (see Map 1.2). These facilities would include an office, maintenance shop, equipment wash bay, oil and fuel storage tanks, oil and fuel storage containment, truck unloading and coal sizing area, coal stockpile area, and truck loadout area. Dispersed facilities necessary to conduct mining operations would include temporary light-use roads and haul roads, electrical poles and lines, various temporary ponds and water-control structures, temporary topsoil and overburden stockpiles, and temporary berms and screens. These facilities would be moved on a regular basis based on the mining sequence and would result in approximately 160 acres of active disturbance. Dispersed facilities would be sited to avoid disturbances to cultural resources, wetlands, floodplains, stream channels, and intact sagebrush stands wherever possible. Where it is not possible to avoid disturbances to these areas, mitigation measures would be prescribed.

[4] Under the Proposed Action, an EODA may be required, as described in Section 2.4.2.1, if a company other than ACD were the successful bidder. ACD would not require an EODA under the Proposed Action because they have already obtained fee coal leases adjacent to the tract that would allow them to start mining operations on the tract without creating a new pit that is not adjacent to an existing open pit.

SMCRA requires that mine operators "minimize disturbances to the prevailing hydrologic balance at the mine-site and in associated offsite areas and to the quality and quantity of water in surface and ground water systems both during and after surface coal mining operations and during reclamation" (30 USC 1265(b)(10)). DOGM is responsible for ensuring protection of the hydrologic balance when permitting coal mining operations (UAC R645-301-731.100).

At any one time, anticipated active mining operations (including open surface-mining pits from which coal would be removed and areas where topsoil and/or overburden would be removed) would involve approximately 120 acres (one open pit). The depth of an open pit from which coal is being removed would be up to approximately 200 feet, and highwall length would be up to approximately 1,500 feet. An additional approximately 120 acres or more would be in some stage of reclamation (overburden replacement and top-soiling, grading to approved post-mine topography [PMT], or seedbed beginning).

Where the depth of overburden is approximately 200 feet or less, surface-mining methods would be used to mine in-place coal reserves. Topsoil removal with suitable heavy equipment, such as rubber-tired scrapers, would proceed ahead of overburden removal. Topsoil would be salvaged and stored in a protected site until required for reclamation. Whenever possible, direct placement of topsoil in an active reclamation area would be conducted; however, due to scheduling, some topsoil would be stockpiled. Overburden removal would be conducted using equipment such as trucks and shovels. Other equipment used during overburden removal and backfilling would include dozers, scrapers, excavators, front-end loaders, graders, and water trucks. To confine disturbance to the active mine blocks, as overburden is removed, most of it would be directly placed into areas where coal has already been removed. According to DOGM rules and regulations, as part of the PAP for a permit to conduct mining operations, overburden is pre-sampled to verify that it is suitable for reclamation. Material found to be unsuitable for reclamation (i.e., material that is not suitable for use in reestablishing vegetation or that may affect groundwater quality due to high concentrations of certain constituents, such as adverse pH levels) would either be removed and treated, or adequately covered with suitable overburden material prior to grading and top-soiling.

Where the depth of overburden is approximately 200 feet or more, underground mining methods would be used to mine in-place coal reserves. This would account for approximately 613 acres in the northeast section of the tract[5]. For underground mining, the use of methods such as development mining, auger mining, highwall mining, longwall mining, and/or room and pillar mining would be anticipated. For descriptions of these underground mining methods and references for further information, see Appendix C. Following coal removal, trucks would transport coal from the open pit to the centralized facilities for sizing, temporary stockpiling, and eventual placement on trucks for transport to market. This process would likely involve loading unsized coal into a hopper, which would then feed coal into a breaker to reduce the coal to a maximum size and to even the flow of coal to the conveyor belt. The conveyor belt would lead to a crusher that would size coal to the appropriate dimensions for sale and delivery to market. After sizing, coal would be moved to a temporary stockpile (approximately 50,000+ tons would be stockpiled at any one time) via a stacker (an inclined conveyor belt) or system with a similar purpose before being placed on coal trucks via a feeder system. Each truck would carry approximately 42 tons of coal.

2.3.2.2 RECLAMATION

The successful bidder is required to develop a site-specific, detailed reclamation plan as part of the PAP, in consultation with BLM and DOGM. The reclamation plan in the PAP would include specifications for grading the surface to an acceptable PMT, replacement of salvaged topsoil to an acceptable depth over

[5] Surface-mining operations would be discontinued at an approximate 200 feet maximum of overburden removal, resulting in 613 acres of the tract being mined using underground mining methods. This acreage figure describes the total area within the tract where coal recovery would occur due to underground mining methods. Also see Maps 1.2, 2.2, and 2.3.

suitable overburden, and reestablishment performance criteria for revegetation for the determined post-mining land use.

The reclamation plan describes concurrent reclamation (occurring during operation of the mine) and final site reclamation (upon closure of the facility). The UAC R645-301-553 requires rough backfilling and grading to follow coal removal by not more than 60 days or 1,500 linear feet; although, additional time may be granted if it can be demonstrated in a detailed written analysis that additional time is necessary. Upon approval of the PAP by DOGM, the mine operator would be required to post a reclamation performance bond with the State of Utah for all areas physically disturbed by mining operations. This would ensure that the operator complies with all the reclamation requirements of the DOGM MRP Permit[6] and that all reclamation requirements are met. The reclamation bond could be fully released after a minimum10-year period (post-completion of permanent reclamation operations) on stable reclaimed land where revegetation standards have been met. DOGM would release the full reclamation performance bond after strict reclamation standards have been met and after the public has been provided an opportunity to comment.

As previously described, approximately 120 acres or more would be in some stage of reclamation (overburden replacement and topsoiling, grading to approved PMT, or reseeding/revegetation). Most replaced overburden would be graded to approximate original contour (AOC), plowed, and finally covered with topsoil (from the topsoil storage areas on-site). In locations where the AOC cannot be achieved, a variation from AOC would be requested in the PAP and would require approval from DOGM and the land management agency or private landowner. Elevations consistent with an approved PMT would be established as soon as reasonably possible. Under certain conditions, the PMT may not be immediately achievable. This would occur if there is an excess of material that may require temporary stockpiling, if there is insufficient material available from current overburden removal operations, or if future operations could redisturb an area previously mined.

Prior to reseeding, compacted areas would typically be plowed or chiseled to loosen compacted soils. Plowing or chiseling promotes water infiltration, soil aeration, and root penetration. This would be done when soils are at an optimum moisture content and are loose and friable, to promote shattering of compacted soils, but to avoid pulverizing the soil into powder. Seedbed preparation would be conducted immediately prior to seeding to prepare a firm seedbed conducive to proper seed placement, to provide for moisture retention, to break up dried and hardened surface soil, and to discourage weeds. It is anticipated that chiseling would be sufficient because it leaves a surface smooth enough to accommodate a tractor-drawn drill seeder but rough enough to catch broadcast seed and trap moisture and runoff. An alternative to the use of chiseling is to spread topsoil using a low ground pressure dozer, which would minimize compaction of the soil, leaving a suitable surface for seeding.

Vegetation would be reestablished with a DOGM-approved seed mix (developed based on input from the BLM, UDWR, or private landowner) that is consistent with the determined post-mining land use. The seed mix used for revegetation on federal land would include a diverse mix of suitable native and non-native perennial grasses, forbs, and shrubs. On these lands, reclamation would most likely require an attempt to reestablish native and non-native vegetation communities suitable for the post-mining land use. Establishment of reclamation species would be designed to support post-mining land use by stabilizing the soil, providing livestock and wildlife forage, and providing thermal, nesting, and parturition cover for wildlife. On private land, revegetation would most likely involve the reestablishment of pre-mining agricultural vegetation in accordance with directives from private landowners and local, state, and federal

[6] State of Utah coal mine permitting requirements (Coal Mining Rules - UAC R645) are available at http://www.rules.utah.gov/publicat/code/r645/r645.htm. They may also be viewed at the main office of the DOGM at 1594 West North Temple, Suite 1210, Salt Lake City, Utah 84114.

regulations, as applicable[7]. In general, reclamation operations would use weed-free seed and equipment, methods that are appropriate for local rainfall and soil conditions, and methods that have been successfully used for revegetation at other, similar mines. On federal land, special consideration of post-mining habitat establishment for sagebrush obligate species would be performed in coordination with DOGM, UDWR, and the BLM.

Fall and spring seeding would occur to take advantage of available moisture. During final reclamation and return of the site to direct federal management (as specified in the approved PAP), the successful bidder would obtain necessary authorizations from the appropriate regulatory agencies for final bond release and to properly reclaim and abandon facilities. In general, reclamation operations would follow BLM, DOGM, and OSM best management practices (BMP) for land use, including reclamation and would be described in detail in the PAP for the successful bidder.

In regard to water resources, SMCRA requires that mine operators "minimize disturbances to the prevailing hydrologic balance at the mine-site and in associated offsite areas and to the quality and quantity of water in surface and ground water systems both during and after surface coal mining operations and during reclamation" (30 USC 1265(b)(10)). DOGM is responsible for ensuring protection of the hydrologic balance when permitting coal mining operations (UAC R645-301-731.100).

2.3.2.3 WATER REQUIREMENTS

Assuming approximately 2 million tons of coal production per year, 8.2 million gallons (25 acre-feet) of water per year would be used for dust suppression and equipment washing. Water would be provided from groundwater accumulated in open coal pits as is currently done at the adjacent Coal Hollow Mine, or from a permitted off-site source. ACD currently has rights to 50 acre-feet of groundwater acquired from the Town of Alton. The successful bidder, if other than ACD, would need to negotiate for these or other available groundwater or surface-water rights. ACD has not obtained rights to any surface waters in the watershed. If wells are used, water would most likely be transported by a pump and piping system. To produce an annual volume of 25 acre-feet of water, a well (or network of wells) would be required to pump at a combined rate equivalent to a continuous flow rate of 15.5 gallons per minute. This system would consist of waterlines connected to a storage tank. The system would maintain the water level in the tank that would then be used to load one to three water trucks for use in dust suppression or to supply the underground mine. The pipe length would be shortened, extended, and rerouted as needed to provide water to the active mining area. In addition to this system, water (groundwater) may also be used from the excavated areas when water is available at these locations. The water would be used by installing a pump attached to a stand pipe at the water retention location. The pump and stand pipe would then be used to load the water trucks from the retention area. This system would be used whenever practicable.

Mine dewatering using dewatering wells would likely not be performed in mining operations in the tract area. Mine dewatering using dewatering wells has not been performed at the existing Coal Hollow Mine. The potential for dewatering using pumping wells is limited due to the generally low permeability of the clayey and silty sediments that are pervasive in the shallow groundwater systems in the area (the groundwater production rates from dewatering wells would likely be too low for effective mine dewatering). At the Coal Hollow Mine, some attempts have been made to intercept upgradient alluvial groundwater and divert it away from the mine pit areas using excavated groundwater interception trenches. Such practices could be used in the tract area if appreciable upgradient alluvial groundwater resources are encountered. All water sources would be permitted by the Utah Division of Water Quality and the Utah State Engineer's Office, as necessary.

[7] Revegetation would occur in accordance with the approved post-mining land use. Private landowners can change their minds in regard to the post-mining land use, and hence revegetation species and composition, but a DOGM process must be followed for approvals.

2.3.2.4 BLASTING

Blasting operations (shooting operations) would be conducted in compliance with DOGM and the Bureau of Alcohol, Tobacco, and Firearms' rules and regulations. In the approved mine plan, a blasting plan would be developed and approved that is sensitive to noise impacts on wildlife, residents of the town of Alton, and points in Bryce Canyon National Park where the analysis shows blasting-related impacts. The blasting plan would be reviewed for comment by the BLM, USFWS, and UDWR prior to approval by the DOGM and prior to any blasting activity. To make the general public aware of blasting operations, the blasting schedule would be published (as blasting requirements are identified) in accordance with DOGM regulations and requirements at UAC R645-301-524, Blasting and Explosives. The blasting schedule would be published in the local and regional newspapers. This notice would also be mailed to the residents of the town of Alton, including any residences located within 0.5 mile of the tract. In accordance with DOGM blasting regulations, at least 30 days prior to blasting, all residents or owners of dwellings or structures within 0.5 mile of the mining area would receive instructions on how to request a pre-blasting survey. Pre-blasting surveys would be conducted as requested and seismographic recordings of blasting operations would be completed. Pre-blasting surveys would determine the condition of dwellings or structures and would document any pre-blasting or existing damage and other physical factors that could reasonably be affected by blasting operations. For surface blasting incident to underground mining and reclamation activities, local government and residents within 0.5 mile of the blasting site would receive notification as required by 30 CFR 817.64; however, pre-blasting surveys would only be required if 5 pounds of explosives (or more) are used (UAC R645-301-524.300).

There would be two basic types of blasts (shots): 1) overburden shots for shovels or other equipment and 2) coal shots. As a safety measure, shots would be designed to minimize flyrock, airblast (noise), ground vibration, emissions of nitrogen oxides ($NO_{x)}$, and particulate matter (PM) with PM of 10 micrometers or less (PM_{10}), 2.5 micrometers or less ($PM_{2.5}$), or both. The area would also be well marked and monitored prior to and immediately following a shot. Airblast and ground vibration due to blasting operations would be at or below the MSHA's maximum limits and emissions of NO_x, and PM would be controlled to maintain compliance with NAAQS. Blasting would also be used for underground mining as regulated by the MSHA.

2.3.2.5 LIGHTING FOR NIGHTTIME OPERATIONS

Lighting during nighttime operations would likely consist of one to six portable light towers, four to six fixed-position light poles, and equipment lighting. Portable light towers would be diesel powered with four lights (1,000 watts each) per tower. Each portable light tower would be approximately 30 feet tall and would be moved in accordance with the mining sequence. Fixed position light poles would consist of one 250-watt lamp per pole and would be permanently located near the centralized mine facilities. Lamps on portable light towers and fixed-position light poles would be oriented approximately 30 degrees from the horizontal down toward the ground. Equipment lighting would come from head lights, brake lights, and other safety lighting on the heavy equipment used for mining operations. The following is an estimate of ranges for the quantity of equipment that may be used during nighttime operations:

- Shovels or other loaders: 1–2
- Backhoes/front-end loaders: 1–3
- Bulldozers: 2–5
- Haul trucks: 3–10
- Graders: 1–2
- Light vehicles: 2–6
- Mechanic trucks: 1–4
- Fuel trucks: 1–2
- Water trucks: 1–2

In addition, miscellaneous lighting such as interior building lights and flashlights would commonly be used at the site.

2.3.2.6 POWER GENERATION

Electrical power generation for mining operations would be supplied through a combination of diesel generators. Fixed position, heavy equipment operations located at the centralized facilities (hopper, feeder breaker, conveyor belt, crusher, stacker, and truck feeder) would require 2–3 megawatts (mW) of power supplied by one generator. An additional generator would likely be required on-site as a backup in the event that prolonged generator maintenance or repair renders another generator temporarily unusable. Additional power (500 kilowatts to 1 mW) would be required for offices, fixed position light poles, maintenance shop, equipment wash bay, etc. One generator would be used to supply this power.

The generator configuration and precise specifications would be determined at the time of permitting and detailed mine planning if the tract is offered for lease. All generators would use ultra-low sulfur diesel fuel (15 parts per million [ppm] of sulfur) and be equipped with EPA Tier 4 emissions controls. Generator mufflers would be construction grade (reducing noise emissions approximately 15 decibels [dB]), residential grade (reducing noise emissions approximately 25 dB), or critical grade (reducing noise emissions approximately 35 dB). Underground mining could require additional generating capacity, but what is analyzed is what is reasonably foreseeable.

Electrical power from existing or upgraded local power systems could be an alternative power source but would be analyzed separately if determined to be pursued. Obtaining power from existing or upgraded local power systems is not considered reasonably foreseeable at this time (see Section 2.7.2.3, Power Generation Options).

2.3.2.7 HAZARDOUS MATERIALS AND HAZARDOUS AND SOLID WASTE

Potentially hazardous materials anticipated to be used or produced during the implementation of the Proposed Action fall into the following categories:

- Liquid wastes
- Fuels: gasoline (potentially containing benzene, toluene, xylene, methyl tert-butyl, ether, and tetraethyl lead) and diesel fuel
- Coolants and antifreezes
- Lubricants: grease (potentially containing complex hydrocarbons and lithium compounds) and motor oil
- Paints
- Solvents
- Solid wastes

Solid waste that would be produced at the surface-support facilities and throughout the tract may include floor sweepings, shop rags, lubricant containers, welding rod ends, metal shavings, worn tires, packing material, used filters, and office and food wastes. Portable toilets would be provided for mine employees near areas of active mining and reclamation. Waste from these would typically be removed by a portable toilet service company according to a regular schedule. Permanent toilet facilities would be located at the surface support facilities. These would involve sealed containment tanks (as opposed to septic systems) pumped as necessary to remove wastes.

Maintenance and major oil changes for most moveable equipment would take place inside the maintenance shop. Used oil would be contained and disposed of or recycled in accordance with guidelines administered by the Utah Department of Environmental Quality's (UDEQ's) Division of Solid and Hazardous Waste. Mobile fuel trucks would be used to service and fuel mine equipment in the tract, as appropriate. All fuel storage facilities and equipment would be constructed and operated in accordance with all applicable state and federal regulations.

All solid and liquid wastes would be contained, stored, and disposed of in accordance with applicable local, state, and federal rules and regulations. Specific containment, storage, and disposal techniques would depend on the type and quantity of waste according to applicable rules and regulations. Typically, nonhazardous solid and liquid waste would be contained on-site in dumpsters and transported periodically to a landfill. Any hazardous solid or liquid wastes would typically be separated and stored in appropriately labeled (according to type of waste) barrels that meet the requirements in the Resource Conservation and Recovery Act. Barrels would typically be stored temporarily under cover before being hauled to a hazardous waste disposal facility. A spill prevention plan and other plans would also be required (see Table 2.6.1 in Section 2.6.1.9).

2.3.2.8 NORMAL OPERATING HOURS

Under the Proposed Action, it is anticipated that mining operations would occur 24 hours per day, five to seven days per week, and 52 weeks per year. The total number of operating days per year would be approximately 260–365.

2.3.2.9 SIGNAGE

To facilitate health and safety requirements to the general public, all public access would be restricted and precluded in the tract for the life of the mining operation. An entrance identification sign would be posted and maintained at all major entrances into the area. The signs would contain the name, address, and telephone number of the operator, the name of the local authorized agent, the DOGM permit number of the operation, and notification of restricted access. Safety signs for the public would be used where appropriate.

2.3.2.10 ESTIMATED EMPLOYMENT REQUIREMENTS

Under the Proposed Action, at maximum production, approximately 160 workers would be required to conduct mining operations. Approximately 100 of these workers would be employed at the tract and would be conducting mining operations. The remaining 60 workers would be engaged in transporting mined coal from the tract to market. It is assumed that mine employees would come primarily from Alton and surrounding towns located within approximately one to two hours (driving time) of the tract. These would include Kanab, Mt. Carmel, Orderville, Glendale, Hatch, Panguitch, Circleville, Kingston, Junction, Cedar City, Tropic, Enoch, Parowan, Paragonah, La Verkin, Hurricane, Henryville, and Escalante. Mine employees would be expected to commute to and from the work site using their private vehicles. No housing would be provided for mine employees at or near the tract.

2.3.2.11 TRAFFIC ESTIMATES

Under the Proposed Action, there would be an estimated 153 trucks travelling daily to and from the tract and reasonably foreseeable coal loadout location (the transportation route and loadout location are described in Section 2.6.4 Reasonably Foreseeable Coal Loadout Location and Transportation Route). Loaded trucks, specifically designed to reduce loss of coal dust and larger coal particles while traveling, would carry approximately 42 tons of coal each.

Traffic would also be generated from employee commuting and service operations. Employees would commute from their homes to the tract according to the normal operating hours detailed in Section 2.3.2.8. Service operations would include delivery of diesel fuel and machine and equipment parts (daily or weekly), servicing of portable toilets (weekly or biweekly), servicing of permanent toilet facilities (monthly or bimonthly), removal of waste oil (weekly or biweekly), and incidental service operations such as delivery of office supplies (biweekly or monthly) as necessary.

2.3.2.12 KANAB FIELD OFFICE ROUTE 116 RELOCATION

To comply with the rules and regulations of SMCRA, portions of KFO Route 116 in the tract would need to be relocated so that no surface disturbance occurs within 100 feet on either side of the outside line of the road. Relocation of the road would allow the successful bidder to mine in-place coal reserves currently underlying portions of the road and the 100-foot buffer zone on either side of the road. This EIS analysis assumes that an agreement to relocate the road would be reached if the BLM decides to hold a competitive lease sale for the tract. The lessee would be responsible for road relocation. Mining would be feasible without relocating KFO Route 116; however, the total amount of recoverable coal would be reduced if KFO Route 116 were not relocated.

Under the Proposed Action, KFO Route 116 would be relocated, wherever possible, in the tract to a no-coal or recovered coal zone. While relocating the road to the no-coal zone or the recovered coal zone, the road would be sited to avoid disturbances to cultural resources, wetlands, floodplains, stream channels, and intact sagebrush stands wherever possible. Where it is not possible to avoid disturbances to these areas, mitigation measures would be prescribed. Access for and impacts to private landowners would also be considered while relocating the road. Under the Proposed Action, the northwest portion of the tract (Block NW) would contain a 0.8-mile stretch of KFO Route 116. It is assumed that this stretch of the road would be relocated onto previously mined surface in this portion of the tract, according to the mining sequence. It is also assumed that relocation of KFO Route 116 would be temporary and that it would be replaced in the approximate original (current) roadbed following mining.

2.4 Alternative C: Reduced Tract Acreage and Seasonal Restrictions

Under Alternative C, the Alton Coal Tract would be modified to exclude Block NW (see Map 2.2). Further, certain mining activities in the south portion of the tract (Block S) would be subject to seasonal restrictions to reduce impacts to the local Greater Sage-Grouse population (hereafter generally referred to as sage-grouse). Under Alternative C, the modified tract would be offered for a competitive lease sale, subject to lease stipulations developed for the tract. The boundaries of the modified tract and the area where seasonal restrictions would be required would be reasonably consistent with the configuration and information shown in Map 2.2.

Consistent with the purpose and need for the federal action, the intent of Alternative C is to resolve, in part or in full, the following: issues related to the local sage-grouse population, noise, and visual impacts to the town of Alton, and issues related to conflicting land uses (agriculture versus surface mining). As discussed in the environmental impacts analysis in Chapter 4, Alternative C may also reduce impacts to other resources such as springs and surface waters, wetlands, wildlife, soils, public health and safety, paleontological resources, cultural resources, and vegetation.

The BLM is also evaluating a potential modification to Alternative C that would eliminate the seasonal timing restrictions on Block S of the tract. Removing the restrictions would increase the maximum economic recovery of the coal resources present in the tract while staying within applicable legal and regulatory limits in terms of potential impacts. The BLM is considering such a modification to avoid potential exceedances of NAAQS for PM_{10}, which were detected in the air resources analysis (see Section 4.3). Consideration of such an alternative is feasible because provisions of the sage-grouse mitigation plan and the exclusion of Block NW (which is used by sage-grouse in the Panguitch population) potentially make seasonal timing restrictions unnecessary to adequately reduce impacts to sage-grouse from leasing and mining activities. This modification did not necessitate the development of a separate alternative because the impacts of mining Block S absent such seasonal restrictions are already analyzed under the Proposed Action. For purposes of comparison, the analysis of impacts under Alternative C in this SDEIS retains those restrictions, giving the BLM the flexibility to impose them in any final decision.

2.4.1 Location and Overview

The modified tract would encompass approximately 3,173 acres, of which approximately 2,280 acres are federal surface and mineral estate and 893 acres are split estate; private surface estate and federal mineral estate (Map 2.2 depicts private and BLM surface in the modified tract). As under the Proposed Action, not all surface estates, private or federal, have coal reserves underlying them (Map 2.2 also depicts the approximate extent of the coal line in the tract). The legal description of the modified tract under Alternative C is in Table 2.4.1. The land description and acreages are based on the BLM Status of Public Domain and Mineral Titles approved Coal Plats as of August 21, 2002 and July 28, 2006.

Under Alternative C, recoverable portions of in-place coal reserves would be mined over approximately 21 years using surface-mining methods where the depth of overburden is approximately 200 feet or less, and using underground methods (development mining, longwall mining, and/or room and pillar mining) where the depth of overburden exceeds approximately 200 feet. The choice of mining method, however, can vary from the 200-foot overburden threshold depending on the coal thickness, overburden type, overburden (highwall) stability, underground mining techniques available, operating and capital costs, and coal market economics. Approximately 2 million tons of coal per year would be mined once topsoil stockpiling and initial overburden removal have occurred. Reclamation would be concurrent with mining over the course of the estimated 21-year life of the mine and would be followed by a potential 10-year reclamation and revegetation monitoring period. Although some reclamation of the final mining areas would be concurrent with development of new mining areas, due to seasonal timing design features developed as part of the alternative design, an additional mining area with concurrent reclamation would be developed under Alternative C for Block S of the tract. The length of time between surface disturbance initiation of the mining process and concurrently occurring reclamation activities would be extended for some pits until final mining occurs. An additional pit would remain disturbed and available for development while seasonal mining occurs on Block S.

Table 2.4.1. Legal Description of the Modified Alton Coal Tract under Alternative C

Legal Description*	Surface Owner†	Acres
Township 39 South, Range 5 West, Salt Lake Meridian, Utah		
Section 7, SE ¼SW¼, S½SE¼	3	122
	5	7
Section 18, lots 3 and 4, E½, E½W½	BLM	357
	3	42
	16	158
	17	3
Section 19, lots 1 through 4, NE¼, E½W½, N½SE¼, SE¼SE¼	BLM	472
	1a	120
Section 20, lots 4 and 5, N½SW¼	BLM	47
	1a	111
Section 30, lots 2 through 4, SW¼NE¼, SE¼NW¼, E½SW¼, W½SE¼	BLM	338
	1a	13
Section 31, lots 1 through 3, NE¼, E½NW¼, NE¼SW¼, N½SE¼	BLM	471

Table 2.4.1. Legal Description of the Modified Alton Coal Tract under Alternative C

Legal Description*	Surface Owner†	Acres
Township 39 South, Range 6 West, Salt Lake Meridian, Utah		
Section 13, SE¼	BLM	160
Section 24, NE¼, N½NW¼, SE¼NW¼, E½SW¼, N½SE¼, SE¼SE¼	BLM	159
	11	4
	12	313
Section 25, E½NE¼, SW¼NE¼, SE¼	BLM	276
Error‡		5
Total Private		**893**
Total BLM		**2,280**
Total LBA		**3,178**

* Based on the BLM Status of Public Domain Land and Mineral Titles approved Coal Plats as of August 21, 2002, and July 28, 2006.

† Where the BLM is the surface owner of the parcel, this is explicitly noted. Private surface owners are numbered rather than identified by name due to privacy concerns.

‡ The acreages above were calculated using ESRI ArcGIS 9.2 and NAD 1983 UTM Zone 12N coordinate system. The BLM shapefile of coal ownership is georeferenced (in NAD 1983 UTM Zone 12N), but is not survey accurate. ACD provided a hardcopy map (with surface ownership and section boundaries), which was scanned and georeferenced to section corners visible on USGS 7.5-minute topographic maps. Polygons were then digitized to encompass/represent each of the legal descriptions above using the BLM shapefile, ACD's georeferenced map, and the USGS 7.5-minute topographic map as references while digitizing. All acreages are approximate and have not been verified by ground surveys. The error is largely a result of the disparate sources for boundary data. Additionally, the ownership lines from the map provided by ACD do not align well in all locales with the BLM boundary. This suggests that one or both of these datasets are approximate and is another potential source of error.

BLM independently evaluated the coal resources included in the tract. They estimate that under Alternative C, the tract includes approximately 52.1 million tons of in-place coal and that an estimated 39.2 million tons of coal would be recoverable from the tract. BLM estimates that in areas where coal would be mined by surface-mining methods, approximately 90% of the estimated in-place coal reserves would be recoverable. However, in those portions of the tract that must be mined by underground mining methods, approximately 50% of the in-place coal reserves would be recoverable. These percentage recovery estimates are based on assumptions regarding the depth to which the use of surface-mining methods is feasible and the extent of the no-coal zone.

2.4.2 Preliminary Mine Plan

This section describes, on a conceptual level, the MRPs that would be used to mine and reclaim lands in the tract under Alternative C. The conceptual MRPs described here are not final plans but represent RFD for use in analyzing the potential environmental consequences of issuing a lease for the tract.

Post-mine reclamation, water requirements, blasting, lighting for nighttime operations, power generation, hazardous materials and hazardous and solid waste, normal operating hours, signage, estimated employment requirements, and traffic estimates would be the same under Alternative C as under the Proposed Action. Therefore, these components of the preliminary mine plan for Alternative C are not described below (see Sections 2.3.2.1–2.3.2.12 for these descriptions).

2.4.2.1 MINING METHODS AND MINE FACILITIES

It is anticipated that approximately 1,662 acres of surface disturbance would occur in the tract under Alternative C. Of this, 1,454 acres would be the result of surface-mining operations (pit disturbance). Centralized facilities associated with mining activities on the tract would be located in the same area, occupy the same acreage (36 acres), and include the same items as the Proposed Action (see Section

2.3.2.1; see Maps 1.2 and 2.2). Dispersed facilities necessary to conduct mining operations would also be the same as the Proposed Action (see Section 2.3.2.1), including avoidance criteria, though acres (135 acres) of disturbance would differ due to the differing size of the tract. Underground mining would occur on approximately 613 acres in the northeast section of the tract (see footnote 4 above for additional information on acreage of underground mining).

Mining methods employed under Alternative C would be the same as those under the Proposed Action (see Section 2.3.2.1). However, due to seasonal timing restrictions described in Section 2.4.2.3 (Sage-grouse Timing Restrictions), and as a result of the need for two simultaneously open pits (one "idle" [in Block S] during the period of the timing restriction and the other active [in another block of the tract] with the idle and active pits switching during the period where the timing restriction does not apply), Alternative C would likely involve a greater quantity of heavy equipment and an external overburden disposal area (EODA) occupying approximately 40–60 acres (depending on mining sequence) located on BLM-administered land. The EODA is an area where overburden, after excavation, is permanently stockpiled. It is often required when a new pit is opened that is not adjacent to an existing pit into which overburden would otherwise be placed as part of the concurrent mining and reclamation process. At any one time, active and suspended (due to seasonal timing restrictions) mining operations (open surface-mining pits from which coal is being removed, areas where topsoil and overburden are being removed, or both) would involve an estimated 240 acres (two pits). The depth of open pits from which coal is being removed would be up to approximately 200 feet, and highwall length would be up to 600 feet. An additional 240 acres or more would be in some stage of reclamation (overburden replacement and top-soiling, grading to approved PMT, or seedbed beginning).The UAC R645-301-553 requires rough backfilling and grading to follow coal removal by not more than 60 days or 1,500 linear feet; although, additional time may be granted if it can be demonstrated in a detailed written analysis that additional time is necessary.

2.4.2.2 KANAB FIELD OFFICE ROUTE 116 RELOCATION

As under the Proposed Action, to comply with the rules and regulations of SMCRA, portions of KFO Route 116 in the tract would need to be relocated so that no surface disturbance occurs within 100 feet on either side of the outside line of the road. Relocation of the road would allow the successful bidder to mine in-place coal reserves currently underlying portions of the road and the 100-foot buffer zone on either side of the road. This EIS analysis assumes that an agreement with Kane County to relocate the road would be reached if the BLM decides to hold a competitive lease sale for the tract. The lessee would be responsible for the costs of road relocation. Mining would be feasible without relocating KFO Route 116; however, the total amount of recoverable coal would be reduced if KFO Route 116 were not rerouted.

Under Alternative C, as under the Proposed Action, KFO Route 116 would be relocated, wherever possible, in the tract in the no-coal zone or the recovered coal zone. While relocating the road to the no-coal zone or the recovered coal zone, the road would be sited to avoid disturbances to cultural resources, wetlands, floodplains, stream channels, and intact sagebrush stands wherever possible. Where it is not possible to avoid disturbances to these areas, mitigation measures would be prescribed. Access for and impacts to private landowners would also be considered while relocating the road. It is assumed that relocation of KFO Route 116 would be temporary and that it would be replaced in the approximate original (current) roadbed following mining.

Unlike the Proposed Action, under Alternative C, road relocation (0.8 mile) would not be required for the stretch of KFO Route 116 that traverses Block NW because this portion of the tract is excluded from Alternative C (see Map 2.2).

2.4.2.3 SAGE-GROUSE TIMING RESTRICTIONS

Under Alternative C, timing restrictions would be in place for Block S to reduce impacts to the local sage-grouse population. Timing restrictions would prohibit active mining (and hence reduce associated impacts to sage-grouse) on this portion of the tract during a crucial period in the reproductive cycle of the species. Data show that a lek complex occurs partly on the tract and partly on adjacent private property, and that birds from this population use this portion of the tract during the nesting and brooding period. The location of the lek complex is described in more detail in Section 3.18.3.5.1. Under this alternative, no mining, mine-related, or surface-disturbing activities would be allowed within 0.5 mile of an active lek location during the lek establishment and strutting period (February 15–March 15). Likewise, no surface-disturbing activities would be allowed under this alternative on Block S during the local sage-grouse's strutting, nesting, and brooding period (March 15–July 15). This timing restriction would likely alter mining activities as compared to the Proposed Action. The KFO RMP (BLM 2008b) contains surface use stipulations that 1) prohibit surface-disturbing activities within 2 miles of a Greater Sage-Grouse lek in the nesting and brooding habitat from March 15 to July 15; 2) prohibit surface-disturbing activities within 0.5 mile of a Greater Sage-Grouse lek site; and 3) prohibit surface-disturbing activities in Greater Sage-Grouse winter habitat from December 1 to March 14. As noted in Chapter 1, an amendment to the KFO RMP is currently pending, which could change some or all of these restrictions. Before making a leasing decision, the BLM will have to verify that any terms in the lease are consistent with the applicable requirements of the RMP. It should be noted that if mining activities are not allowed within 2 miles of the Alton–Sink Valley lek, it would be economically unviable to mine the tract. Under the existing KFO RMP, it is possible to obtain an exception, modification, or waiver from these requirements. The BLM would have to verify the availability of such an exception, modification, or waiver before any decision to lease. For the purpose of analysis in this EIS, it is assumed that an exception, modification, or waiver could be granted. Such an exception, modification, or waiver of these stipulations would eliminate no surface occupancy protections within 0.5 mile of sage-grouse leks, allow surface-disturbing activities within 2 miles of sage-grouse leks from March 15 to July 15, and allow surface-disturbing activities in sage-grouse wintering habitat from December 1 to March 14. Alternative C, which was carried forward for detailed analysis, uses a 0.5-mile buffer around the lek to allow some mining to take place in the tract.

2.5 Alternative K1: Reduced Tract Acreage

In the DEIS, the BLM eliminated Alternative K1 from detailed analysis. However, based on public comments on the DEIS, the BLM has decided to consider Alternative K1 in detail in this SDEIS. Under Alternative K1, the Alton Coal Tract would be modified to exclude Block NW and Block S (see Map 2.3). Under this alternative, the modified tract would be offered for lease at a sealed-bid, competitive lease sale, subject to lease stipulations developed for the tract. The boundaries of the modified tract would be reasonably consistent with the configuration shown in Map 2.3.

Consistent with the purpose and need for the federal action, the intent of Alternative K1 is to resolve, in part or in full, the following: issues related to the local Greater Sage-Grouse population, noise and visual impacts to the town of Alton, and issues related to conflicting land uses (agriculture versus surface mining). Alternative K1 may also reduce impacts to other resources such as springs and surface waters, wildlife, soils, public health and safety, paleontological resources, cultural resources, vegetation, and air quality.

2.5.1 Location and Overview

The modified tract would encompass approximately 2,114 acres, of which approximately 1,227 acres are federal surface and mineral estate and 887 acres are split estate (private surface and federal mineral estate). As under the other action alternatives, not all surface estates, private or federal, have coal reserves underlying them. The legal description of the modified tract under Alternative K1 is in Table 2.5.1. The

land description and acreages are based on the BLM Status of Public Domain and Mineral Titles approved Coal Plats as of August 21, 2002 and July 28, 2006.

Under Alternative K1, recoverable portions of in-place coal reserves would be mined over approximately 16 years using surface-mining methods where the depth of overburden is approximately 200 feet, and using underground methods (development mining, auger mining, highwall mining, longwall mining, and/or room and pillar mining) where the depth of overburden exceeds approximately 200 feet. The choice of mining method, however, can vary from the 200-foot overburden threshold depending on the coal thickness, overburden type, overburden (highwall) stability, underground mining techniques available, operating and capital costs, and coal market economics. Approximately 2 million tons of coal per year would be mined once topsoil stockpiling and initial overburden removal have occurred. Reclamation would be concurrent with mining over the estimated 16-year life of the mine and would be followed by a potential 10-year reclamation and revegetation monitoring period.

Table 2.5.1. Legal Description of the Modified Alton Coal Tract under Alternative K1

Legal Description*	Surface Owner†	Acres
Township 39 South, Range 5 West, Salt Lake Meridian, Utah		
Section 7, SE ¼SW¼, S½SE¼	3	122
	5	7
Section 18, lots 3 and 4, E½, E½W½	BLM	357
	3	42
	16	158
	17	3
Section 19, lots 1 through 4, NE¼, E½W½, N½SE¼, SE¼SE¼	BLM	472
	1a	120
Section 20, lots 4 and 5, N½SW¼	BLM	47
	1a	111
Township 39 South, Range 6 West, Salt Lake Meridian, Utah		
Section 13, SE¼	BLM	160
Section 24, NE¼, N½NW¼, SE¼NW¼, E½SW¼, N½SE¼, SE¼SE¼	BLM	159
	11	4
	12	313
Section 25, NE¼NE¼	BLM	40
Error‡		5
Total Private		**880**
Total BLM		**1,235**
Total LBA		**2,114**

* Based on the BLM Status of Public Domain Land and Mineral Titles approved Coal Plats as of August 21, 2002, and July 28, 2006.

† Where the BLM is the surface owner of the parcel, this is explicitly noted. Private surface owners are numbered rather than identified by name due to privacy concerns.

‡ The acreages above were calculated using ESRI ArcGIS 9.2 and NAD 1983 UTM Zone 12N coordinate system. The BLM shapefile of coal ownership is georeferenced (in NAD 1983 UTM Zone 12N), but is not survey accurate. ACD provided a hardcopy map (with surface ownership and section boundaries), which was scanned and georeferenced to section corners visible on USGS 7.5-minute topographic maps. Polygons were then digitized to encompass/represent each of the legal descriptions above using the BLM shapefile, ACD's georeferenced map, and the USGS 7.5-minute topographic map as references while digitizing. All acreages are approximate and have not been verified by ground surveys. The error is largely a result of the disparate sources for boundary data. Additionally, the ownership lines from the map provided by ACD do not align well in all locales with the BLM boundary. This suggests that one or both of these datasets are approximate and is another potential source of error.

BLM independently evaluated the coal resources included in the tract. They estimate that under Alternative K1, the tract includes approximately 40.9 million tons of in-place coal, and that an estimated 30.8 million tons of coal would be recoverable from the tract. BLM estimates that in areas where coal would be mined by surface-mining methods, approximately 90% of the estimated in-place coal reserves would be recoverable. However, in those portions of the tract that must be mined by underground mining methods, approximately 50% of the in-place coal reserves would be recoverable. These percentage recovery estimates are based on assumptions regarding the depth to which the use of surface-mining methods is feasible and the extent of the no-coal zone.

2.5.2 Preliminary Mine Plan

This section describes, on a conceptual level, the MRPs that would be used to mine and reclaim lands in the tract under Alternative K1. The conceptual MRPs described here are not final plans but represent RFD for use in analyzing the potential environmental consequences of issuing a lease for the tract.

Post-mine reclamation, water requirements, blasting, lighting for nighttime operations, power generation, hazardous materials and hazardous and solid waste, normal operating hours, signage, estimated employment requirements, and traffic estimates would be the same under Alternative K1 as under the Proposed Action. Therefore, these components of the preliminary mine plan for Alternative K1 are not described below (see Sections 2.3.2.1–2.3.2.12 for these descriptions).

2.5.2.1 MINING METHODS AND MINE FACILITIES

It is anticipated that approximately 1,012 acres of surface disturbance would occur on the tract under Alternative K1. Of this, 869 acres would be the result of surface-mining operations (pit disturbance). Centralized facilities associated with mining activities on the tract would be located in the same area, occupy the same acreage (36 acres), and include the same items as the Proposed Action (see Section 2.3.2.1; see Maps 1.2 and 2.2). Approximately 92 acres of dispersed facilities would be needed under Alternative K1, as opposed to 160 acres of dispersed facilities under the Proposed Action. Underground mining would occur on approximately 613 acres in the northeast section of the tract (see footnote 4 above for additional information on acreage of underground mining).

Mining methods employed under Alternative K1 would be the same as those under the Proposed Action (see Section 2.3.2.1).

2.5.2.2 KANAB FIELD OFFICE ROUTE 116 RELOCATION

As under the Proposed Action, to comply with the rules and regulations of SMCRA, portions of KFO Route 116 in the tract would need to be relocated so that no surface disturbance occurs within 100 feet on either side of the outside line of the road. Relocation of the road would allow the successful bidder to mine in-place coal reserves currently underlying portions of the road and the 100-foot buffer zone on either side of the road. This EIS analysis assumes that an agreement with Kane County to relocate the road would be reached if the BLM decides to hold a competitive lease sale for the tract. The lessee would be responsible for the costs of road relocation. Mining would be feasible without relocating KFO Route 116; however, the total amount of recoverable coal would be reduced if KFO Route 116 is not rerouted.

Under Alternative K1, as under the Proposed Action, KFO Route 116 would be relocated, wherever possible, in the tract in the no-coal zone or the recovered coal zone. While relocating the road to the no-coal zone or the recovered coal zone, the road would be sited to avoid disturbances to cultural resources, wetlands, floodplains, stream channels, and intact sagebrush stands wherever possible. Where it is not possible to avoid disturbances to these areas, mitigation measures would be prescribed. Access for and

impacts to private landowners would also be considered while relocating the road. It is assumed that relocation of KFO Route 116 would be temporary and that it would be replaced in the approximate original roadbed following mining.

Unlike the Proposed Action, under Alternative K1, road relocation (2 miles) would not be required for the stretches of KFO Route 116 that traverse Block NW and Block S because these portions of the tract are excluded from the tract configuration under Alternative K1 (see Map 2.3).

2.6 Management and Considerations Common to Each Action Alternative

A number of management prescriptions and other considerations are common to each action alternative. These items are common to each action alternative for one or more of the following reasons: 1) they are already required by law or regulation for purposes of leasing and/or mining; 2) they are BMPs or management techniques that could be readily applied to reduce impacts regardless of alternative; 3) they were developed to address issues specific to the tract and could be readily applied to reduce impacts regardless of alternative; 4) they pertain to actions and/or plans already occurring and/or over which BLM has no jurisdiction; and 5) they pertain to BLM decisions related to the tract that are independent of decisions with respect to the Proposed Action, Alternative C, or Alternative K1 (i.e., BLM decisions regarding the Proposed Action, Alternative C, or Alternative K1 would not necessitate changes to decisions related to these items and vice versa).

Management and considerations common to each action alternative that are discussed in this section consist of

- permits, approvals, regulatory compliance, mitigation, and monitoring (Section 2.6.1)
- other roads in the tract (Section 2.6.2);
- potential short haul routes (Section 2.6.3); and
- reasonably foreseeable coal loadout location and transportation route (Section 2.6.4).

2.6.1 Permits, Approvals, Regulatory Compliance, Mitigation, and Monitoring

There are certain permits, approvals, and regulatory compliance, mitigation, and monitoring measures that would be required under the action alternatives. These are related to 1) compliance with existing local, state, and federal rules and regulations with respect to surface coal mining and 2) special mitigation and monitoring requirements (i.e., design features) developed for the tract. See Table 1.5.1 in Chapter 1 and Table 2.6.1 below for a summary of permits, approvals, and regulatory compliance requirements for the successful bidder.

2.6.1.1 LEASES

A federal coal lease would be required of the lessee to access and remove coal from the tract. Under all action alternatives, the surface ownership of the tract is mixed (federal and private). The successful bidder would need to obtain private surface lease agreements from private surface owners to access leased federal coal reserves underlying private surface owners' lands. Tables 2.3.1, 2.4.1, and 2.5.1 (see Sections 2.3.1, 2.4.1, and 2.5.1) identify the number of private landowners and the acreage of private surface by legal description for the Proposed Action, Alternative C, and Alternative K1, respectively.

2.6.1.2 MINE PERMIT

As previously discussed in Chapter 1, the issuance of a lease for the BLM-administered lands is a prerequisite for mining, but is not the enabling action that would allow mining to commence. The successful bidder would need to submit an application package (the PAP) to DOGM to obtain a permit to mine federal coal from the tract. DOGM reviews the PAP to ensure that it complies with the approved State of Utah permanent SMCRA program and other statutes. If it does comply, DOGM issues the applicant a permit to conduct site-specific surface coal mining operations. The approved permit to mine, a MRP, would define the operator's comprehensive MRP. All aspects of the MRP are developed in coordination with DOGM and other federal, state and local agencies. The MRP serves as a platform for the development of air quality, water quality and appropriation, and wetland and stream alteration permits potentially required from state and federal agencies. In addition to comprehensive resource assessment and evaluation, the MRP includes resource protection and mitigation measures and criteria for reclamation development and success. Some of these resource protection and mitigation measures are identified in this EIS analysis, though others may be identified in the permitting process. Reclamation requirements and criteria are identified in this EIS analysis as well. Utah's coal mining permit requirements are detailed in UAC R645 (see footnote 5 in Section 2.3.2.2).

2.6.1.3 RESOURCE RECOVERY AND PROTECTION PLAN

The MLA requires that before conducting any federal coal development or mining operations on a federal coal lease, the operator must submit a R2P2 for review by the BLM, OSM, and DOGM. BLM, OSM, and DOGM recommend approval to the Assistant Secretary of the DOI, Lands and Minerals Management. Following these recommendations and MLA determinations, the Assistant Secretary approves the R2P2. Subsequent approvals of minor R2P2 modifications would be issued by the BLM unless the OSM determines that the modification is not minor and requires further approval by the Assistant Secretary (30 CFR 746.18).

The R2P2 would describe how the operation would meet the MLA requirements for due diligent development, production, resource recovery and protection (i.e., effective recovery of the federal coal reserves), continued operation, maximum economic recovery, and compliance with the rules detailed in 43 CFR 3480 for the life of the mine. The successful bidder would mine the leased tract according to the approved plan, respective lease terms, and appropriate rules and regulations.

2.6.1.4 AIR QUALITY

An air quality permit would be required from the UDAQ. The permit would address allowable particulate and other emission levels and would stipulate mechanisms to be used to control emissions. As part of the air quality permit a dust control plan would be developed and implemented.

Continuous ambient air monitoring for PM_{10}, NO_2, and visibility would be required as a design feature and would be conducted according to the adaptive management strategy described in Section 4.3.1.1. The adaptive management strategy is designed to detect and address monitored air quality and air quality–related values (AQRV) degradation that can reasonably be attributed to emissions originating from mine activities on the tract. It would consist of targeted air monitoring, the refining of air quality analyses or modeling assessments as needed to determine whether an air quality or AQRV deterioration is reasonably attributable to mine operations, and the implementation of additional environmental protection and mitigation measures if necessary.

2.6.1.5 WATER QUALITY AND APPROPRIATION

The Utah Division of Water Quality would review the storm discharge permit application (Utah Pollution Discharge Elimination System [UPDES] section of the PAP), and if the plan conforms and complies with applicable rules and regulations, specific environmental permits would be issued. The Utah State Engineer's Office would review specific applications to install monitoring and production wells, and would issue permits and appropriations in accordance with the successful bidder's needs and available water resources. Installation, use, and maintenance of monitoring and production wells would be at the mine operator's expense.

2.6.1.6 WETLAND AND STREAM CHANNEL ALTERATION

In the event of a lease sale, as part of the mine permitting process, CWA Section 404 permit approval by the USACE would be required to authorize disturbances to jurisdictional wetlands. Likewise, modifications to Lower Robinson Creek (for placement of facilities), one or two road crossings of Lower Robinson Creek, and one or two road crossings of Kanab Creek (the number of crossings would depend on specific mining sequence and specific alignment of the rerouted KFO Route 116) would require stream alteration permits from the Utah State Engineer's Office. The permit applications would be reviewed by USACE for compliance with applicable rules and regulations. Permits would be issued by the State of Utah if the application meets the criteria.

Wetland and stream channel delineations were conducted on the tract by qualified wetland and stream channel delineators in May and June 2012 (Frontier Corporation USA 2012). Based on the results of the delineations, a preliminary jurisdictional determination (JD) was made by the USACE in November 2012 (USACE 2012b). The USACE's preliminary JD concludes that the tract contains the following potential waters of the U.S. regulated under Section 404 of the CWA (Map 2.4):

- 53.95 acres of wetlands
- 4.01 acres of open water
- 9,110 linear feet of perennial stream channel
- 17,629 feet of intermittent stream channel
- 29,295 linear feet of ephemeral stream channel
- 540 linear feet of road ditch
- 2,440 linear feet or irrigation ditch

Additional information related to wetland and stream channel features of the tract is provided in Section 3.16. Potential impacts associated with these features of the tract from implementation of the alternatives are discussed in Section 4.16.

2.6.1.7 GREATER SAGE-GROUSE

In the event of a lease sale, the sage-grouse mitigation plan (see Appendix E) would be adopted as a design feature for any action alternative that is selected. The purpose of the sage-grouse mitigation plan is to describe the strategy for avoiding, reducing, and compensating for impacts to the sage-grouse populations potentially affected by leasing and mining the tract. The sage-grouse mitigation plan is intended to prevent mining activity surface disturbance from outpacing vegetation treatments aimed at increasing available habitat for sage-grouse. To ensure that mine disturbance does not outpace vegetation treatment, the sage-grouse mitigation plan would require that approximately 186.3 acres of initial vegetation treatment occurs in Block Sa prior to any surface-disturbing activities in the tract. Further, off-tract vegetation treatment mitigation projects intended to comply with the 4:1 mitigation ratio are to be

completed no more than one year following the corresponding on-tract surface disturbance, though they may be completed on a more accelerated schedule. Vegetation treatments would be prioritized in areas of pinyon-juniper encroachment that have sagebrush understory and are near the tract and adjacent to occupied habitat. Vegetation treatments would also be required to use techniques that ensure suitable habitat, such as a lop-and-scatter approach to pinyon-juniper removal.

The sage-grouse mitigation plan is also intended to address the BLM Washington Office IM 2012-043, which identifies the need to cumulatively maintain or enhance sage-grouse habitat. The sage-grouse mitigation plan complies with this IM by instituting the following requirements:

- Avoiding habitat through the designation of limited-touch areas in sagebrush habitats in the tract
- Enhancing Block Sa (comprising 186.3 acres) and the portions of Block S that have not yet been enhanced before mining activities begin
- Requiring that Blocks S and NW are not be mined simultaneously so one would provide a refuge while the other is experiencing surface disturbances due to mining
- Reclaiming in-tract sagebrush habitats to vegetation standards that would provide sage-grouse habitat in the long term
- Providing a 4:1 ratio of mitigation acres to surface disturbance acres to increase available habitat in the analysis area in the short term

The goals of the sage-grouse mitigation plan are as follows:

- Offset habitat impacts of mining the tract, as identified through the EIS process, by implementing habitat management and vegetation treatment projects in the mitigation plan area.
- Identify mitigation opportunities that reduce or remove threats under the five listing factors used by the USFWS to assess the status of ESA-listed and candidate species. A detailed discussion of these factors can be found in *Endangered and Threatened Wildlife and Plants; 12-month Findings for Petitions to List the Greater Sage-Grouse (*Centrocercus urophasianus*) as Threatened or Endangered; Proposed Rule* (50 CFR 17, *Federal Register* 75:13910–14014). These factors are as follows:
    - The presence of threatened destruction, modification, or curtailment of habitat or range, including urbanization, energy development, mining, fences, fire, invasive plants, pinyon-juniper encroachment, climate change, and habitat fragmentation.
    - Overuse for commercial, recreational, scientific, or educational purposes, including hunting, bird watching, Native American religious use, and scientific studies
    - Disease and predation, including the potential for West Nile virus outbreaks, and increased predation.
    - Inadequacy of existing regulatory mechanisms at the local, state, federal, and international levels[8].
    - Other natural or human-made factors affecting the species' continued existence, including pesticides, contaminants, recreational activities, life history traits that may affect viability, and drought.
    - The key threats to sage-grouse in the mitigation plan area are increased predator populations, vegetation management (conflicting uses or lack of management), energy development, conifer encroachment and residential/commercial development (Frey et al. 2008; USFWS 2013a), as described in Section 5 of this document.

[8] The findings were published on March 5, 2010. Since that time, regulatory mechanisms have been created to address threats to Greater Sage-Grouse, such as the sage-grouse conservation plan (UDWR 2013); a resolution passed by Kane County, Utah, on April 22, 2013, with the goal to protect, maintain, improve, and enhance Greater Sage-Grouse habitat in Kane County; and the BLM's IM No. 2012-043, which was published on December 22, 2011, and ensures that interim conservation policies and procedures are implemented when field offices authorize or carry out activities on public land while the BLM develops and decides how to best incorporate long-term conservation measures for Greater Sage-Grouse into applicable land use plans.

- Establish potential mitigation project types and locations based on the availability of existing site-specific sage-grouse population information (e.g., lek counts) and ecological condition information (e.g., habitat location and size, opportunity locations, and completed vegetation treatment locations). This site-specific information includes data gathered for the adjacent Coal Hollow Mine, which has been in operation since 2010. Monitoring data regarding sage-grouse population and activity have been gathered, and continue to be gathered, in association with this mine. The existing site-specific population information may not be conclusive, but it can be used to help inform project planning.
- Ensure the short and long-term persistence of
  - the current southern-most population of Greater Sage-Grouse across the range of the species, and
  - suitable habitat to support that population.

2.6.1.8 NIGHT SKY

In the event of a lease sale, design features addressing potential impacts to night skies would be reflected in lease stipulations in the ROD. The purpose of these lease stipulations would be to reduce potential night sky impacts from artificial lighting used during mining activities. One design feature would require the development of a detailed mine lighting plan. In development of the mine lighting plan, further consultation will be required with NPS to fully examine techniques, technology/equipment, and mitigation measures available to effectively protect night sky quality, realizing technology may be improved at the time a lighting plan is developed, carrying forward an adaptive management approach. Such a lighting plan would allow the BLM and NPS to continue to monitor potential impacts to night sky from mining activities on the tract. Another design feature would require an initial lumens cap on all lighting on the tract. In the absence of a detailed mine plan, a maximum initial lumens cap of 3.15 million lumens was decided on to provide flexibility for a lessee to have adequate lighting for mine employee safety while still putting a limit on the amount of light potentially contributing to increased skyglow. Another design feature would require the use of full cut-off shields for all fixed-position light poles at centralized facilities. Full cut-off shields would reduce the amount of artificial lighting contributing to skyglow.

2.6.1.9 DESIGN FEATURES, REGULATORY COMPLIANCE, MITIGATION, AND MONITORING

Design features are environmental protection measures, actions, or practices that are part of the Proposed Action and all action alternatives and would be implemented by the lessee. They are described in this chapter and summarized as appropriate in the impacts analysis in Chapter 4. SMCRA and Utah State law require surface coal mines to collect extensive baseline information and to implement extensive monitoring programs and mitigation measures. Monitoring programs and mitigation measures that are required by regulation are essentially design features and are considered to be part of any action alternative for the tract. If BLM issues a lease, an approved PAP for mining operations on the tract would be required before mining operations could be conducted. The major mitigation and monitoring measures that are required by state or federal regulation are listed in Table 2.6.1. Some of these are also summarized in greater detail above (Sections 2.6.1.1 through 2.6.1.8). Those measures that are applicable to the mining operation under any action alternative would be implemented, as necessary, and they have been incorporated into the analysis. Lease stipulations would generally reflect the measures, actions, and practices identified as additional design features in Table 2.6.1, and would be applied to the lessee in the lease contract following issuance of the ROD. The design features identified in Table 2.6.1 have been incorporated into the analysis of the action alternatives. As described in the following paragraph, the BLM can also choose to adopt potential mitigation measures as lease stipulations in the lease contract following issuance of the ROD.

During the NEPA process, if there are impacts not addressed by the existing required measures (see Table 2.6.1 and above), the BLM can require further mitigation measures, in the form of stipulations on the lease, within the limits of its regulatory authority. Potential mitigation measures include additional means, measures, or practices not incorporated into the Proposed Action or alternatives as design features that would further reduce or eliminate impacts. These mitigation measures are specific to resource sections and are considered following the impact analyses for each resource in Chapter 4. In general, the levels of mitigation and monitoring required for surface coal mining by SMCRA and Utah State law are more extensive than those required for other surface-disturbing activities; however, concerns may periodically be identified that are not normally monitored or mitigated under existing procedures. These concerns would be addressed by DOGM under the requirements of the ongoing five-year permit review process. DOGM is the permitting agency with primary regulatory authority over compliance and mitigation associated with the exploration, development, and reclamation of coal mining operations. The State of Utah and the DOI have entered into a cooperative agreement defining the scope of jurisdiction for DOGM (representing the State of Utah) and the OSM (representing the DOI) regarding issues such as funding, permit application and review, reclamation bonding, and enforcement matters (30 CFR 944.30). UDAQ is the permitting agency with end authority over air quality compliance and mitigation. Both DOGM and UDAQ would work with the BLM to ensure compliance with regulatory and other requirements.

Table 2.6.1. Regulatory Compliance or Mitigation Required by Federal, State, or Local Law and Additional Design Features

AIR RESOURCES	
Federal, state, and local requirements	• Monitor on-site air quality for PM_{10}. • Monitor off-site ambient PM_{10}. • Conduct on-site compliance inspections. • Periodically monitor airblast frequency levels (conducted by operator), establish ground vibration limits before blasting plan is approved and is monitored by seismograph or scaled-distance equation; and keep records of on-site blasting for three years. • Conduct dispersion modeling of mining plans for annual average particulate pollution impacts on ambient air. • Employ particulate pollution control technologies. • Employ work practices designed to minimize fugitive particulate emissions. • Use EPA-mandated or state-mandated best available control technology, which may include the following: o Watering or using chemical dust suppression (magnesium chloride [MgCl]) on haul roads and exposed soils o Promptly mulching and revegetating exposed soils o Using high efficiency baghouse dust collection systems or passive enclosure containment systems, or atomizers/foggers on the crusher, conveyor transfer, storage bin and train loadout, meeting a standard of 0.01 grain per dry standard cubic foot of exit volume o Watering of active work areas o Putting in place a reclamation plan to minimize surface disturbances subject to wind erosion; o Graveling of access roads with subsequent watering or chemical treatment for dust abatement to meet air quality standards o Limiting haul truck speeds o Limiting material drop heights for shovels • Implement measures to avoid exposing the public to NO_2 from blasting clouds, including the following: o Notifying neighbors and employees at least 24 hours prior to initial blasting according to an approved blasting schedule o Publishing the blasting schedule in a newspaper at least 10 days prior to initial blasting, and distributing copies of the blasting schedule to local governments and public utilities and residents within 0.5 mile of the mining area (republishing every 12 months or more frequently if the schedule changes) o Notifying each person who resides or works within a 0.5-mile radius of the mining area of the blasting schedule and the meaning of the signals used in the blasting o Timing blasts to avoid temperature inversions and to minimize inconvenience to neighbors o Closing public roads, when appropriate, to protect the public o Minimizing blast sizes o Posting signs on all entrances to the permit area from public roads or highways o Incorporating any applicable air resources stipulations from the KFO RMP (BLM 2008b)

Table 2.6.1. Regulatory Compliance or Mitigation Required by Federal, State, or Local Law and Additional Design Features

Additional design features	• Use ultra-low sulfur diesel fuel in generators. • Use EPA Tier 4 emissions controls on generators. • Comply with adaptive management strategy negotiated between the BLM and NPS. • Do not permit surface mining where overburden depths exceed approximately 200 feet. • Conduct continuous ambient air monitoring for PM_{10}, $PM_{2.5}$, NO_2, and visibility according to the adaptive management strategy. • Install fencing to restrict public access to active mining areas. • Require blasting provisions for wind speed, direction, and variability, plus provisions for public notifications/alerts during blasting events. • Require diesel oxidation catalysts on heavy equipment. • Implement a dust control plan. • See Table 4.3.1 for specific design features and project design assumptions.
ALLUVIAL VALLEY FLOORS	
Federal, state, and local requirements	• Identify all AVFs in or adjacent to the permit area (DOGM). • Determine significance to agriculture of all identified AVFs affected by mining (DOGM). • Protect downstream AVFs during mining. • Restore essential hydrologic function of all AVFs affected by mining. • Monitor to determine restoration of essential hydrologic functions of any declared AVFs. • Incorporate any applicable AVF stipulations from the KFO RMP.
Additional design features	• None identified at this time
COAL	
Federal, state, and local requirements	• Achieve maximum economic recovery of the coal resources in the tract (MLA and BLM coal leasing regulations). • Successful bidder inspections and reporting to the BLM. • Incorporate any applicable coal resources stipulations from the BLM-KFO RMP.
Additional design features	• None identified at this time

Table 2.6.1. Regulatory Compliance or Mitigation Required by Federal, State, or Local Law and Additional Design Features

CULTURAL RESOURCES AND NATIVE AMERICAN CONCERNS	
Federal, state, and local requirements	• Conduct Class I and III surveys to identify cultural properties on all state and federal lands and on private lands affected by federal undertakings. • Consult with the state historic preservation office (SHPO) to evaluate eligibility of cultural properties for the NRHP. • Consult with SHPO to evaluate effects of the federal action on historic properties. • Avoid or recover data from significant cultural properties identified by surveys, according to the approved historic properties treatment plan (HPTP). • Notify appropriate federal personnel if historic or prehistoric materials are uncovered during mining operations. • Instruct employees of the importance of and regulatory obligations to protect cultural resources. • Consult Native American tribes with known interest in this area of leasing action and request for help in identifying potentially significant religious or cultural sites. • Comply with Native American Graves Protection and Repatriation Act. • Monitor and mitigate according to the approved HPTP. • Incorporate any applicable cultural resources stipulations from the KFO RMP.
Additional design features	• Comply with stipulations of the programmatic agreement between the BLM-KFO, OSM, DOGM, and Utah State Historic Preservation Officer regarding the Alton Coal Tract LBA.
GEOLOGY AND MINERALS	
Federal, state, and local requirements	• Identify and selectively place or mix chemically or physically unsuitable overburden materials to minimize adverse effects to vegetation or groundwater. DOGM requires analysis in advance of mining to detect unsuitable overburden. • Restore topography to AOC as required by UAC R645-301-553.100. • Incorporate any applicable geological resources stipulations from the KFO RMP.
Additional design features	• Monitor areas susceptible to subsidence due to underground mining; notify DOGM and BLM within 24 hours of the formation of sinkholes; repair sinkholes through backfilling or grouting as required by UAC R645-301-553.100; and use barricades or fences where necessary to protect recreationists and wildlife from sinkholes.
GROUNDWATER QUALITY	
Federal, state, and local requirements	• Evaluate cumulative impacts to water quality associated with mining. • Replace existing water rights that are interrupted, discontinued, or diminished by mining with water of equivalent quality. • Monitoring wells serve to track water quality in overburden, coal, interburden, underburden, and backfill. • Do not materially damage the quality of water in underground water systems that supply AVFs (30 USC 1260(b)(5)(B); UAC R645-301-731.100). • Minimize disturbances to the prevailing hydrologic balance at the tract and in associated off-site areas and to the quality of water in groundwater systems both during and after surface coal mining operations and during reclamation (30 USC 1265(b)(10); UAC R645-301-731.100). • Incorporate any applicable groundwater quality stipulations from the KFO RMP.
Additional design features	• None identified at this time.

Table 2.6.1. Regulatory Compliance or Mitigation Required by Federal, State, or Local Law and Additional Design Features

GROUNDWATER QUANTITY	
Federal, state, and local requirements	• Evaluate cumulative impacts to water quantity associated with mining. • Replace existing water rights that are interrupted, discontinued, or diminished by mining with water of equivalent quantity. • Monitoring wells serve to track water levels in overburden, coal, interburden, underburden, and backfill. • Do not materially damage the quantity of water in underground water systems that supply AVFs (30 USC 1260(b)(5)(B); UAC R645-301-731.100). • Minimize disturbances to the prevailing hydrologic balance at the tract and in associated off-site areas and to the quantity of water in groundwater systems both during and after surface coal mining operations and during reclamation (30 USC 1265(b)(10); UAC R645-301-731.100). • Incorporate any applicable groundwater quantity stipulations from the KFO RMP.
Additional design features	• None identified at this time.
HAZARDOUS AND SOLID WASTE	
Federal, state, and local requirements	• Dispose of solid waste and sewage according to approved plans. • Store and recycle waste oil. • Maintain files containing Material Safety Data Sheets for all chemicals, compounds, and/or substances used during the course of mining and reclamation. • Ensure that all production, use, storage, transport, and disposal of hazardous materials is in accordance with applicable existing or hereafter promulgated federal and state government requirements. • Comply with emergency reporting requirements for releases of hazardous materials as established in the Comprehensive Environmental Response, Compensation, and Liability Act (or Superfund) of 1980, as amended. • Prepare and implement spill prevention control and countermeasure plans, spill response plans, inventories of hazardous chemical categories pursuant to Section 312 of the Superfund Amendments and Reauthorization Act of 1986, as amended. • Prepare emergency response plans. • Incorporate any applicable hazardous and solid waste stipulations from the KFO RMP.
Additional design features	• None identified at this time.
LAND USE	
Federal, state, and local requirements	• Suitably restore reclaimed areas for historic uses (grazing and wildlife). • Monitor controlled grazing prior to bond release evaluation (also see vegetation monitoring requirements). • Obtain a conditional use permit from Kane County to mine lands currently zoned as agricultural. • Incorporate any applicable land use stipulations from the KFO RMP. • Replace all damaged, disturbed, or displaced corner monuments (section corners, quarter corners, etc.), their accessories, and appendages (witness trees, bearing trees, etc.), or restore them to their original condition and location, or at other locations that meet the requirements of the rectangular surveying system per the standards and guidelines found in the Manual of Surveying Instructions, DOI.
Additional design features	• None identified at this time.

Table 2.6.1. Regulatory Compliance or Mitigation Required by Federal, State, or Local Law and Additional Design Features

NOISE	
Federal, state, and local requirements	• Protect employees and local members of the community from hearing loss. • Conduct MSHA inspections. • Incorporate any applicable noise stipulations from the KFO RMP.
Additional design features	• In the DOGM-approved mining plan, a blasting plan would be approved that is sensitive to noise impacts on wildlife, residents of the town of Alton, and points in Bryce Canyon National Park. The plan would be reviewed for comment by the BLM, USFWS, and UDWR before it is approved by the DOGM and before any blasting activity takes place. • Develop a noise monitoring and mitigation plan that addresses noise impacts on wildlife and residents of the town of Alton.
PALEONTOLOGICAL RESOURCES	
Federal, state, and local requirements	• Notify appropriate federal personnel if potentially significant paleontological sites (significant large vertebrate specimens) are discovered during mining, and halting mining in that portion of the mine until the specimen(s) can be collected with accepted scientific techniques. • Incorporate any applicable paleontological resources stipulations from the KFO RMP.
Additional design features	• Monitor spoils heaps in the active portion of the mine every five days during operations to locate and collect significant fossils as they appear. • Establish a fund (available through a competitive granting process to academic institutions, museums, federal, state, local, or other qualified parties) in the amount of $100,000 for research on the same types of resources on adjacent public lands.

Table 2.6.1. Regulatory Compliance or Mitigation Required by Federal, State, or Local Law and Additional Design Features

SAGE-GROUSE	
Federal, State, and Local Requirements	• See Section 1.7.1.2.2; for purposes of analysis in this EIS, it is assumed that an exception, modification, or waiver would be granted in the event of a lease. Lease stipulations detailed below would apply. • The Washington Office IM 2012-043 (BLM 2011c) identifies the need to "cumulatively maintain or enhance Greater Sage-Grouse habitat." The IM requires the BLM to determine, in coordination with the respective state wildlife agency, whether the proposed leasing decision would likely have more than minor adverse effects to Greater Sage-Grouse and its habitat. • Incorporate any applicable sage-grouse stipulations from the KFO RMP.

Additional Design Features	• Comply with the requirements of the sage-grouse mitigation plan (see Appendix E).
	• Create or enhance nesting and brooding habitat on BLM-administered land in the tract in the no-coal zone (habitat creation/enhancement area identified as Block Sa in maps).
	• Following short- and medium-term mitigation and habitat reclamation measures, including the following:
	  • Reclaiming to AOC and seeding with sagebrush and grasses based on approved ecological site descriptions
	  • Protecting sagebrush stands in no-coal zones as habitat to the extent practicable
	  • Locating centralized and dispersed facilities to create the least possible disturbance to sage-grouse and sage-grouse habitat
	  • Clearing young juniper from intact sagebrush stands
	  • Cutting back juniper woodlands surrounding intact sagebrush stands
	• On Block S of the tract, following long-term habitat reclamation measures, including the following:
	  • Creating range sites based on approved ecological site descriptions (conditions for the growth of grasses, forbs, and sagebrush) for reclamation purposes
	  • Planting bare root or potted sagebrush and bitterbrush transplants in identified sites to accelerate shrub reestablishment
	  • Seeding/planting in the fall
	• Remove juniper and pinyon seedlings found in reclaimed areas until full release of the reclamation bond.
	• Conduct post-reclamation surveys for undesirable/ invasive plant species on biannual basis (spring and fall).
	• Begin monitoring in the next growing season after fall seeding/planting and monitor until reclamation goals are achieved.
	• Monitor reclamation sites to assess habitat reclamation success.
	• Monitor bird population (currently in the Alton area) throughout the year to assess bird survival, nest site and nest success, brood-rearing sites, and key winter habitat areas.
	• Conduct mosquito abatement in holding ponds and standing water to reduce the potential for transmission of West Nile Virus to sage-grouse.

SOCIOECONOMICS	
Federal, State, and Local Requirements	• Pay royalties and taxes as required by federal, state, and local regulations. • Survey and report to document volume of coal removed. • Incorporate any applicable socioeconomics stipulations from the KFO RMP.
Additional Design Features	• None identified at this time.

Table 2.6.1. Regulatory Compliance or Mitigation Required by Federal, State, or Local Law and Additional Design Features

SOIL	
Federal, State, and Local Requirements	• Salvage soil suitable to support plant growth for use in reclamation. • Protect soil stockpiles from disturbance and erosional influences. • Selectively place suitable topsoil on the graded backfill overburden surface to meet guidelines for vegetation root zones. • Order one soil survey to establish baseline conditions of fertility and soil type and to establish topsoil depth. • Sample regraded overburden for compliance with root zone criteria. Soil sampling of replaced topsoil would be used to determine amendments to be added prior to seeding. • Incorporate any applicable soil stipulations from the KFO RMP.
Additional Design Features	• None identified at this time.
SURFACE WATER	
Federal, State, and Local Requirements	• Build and maintain sediment control ponds or other devices during mining. • Restore approximate original drainage patterns during reclamation. • Restore stock ponds and playas during reclamation. • Conduct necessary UPDES storm water discharge permitting. • Monitor storage capacity in sediment ponds. • Monitor quality of discharges through the UPDES permit. • Monitor stream flow and water quality in selected springs in and adjacent to the tract. • Do not materially damage the quantity or quality of water in surface-water systems that supply AVFs (30 USC 1260(b)(5)(B); UAC R645-301-731.100). • Minimize disturbances to the prevailing hydrologic balance at the tract and in associated off-site areas and to the quality and quantity of water in surface-water systems both during and after surface coal mining operations and during reclamation (30 USC 1265(b)(10); UAC R645-301-731.100). • Incorporate any applicable surface water stipulations from the KFO RMP.
Additional Design Features	• None identified at this time.
THREATENED, ENDANGERED, PROPOSED, AND CANDIDATE SPECIES	
Federal, State, and Local Requirements	• Survey for threatened, endangered, proposed, and candidate species and their habitat. • Avoid disturbance of identified habitat for threatened, endangered, proposed, and candidate species (see above for sage-grouse). • Restore habitat for threatened, endangered, proposed, and candidate species in areas disturbed by mining. • See Wildlife Resource section below. • Conduct baseline and annual wildlife monitoring surveys. • Incorporate any applicable threatened, endangered, proposed, and candidate species stipulations from the KFO RMP.
Additional Design Features	• None identified at this time.

Table 2.6.1. Regulatory Compliance or Mitigation Required by Federal, State, or Local Law and Additional Design Features

TOPOGRAPHY AND PHYSIOGRAPHY	
Federal, State, and Local Requirements	• Restore to approved AOC as required by UAC R645-301-553.100. (Any variances to AOC would be provided in a plan to DOGM and must be approved.) • Check as-built versus approved topography with each annual report (DOGM). • Incorporate any applicable topography and physiography stipulations from the KFO RMP.
Additional Design Features	• None identified at this time
TRANSPORTATION FACILITIES	
Federal, State, and Local Requirements	• Relocate existing public roads, if necessary, in accordance with specific agreement between road authority, surface management agency, and coal lessee. • Incorporate any applicable transportation stipulations from the KFO RMP.
Additional Design Features	• None identified at this time.
VEGETATION	
Federal, State, and Local Requirements	• Permanently revegetate reclaimed areas according to a comprehensive revegetation plan using approved reclamation seed mixtures consisting of suitable native and non-native species. • Reclaim 20% of reclaimed area with native shrubs at a density of one per square meter. • Control erosion on reclaimed lands prior to seeding with final seed mixture using mulching, cover crops, or other approved measures. • Chemically and mechanically control weed infestation. • Directly haul topsoil wherever possible. • Selectively plant shrubs in riparian areas. • Plant sagebrush. • Create depressions and rock piles. • Use special planting procedures around rock piles. • Post reclamation bond covering the cost of reclamation. • Monitor revegetation growth and diversity until release of final reclamation bond (minimum 10 years). • Monitor erosion to determine need for corrective action during establishment of vegetation. • Use grazing exclosures and vegetation monitoring during revegetation evaluation to determine suitability for post-mining land uses. • Incorporate any applicable vegetation stipulations from the KFO RMP.
Additional Design Features	• None identified at this time.

Table 2.6.1. Regulatory Compliance or Mitigation Required by Federal, State, or Local Law and Additional Design Features

VISUAL RESOURCES AND NIGHT SKY	
Federal, State, and Local Requirements	• Restore landscape character during reclamation through returning to AOC and revegetation with suitable native and non-native species. • Incorporate any applicable visual resources stipulations from the KFO RMP.
Additional Design Features	• Develop a detailed mine lighting plan. In developing the mine lighting plan, further consultation will be required with NPS to fully examine techniques, technology/equipment, and mitigation measures available to effectively protect night sky quality, realizing technology may be improved at the time a lighting plan is developed, carrying forward an adaptive management approach. • Light from all light sources (fixed position light poles, portable light towers, and equipment lighting) shall not exceed 3,150,000 initial lumens subject to approval by the authorized officer. • Use full shielding on fixed position light poles at centralized facilities.
WETLANDS	
Federal, State, and Local Requirements	• Identify all wetlands that would be affected by mining. • Identify jurisdictional wetlands (USACE). • Replace all jurisdictional wetlands that would be disturbed by mining. • Replace functional wetlands as required by surface managing agency, surface landowner, and/or DOGM. • Monitor reclaimed wetlands using the same procedures used to identify pre-mining jurisdictional wetlands. • Incorporate any applicable wetlands stipulations from the KFO RMP.
Additional Design Features	• None identified at this time.
WILDLIFE AND SPECIAL STATUS SPECIES	
Federal, State, and Local Requirements	• Restore pre-mining topography to the maximum extent possible. • Plant a diverse mixture of grasses, forbs, and shrubs in configurations beneficial to wildlife. • Design fences to permit wildlife passage. • Increase habitat diversity by creating rock clusters and shallow depressions on reclaimed land. • Use appropriate plantings along reclaimed drainages. • Replace drainages, wetlands, and AVFs disturbed by mining. • Enforce appropriate vehicle speed limits to minimize mortality. • Instruct employees not to harass or disturb wildlife. • Follow approved raptor mitigation plans such as the USFWS *Utah Field Office Guidelines for Raptor Protection from Human and Land Use Disturbances* (USFWS 2002). • Conduct baseline and annual wildlife monitoring surveys. • Monitor for migratory bird species of management concern in Utah. • Incorporate any applicable wildlife and special status species stipulations from the KFO RMP.

Table 2.6.1. Regulatory Compliance or Mitigation Required by Federal, State, or Local Law and Additional Design Features

Additional Design Features	• Design fences proposed in big game habitat to reduce impacts to big game movement, as well as reduce vehicle-wildlife collisions. BLM would consult with the UDWR on the design and location of new fences. • Prior to ground-disturbing activities, conduct migratory bird nest surveys and, if possible, conduct ground-disturbing and vegetation removal activities outside of critical breeding seasons for migratory birds. If it is not possible to conduct these activities outside of breeding season, make certain a qualified biological monitor is present to ensure compliance with Migratory Bird Treaty Act of 1918 (MBTA). • Develop a blasting plan that is sensitive to noise impacts on wildlife, residents of the town of Alton, and points in Bryce Canyon National Park where the analysis shows blasting-related impacts. • Minimize construction activities in big game crucial summer habitat from May 15 to July 15. • To avoid incidental take, perform any ground-disturbing activities or vegetation treatments before migratory birds begin nesting or after all young have fledged. • If activities must be scheduled to start during the migratory bird breeding season, take appropriate steps to prevent migratory birds from establishing nests in the potential impact area. These steps could include covering equipment and structures to prevent nest-building, covering existing nests with materials approved by USFWS to prevent use, and employing biological monitors to ensure no active nests are disturbed. • If activities must be scheduled during the migratory bird breeding season, perform a site-specific survey for nesting birds starting at least two weeks before groundbreaking activities or vegetation treatments. Do not move established nests with eggs or young, and the do not harass birds until all young have fledged and are capable of leaving the nest site. • Develop a migratory bird conservation plan at the permitting stage to address and mitigate for migratory bird habitat losses resulting from mine operation.

2.6.2 Other Roads in the Alton Coal Tract

Besides KFO Route 116, other roads exist in the tract (see Map 1.4). These include roads identified by Kane County as K3150, K3115, K3120, K3125, K3135, K3140, K3145, and K3155. Roads on BLM-administered land and overlying coal reserves would either be temporarily closed or relocated (following avoidance criteria previously detailed) during active mining operations to allow for full recovery of coal resources in these areas. Following mining, these roads would be replaced in accordance with the travel plan in the land use plan, and any temporary roads created would be reclaimed. Temporary road relocations and/or closures would be determined in consultation with the successful bidder and Kane County. Roads on private land and overlying coal reserves would be closed during active mining operations. Permanent or temporary relocation of these roads would be determined in consultation with the private landowner and Kane County. This EIS analysis assumes that roads located on private land would be closed during active mining operations and replaced in their pre-existing locations and conditions following completion of mining and reclamation.

The BLM would coordinate with the appropriate Kane County officials related to all temporary road closures and/or relocations. The BLM recognizes that it is important to coordinate with Kane County related to matters concerning the relocation and/or temporary closure of KFO Route 116 and other roads on the tract. The State of Utah and Kane County may hold valid existing ROWs in the tract pursuant to RS 2477 codified at 43 USC 932. On October 21, 1976, U.S. Congress repealed RS 2477 through passage of FLPMA. This EIS analysis does not adjudicate, analyze, or otherwise determine the validity of claimed ROWs. However, nothing in this EIS analysis extinguishes any valid ROW, or alters in any way the legal rights the State of Utah and Kane County have to assert and protect RS 2477 rights. Also, nothing in this EIS analysis restricts the rights of the State of Utah and Kane County to challenge in federal court or other appropriate venue any use restrictions imposed by the BLM's decisions regarding leasing that they believe are inconsistent with their rights.

2.6.3 Reasonably Foreseeable Potential Short Haul Route (tract to KFO Route 116 north of Alton)

One reasonably foreseeable potential short haul route exists for transporting coal from the tract to KFO Route 116 north of the town of Alton (Map 2.5). This route would traverse private surface on Block NW south of Alton, and would then head north across private surface and connect with KFO Route 116 west of Alton. This short haul route is described as reasonably foreseeable because it is already planned for potential use by the applicant (ACD) for moving mined coal from the Coal Hollow Mine, adjacent to the tract, to KFO Route 116 west of Alton. If the BLM decides to hold a competitive lease sale for the tract and a lease is issued to ACD, it is reasonably foreseeable that ACD would continue to use this short haul route while mining coal reserves contained in the tract. A successful bidder other than ACD may use a different short haul route between the tract and KFO Route 116 west of Alton. Given that BLM lacks the ability to predict the successful bidder or the potential plans of a successful bidder other than ACD, attempting to guess at other potential short haul routes that may be used by a successful bidder other than ACD would be speculative and, therefore, in this EIS, no consideration is given to these routes. In the event of a competitive lease sale, if the final short haul route differs such that impacts are created that are not addressed here, additional NEPA analysis would be required.

2.6.4 Reasonably Foreseeable Coal Loadout Location and Transportation Route

Future foreseeable transportation of mined coal reserves from the tract to market would be dictated by existing roads and market conditions at the time of sale of mined coal. The applicant (ACD) is currently planning on moving mined coal from the tract to market via development of a rail loadout at Iron Springs, approximately 11 miles west of Cedar City, Utah. To access this loadout, coal transportation would occur via KFO Route 116 continuing north through the town of Alton, north on US-89, west on SR-20, and finally south on I-15 exiting at exit number 59 in Cedar City. For analysis in this EIS, the construction and use of the rail loadout at Iron Springs would be the reasonably foreseeable loadout location associated with the tract, and the approximately 110-mile route would be the reasonably foreseeable transportation route linking the tract and the loadout. Map 2.6 shows the rail loadout location and the transportation route.

If BLM decides to hold a competitive lease sale and a lease is issued to ACD, it is reasonably foreseeable that they would use this rail loadout and transportation route, as conditions dictate, to transport and market the federal coal reserves in the tract. A successful bidder other than ACD may identify a different loadout location, transportation route, or both, to move mined coal from the tract to market. Given that BLM cannot predict the plans of a successful bidder other than ACD, the following would be speculative: attempting to guess at loadout location (or locations), transportation route (or routes), or both, that may be used by a successful bidder other than ACD. Therefore this EIS gives no consideration to other potential loadout locations and transportation routes.

Though transportation of mined coal reserves would not be regulated under the leasing action, all coal haul trucks used for transporting mined coal reserves from the tract would be operated as per federal and Utah Department of Transportation (UDOT) requirements. For analysis of all actions alternatives in this EIS, it is anticipated that in addition to the operation of permitted and regulated haulage from the tract to a reasonably foreseeable rail loadout, the use of best available control measures to minimize and/or eliminate fugitive coal dust along the transportation route would be installed on all coal haul vehicles. Operation of the rail loadout facility would be regulated by DOGM (under their coal regulatory program). In addition to various federal, state, and local regulatory requirements for its operation, it is also anticipated that best available control measures for fugitive coal dust would be implemented at the associated loadout facility.

2.7 Alternatives and Options Considered but Eliminated From Detailed Analysis

The BLM reviewed several potential alternatives and options during the course of alternatives development and following publication of the DEIS. Based on technical, economic, and environmental factors, as well as legal and regulatory constraints, and in light of past, present, and reasonably foreseeable future actions (RFFAs), none of these alternatives or options was carried forward for detailed analysis in this EIS. The rationale for eliminating each alternative (Section 2.7.1) and option (Section 2.7.2) from further analysis is discussed below.

2.7.1 Alternatives Considered but Eliminated from Detailed Analysis

Aside from the Proposed Action, Alternative C, and Alternative K1, 19 alternatives (Alternatives D through V below) were considered during the course of alternatives development and following publication of the DEIS. Each of these was eliminated from detailed analysis in the EIS. Sections 2.7.1.1 through 2.7.1.19 provide descriptions of these alternatives along with the rationale for eliminating each of them from detailed analysis.

2.7.1.1 ALTERNATIVE D: ALTON COAL DEVELOPMENT'S ORIGINAL LEASE BY APPLICATION SUBMITTAL

As indicated in Chapter 1, in November 2004, ACD submitted an LBA (Case Number UTU 081895) to mine federal coal, using primarily surface-mining methods, near the town of Alton, Utah. This LBA submittal contained nearly 2,683 surface acres and approximately 38 million tons of recoverable coal (Map 2.7 shows the original LBA submittal). Due to 1) the identification of additional recoverable coal reserves not included in the LBA, as submitted; 2) additional surface acreage BLM deemed necessary for mine operations; and 3) the need to exclude the Alton cemetery (to comply with regulations under 43 CFR 3461), the BLM reconfigured the tract to include approximately 898 additional surface acres and approximately 11 million additional tons of recoverable coal. The tract as reconfigured is the Proposed Action. Due to reasons as described, ACD's LBA as submitted was not carried forward for detailed analysis. Other tract configurations based on ACD's original LBA submittal were considered to address issues. Each of these was also eliminated from detailed analysis. Descriptions of these alternatives along with the rationale for eliminating each of them from detailed analysis are contained in Sections 2.7.1.8 (Alternative K) and 2.7.1.9 (Alternative L).

2.7.1.2 ALTERNATIVE E: NO SURFACE MINING

An alternative suggested during public scoping identified mining of coal reserves in the tract by use of underground recovery methods. BLM reviewed the feasibility of this alternative and determined that anticipated surface cover (shallow overburden over much of the tract composed largely of unconsolidated material) in the tract would not facilitate this mining method over most of the tract. Furthermore, underground mining methods would significantly reduce the recovery rate of coal in the tract (from approximately 90% to 50%) where shallow overburden facilitates surface-mining methods.

Where overburden exceeds approximately 200 feet, it is anticipated that underground mining methods would be employed to recover in-place coal reserves. Overburden exceeds 200 feet over approximately 613 acres of the tract under all action alternatives. This is the point at which underground mining methods would become more feasible than surface-mining methods, depending on economic conditions. The technical feasibility of underground mining would need to be evaluated at the time that surface mining may no longer be an economic option. Further, by design feature (see Table 2.6.1), surface mining would not be allowed at overburden depths greater than approximately 200 feet.

2.7.1.3 ALTERNATIVE F: POSTPONE LEASING DECISION UNTIL COMPLETION OF THE KANAB FIELD OFFICE RESOURCE MANAGEMENT PLAN REVISION

This alternative was suggested during the public scoping period. The KFO RMP revision was subsequently completed in late 2008. As a result, the suggestion is no longer applicable and has therefore been eliminated from detailed analysis.

2.7.1.4 ALTERNATIVE G: POSTPONE LEASING DECISION UNTIL MORE ENVIRONMENTALLY FRIENDLY COAL MINING PRACTICES ARE AVAILABLE

This alternative is based on the speculative assumption that more environmentally friendly coal mining practices will be developed in the foreseeable future, and that the use of these methods for mining in-place coal reserves contained in the tract would significantly reduce the impacts of mining.

Although more environmentally friendly coal mining techniques and practices may be developed, the timeline for the development of these potential techniques is unknown at this time. To establish a date for postponement of a competitive lease sale would therefore be speculative and the chosen date would be arbitrary. Furthermore, the degree to which potentially more environmentally friendly mining techniques would reduce impacts is not known because these mining methods have not been developed, or even proposed. To assume that more environmentally friendly mining methods would significantly reduce the impacts of mining coal from the tract would also be speculative.

2.7.1.5 ALTERNATIVE H: CONSTRUCT A COAL-FIRED POWER PLANT NEXT TO THE TRACT

An alternative suggested during the public scoping period identified the construction of a coal-fired power plant next to the tract as a way to eliminate impacts due to the transportation of coal resources from the tract to market. This alternative would not meet the purpose and need (see Section 1.2) for the Proposed Action and alternatives and was therefore eliminated from detailed analysis in this EIS. A coal lease obtained from the BLM makes coal available for leasing but does not place constraints on its ultimate use or the location of that use. Further, considering approval of the construction and operation of a coal-fired power plant next to the tract would be outside of the framework established for this EIS when ACD submitted the Alton Coal Tract LBA to lease and mine federal coal reserves. ACD's application does not include a proposal to construct or operate a coal-fired power plant as a part of their proposal to lease and mine federal coal reserves.

Also, the total environmental impacts of Alternative H would be greater than the impacts of transportation of coal from the tract to the reasonably foreseeable rail loadout facility. This is particularly true because coal-fired power plants generally require more coal on a yearly basis than would be produced from the tract, which would likely mean that additional coal would need to be transported to the area.

2.7.1.6 ALTERNATIVE I: PROMOTE THE DEVELOPMENT OF ALTERNATIVE SOURCES OF ENERGY, NATURAL GAS, AND ENERGY CONSERVATION

Under this proposed alternative, the BLM would choose not to offer the tract for competitive leasing. Instead, the BLM would promote energy conservation, the use of natural gas, and the development of alternative sources of energy, such as wind, solar, and geothermal on lands contained in the tract as well as elsewhere in the KFO. This alternative does not meet the purpose and need (see Section 1.2) for the Proposed Action and alternatives and was therefore eliminated from detailed analysis in this EIS. In a similar manner as considering the construction of a coal-fired power plant next to the tract, foregoing coal leasing in favor of promoting energy conservation, the use of natural gas, and the development of alternative sources of energy would be outside the framework established for this EIS when ACD submitted their LBA to lease and mine federal coal reserves in the tract. ACD's application did not include a proposal to promote energy conservation and/or the use of natural gas and/or to develop alternative sources of energy on the LBA tract or elsewhere in the KFO. A primary goal of the Energy Policy Act is to add energy supplies from diverse sources. If an alternative energy proposal were received, a separate NEPA analysis would be conducted.

2.7.1.7 ALTERNATIVE J: COAL TRANSPORTATION ALTERNATIVES

During the public scoping period, one reasonably foreseeable transportation route was presented to the public (Iron Springs rail loadout via US-89, SR-20, and I-15; see Map 2.6 and Section 2.6.4 for a map and description, respectively). Due to concerns regarding transportation impacts along this route, several transportation alternatives were suggested. The BLM considered these alternatives and eliminated them from detailed analysis for the reasons outlined in the bulleted list below.

- Due to operations at the Coal Hollow Mine adjacent to the tract, approximately 153 coal truck round-trips would already be taking place on existing area roads and highways. Approval of the lease and mining on the tract would not result in new traffic impacts but would extend the life over which these impacts occur.
- Decisions regarding the transportation of coal from the tract to market are dictated by market conditions and the intended use of the coal resource at the time of mining and sale of coal. Limiting the ability of the successful bidder to efficiently deliver coal resources to market would not fully meet the purpose and need for the Proposed Action and alternatives because leasing and mining the coal is intended to meet market needs wherever they occur.
- Coal trucks and loads used by the successful bidder would be required to meet state and federal guidelines and regulations. Coal trucks would be legally permitted to use any road or highway not already restricted from truck traffic. Any decision to limit or curtail the use of these roads by trucks (coal trucks or otherwise) is regulated by Kane, Garfield, and Iron counties and UDOT, and it is outside the scope of this EIS and the BLM's jurisdiction.

A decision to lease on the part of the BLM would not approve any particular transportation route. This EIS presents an analysis of reasonably foreseeable impacts from reasonably foreseeable activities to meet NEPA hard-look disclosure requirements. The elimination of transportation alternatives from detailed analysis in this EIS does not mean that transportation impacts are not addressed. These impacts are addressed in detail in Chapter 4, Environmental Consequences.

During the public scoping period, transportation of coal by a conveyor was also suggested. The BLM eliminated each of these alternatives from detailed analysis because they are not reasonable for the following reasons: 1) the volume of coal to be recovered from this LBA tract would not justify the large expenditures to implement either of these alternatives; 2) construction and operation of slurry lines or a large conveyor system would disturb more acreage, create more visual intrusion, and result in an overall increase in environmental consequences as compared to trucking of coal (with minor exceptions, most of the roads for trucking coal are already in place); and 3) slurry lines and conveyor systems are difficult to move once constructed, their construction as an alternative to any potential trucking routes would require that customers for the mined coal be identified prior to the conclusion of the EIS process, including putting agreements in place to ensure that markets identified now would continue to be viable at the completion of the EIS process.

2.7.1.8 ALTERNATIVE K2: TRACT MODIFICATIONS TO ADDRESS CONCERNS RELATED TO GREATER SAGE-GROUSE AND BIG GAME

During the public scoping period, impacts to sage-grouse and big game were expressed as concerns. To address these concerns, BLM considered alternatives to the Proposed Action that removed portions of the tract known to be used by the local sage-grouse population according to recently collected radio collar data. Alternative K2 would remove a small portion of Block NW and another small portion of Block S from the tract (Map 2.8). Both of the blocks eliminated under Alternative K2 are in the no-coal zone. This alternative would also place timing restrictions on mining operations conducted by the successful bidder (no ground surface disturbance in Block NW and Block S from March 15 to July 15 and no ground surface disturbance within 0.5 mile of the existing, nearby lek during the lekking period, February 15 to March 15). To address big game concerns, the BLM considered requiring the successful bidder to leave buffers between forage and cover wherever possible.

The tract configuration as described under Alternative K2 was not carried forward for detailed analysis in the EIS primarily because it does not represent a meaningful change from the tract configuration under the Proposed Action. The tract configuration under Alternative K2 would only be reduced by

approximately 241 acres (7%) compared to the Proposed Action. Also, projected total surface disturbance under Alternative K2 would be approximately 17 acres (0.7%) less than that projected under the Proposed Action. Further, Block S is a good candidate for proposed on-site mitigation measures for sage-grouse and other sagebrush-dependent species, and it makes more sense to retain this block under all alternatives for this purpose than to eliminate it. Except for those restrictions that would also apply to Block NW, surface disturbance timing restrictions described under this alternative were carried forward for detailed analysis as part of Alternative C (see Section 2.4). Also, Alternative K1, which would eliminate Block NW and Block S from the tract and be more protective of sage-grouse and other sagebrush-dependent species than Alternative K2, is analyzed in detail as part of this SDEIS.

To address concerns related to impacts to big game and big game habitat, BLM considered a requirement that the successful bidder leave buffers between big game forage and cover wherever possible. This alternative was eliminated from detailed analysis because it would have limited utility given the large range used by big game, because similar habitat exists in substantial acreages adjacent to the tract, and because of the likelihood that these buffers would not be used by big game in such close proximity to mining operations. Further, this is not an enforceable or measurable requirement. The BLM cannot provide meaningful analysis of the effectiveness of this type of measure because there are no data available upon which to draw reasonable conclusions.

2.7.1.9 ALTERNATIVE L: TRACT MODIFICATIONS TO ADDRESS CONCERNS RELATED TO KANAB CREEK, POSSIBLE ALLUVIAL VALLEY FLOORS, AND OTHER WATER FEATURES

During the alternatives development process, alternatives intended to reduce potential impacts to Kanab Creek and possible AVFs were considered. One alternative (Alternative L1) would require the successful bidder to mine the central-west portion of the tract (Blocks CWN and CWS) from west to east and to remove from the tract that portion of the tract in the no-coal zone to the east of these two blocks (Map 2.9). Another alternative (Alternative L2) would remove the central-west portion (Blocks CWN and CWS, including the no-coal zone) from the tract altogether (Map 2.10). Neither of these alternatives is carried forward for detailed analysis in the EIS.

First, neither alternative would provide a benefit to water quality that would be substantially greater than the water quality protection measures already required by law and regulation. Further, Alternative L1 would create more impact than the Proposed Action or Alternative C by requiring that light-use roads be routed in the LBA around the central portion (no-coal zone) of the tract rather than across this area, therefore increasing the length of the road and not eliminating road stream crossings (either way one to two road stream crossings would be required). Additionally, Alternative L2 would likely result in the bypass of the coal contained in Block CWS (and perhaps CWN as well) because this coal would become isolated and is not anticipated to be present in quantities great enough (approximately 1,900,000 tons and 1,200,000 tons for Block CWS and CWN, respectively) to be economically recoverable as a separate, stand-alone lease tract.

Comments on the DEIS suggested that the BLM analyze an alternative that completely avoids impacts to water resources on the entire tract. This alternative was not carried forward for detailed analysis. First, based on the analysis of the existing alternatives (Alternatives A, B, C, and K1), it is in the BLM's decision space to exclude, in its ROD, portions of the tract to avoid or reduce impacts to water features. Second, there are no reasonable stand-alone action alternatives that avoid impacts to all or most water resources that are not already analyzed in detail in Alternative C and Alternative K1. Finally, the No Action Alternative, which completely avoids impacts to water resources on the entire tract, is already analyzed in detail.

2.7.1.10 ALTERNATIVE M: MAXIMIZE FLEXIBILITY OF MINING OPERATIONS

Under this proposed alternative, the tract configuration and preliminary mine plan would be the same as under the Proposed Action. However, no avoidance criteria (outside of that required by existing law and regulations) would be in place for siting of centralized or dispersed facilities, and the successful bidder would be allowed to disturb (pit disturbance) up to 360 acres of land prior to beginning reclamation activities. The purpose of this alternative was to maximize flexibility in mining operations for the successful bidder and, therefore, to increase maximum economic recovery of the coal resource. This alternative was eliminated from detailed analysis in the EIS because it did not provide a more comprehensive benefit than the Proposed Action in terms of meeting purpose and need. In other words, this alternative would result in more adverse impacts than the Proposed Action without resulting in a substantial increase in the likely maximum economic recovery of the coal resource.

2.7.1.11 ALTERNATIVE N: NITROGEN DIOXIDE EMISSIONS CONTROL MEASURES

Comments provided during the scoping period suggested that BLM should consider measures to ensure that unsafe levels of NO_2, which may be emitted as a result of blasting and engine exhaust, are not released to the environment. During the alternatives development process, BLM considered including NO_2 control measures in one or more alternatives. However, due to measures already required by existing laws and regulations (see Table 2.5.1) to control NO_2 emissions, BLM did not carry any of these alternatives forward for detailed analysis. Emission control measures for NO_2 provided under any alternative would not provide a substantially greater benefit in terms of preventing NO_2 emissions than preventative measures already required.

2.7.1.12 ALTERNATIVE O: RESTRICT MINING OPERATIONS TO DAYLIGHT HOURS

To eliminate the potential for skyglow and impacts to the quality of night skies near the tract, BLM considered an alternative that would restrict mining activities to daylight hours only. This alternative was not carried forward for detailed analysis because it does not conform to standard industry operating practices for mining activities (coal or otherwise). In the United States, there are no known mines restricted by federal, state, or other agencies to operate only during daylight hours. Likewise, there are no known mines in the United States voluntarily operating during daylight hours, only perhaps with the exception of operations with fewer than five employees that may be operating during daylight hours only for convenience or to avoid the added capital cost of night operations. Further, in terms of reduced skyglow and quality of night skies near the tract, the benefits of this alternative as compared to allowing nighttime operations would be limited because lighting requirements for nighttime mining operations would already be limited in nature (see Section 2.3.2.5), and minimization measures would be required, as described in Table 2.6.1 and Section 4.2. Finally, a daylight operations–only alternative is not needed to reduce or eliminate impacts to other resources and uses because these conflicts can be addressed by other alternatives that are analyzed in detail and/or by lease stipulations; compliance with federal, state, or local laws; and the application of mitigation measures that the BLM may adopt in its decision.

2.7.1.13 ALTERNATIVE P: UPDATE THE KFO RMP UNSUITABILITY DETERMINATIONS BASED ON THE ANALYSIS IN THE DEIS AND RECONFIGURE THE TRACT TO EXCLUDE THESE AREAS

Comments on the DEIS requested that the impacts analysis contained in the DEIS be used to update the KFO RMP's coal unsuitability determinations for the area (particularly with respect to Criteria 2, 3, 15, 18, and 19), and that an alternative be created that is in conformance with these updated coal unsuitability results. The development of an additional alternative was not necessary in response to this comment. The

Final Coal Unsuitability Report in the 2008 KFO RMP indicates that unsuitability determinations for Criteria 2, 3, 15, 18, and 19 would be made at the time of lease analysis (see Appendix D). Consistent with that direction and the applicable regulations, these determinations have been made in Section 1.7.1.2.2. This updated determination does not require an update to the coal unsuitability determinations in the KFO RMP as project-specific assessments were contemplated by the RMP and the regulations. Additionally, as explained in Section 1.7, a finding of unsuitability under Criterion 15 does not by necessity prohibit leasing because "[a] lease may be issued if, after consultation with the state, the surface management agency determines that all or certain stipulated methods of coal mining will not have a significant long-term impact on the species being protected" (43 CFR 3461.5(o)(1)).

2.7.1.14 ALTERNATIVE Q: AIR QUALITY PROTECTION ALTERNATIVE

Comments on the DEIS requested that the BLM develop an alternative that ensures no violations of Clean Air Act (CAA) standards. An alternative specifically aimed at ensuring no violations of CAA standards was not considered for detailed analysis because it is unnecessary. The modeling analysis shows that the application of design features and mitigation measures as described in Sections 4.3.1, 4.3.5, and Table 2.6.1 would ensure that violations of air quality standards would not occur under any action alternative. An alternative aimed specifically at ensuring that no violations of air quality standards occur would not address unresolved resource conflicts, because no air quality conflict exists that cannot be addressed by means other than stand-alone alternatives.

2.7.1.15 ALTERNATIVE R: RESTRICT COAL TRUCK TRAFFIC AFTER SUNSET AND BEFORE SUNRISE

Comments on the DEIS requested that the BLM consider an alternative to restrict coal truck traffic for the first two to three hours after sunset and the first two to three hours before sunrise to improve highway safety and decrease the risk of collisions with wildlife. This is considered as a potential mitigation measure in Sections 4.17.6 of this SDEIS rather than as a stand-alone alternative. However, at this time, the BLM does not have the authority to restrict the successful lessee's access to area highways for purposes of transporting coal mined from the tract.

2.7.1.16 ALTERNATIVE S: RECONFIGURE THE TRACT TO EXCLUDE CULTURAL RESOURCES SITES ELIGIBLE FOR THE NATIONAL REGISTER OF HISTORIC PLACES

Comments on the DEIS requested that the BLM reconfigure the tract to exclude cultural resources sites eligible for the NRHP. It is within the BLM's decision space as a result of the analysis of impacts of the existing alternatives to choose to avoid impacts to some or all cultural resources on the tract and/or to ameliorate some or all impacts through mitigation measures. As a result, there is no need for an alternative that is designed specifically to avoid impacts to cultural resources. Further, the programmatic agreement developed with consulting parties addresses how impacts to cultural resources would be dealt with if the BLM decides to offer the tract for competitive leasing.

2.7.1.17 ALTERNATIVE T: SEASONAL TIMING RESTRICTIONS AND VARYING BUFFER-SIZE RESTRICTIONS FOR THE TRACT

Comments on the DEIS requested that the BLM consider employing seasonal timing restrictions on the entire tract under all alternatives rather than just under Alternative C, with the primary intent of decreasing impacts to Greater Sage-Grouse and avoiding impacts to night sky viewers during the prime night-sky viewing season. This alternative was considered but eliminated from detailed analysis because it would result in the prohibition of all mining activities on the tract for approximately two to four months

per year (or more). Suspending mining activities on the tract for this length of time on an annual basis does not conform to reasonable, standard industry operating practices for mining activities (coal or otherwise). In the United States, there are no known mines restricted by federal, state, or other agencies to operate only seasonally with as much as four months per year without mining. Likewise, there are no known mines in the United States voluntarily operating only seasonally, perhaps with the exception of small operations that operate only seasonally for convenience. Also, based on the alternatives analyzed in detail, it is within the BLM's decision space to apply seasonal timing restrictions to other tract configurations without considering those as stand-alone alternatives, because this would be within the range of impacts already analyzed based on the action alternatives carried forward for detailed analysis.

Concerns have also been expressed regarding the size of the buffer around the Greater Sage-Grouse lek near the tract. Alternative C has seasonal restrictions within 0.5 mile of the lek during the sage-grouse nesting and brooding period. Under Alternative K1, there would be no mining at any time of the year within 0.5 mile of the lek. It has been shown that a 0.5-mile buffer is not sufficient to protect sage-grouse nesting habitat (Walker et al. 2007). A range of larger buffer sizes has been suggested, including a 1-mile buffer, a 2-mile buffer, and greater-than-2-mile buffer. It has also been suggested that seasonal restrictions on mining within the buffer should be replaced with permanent restrictions (i.e., reconfiguring the tract to exclude the portion within the buffer from the tract). However, a 1-mile buffer is already being analyzed in the EIS because Alternative C essentially represents a 1-mile seasonal buffer, and a buffer greater than 1 mile would make mining operations on the tract economically unviable.

Alternative C includes seasonal restrictions on mining activities in Block S during the sage-grouse's nesting and brooding period (March 15–July 15). This includes nearly all the coal resources within 1 mile of the lek. Alternative C also allows two pits to be open at any one time with significant initial costs. Thus, the EIS is essentially already considering an alternative that seasonally restricts mining within a 1-mile buffer of the lek, while allowing mining operations to take place in another area of the tract.

Requiring a 2-mile buffer around the lek would restrict mining on the entire tract except Block NW. A 3- or 4-mile buffer would encompass the entire tract. Prohibiting mining activities altogether within these buffers would make mining the tract economically unviable because nearly the entire tract would be off limits when using a 2-mile buffer and the entire tract would be off limits when using a 3- or 4-mile buffer. Suspending mining operations on the entire tract or nearly the entire tract for four or five months every year would also make mining the tract economically unviable and result in significant negative economic impacts to employees and the communities. This is because of the substantial expense of shutting down and then restarting operations every year. These costs would result from the three factors listed below:

- Capital cost per ton of coal sold would increase dramatically due to decreased production or the additional capital equipment that must be acquired to produce the same tonnage in fewer months.
- The operator would have increased labor costs to lay off, hire, and train or retrain personnel.
- The operator would incur added operating costs to rehabilitate roadways and pits after sitting idle without maintenance for an extended period, which would increase the nonproductive time from two weeks to two or more months depending on the weather conditions during the idle period.

It might be possible to expand the acreage of disturbed lands outside the buffer areas throughout the life of the mine to provide other locations for production during the seasonal restrictions. However, a detailed evaluation of the mining plans would be required to determine if this would be feasible. Detailed mining plans would not be available until the permitting stage. This approach may also be economically unviable because maintaining additional open mine pits for alternative production would add substantial operating costs. A noneconomic cost of this approach would be that the additional open mine pits would be additional surface disturbance that would remain open until reclamation.

Although the financial implications of the restrictions described above could be specifically quantified with significant effort, operators generally would not have sufficient operating margins to withstand the substantial added costs. Because it would not be economically feasible to prohibit mining on most of the tract permanently or seasonally, this alternative was not carried forward for detailed analysis.

2.7.1.18 ALTERNATIVE U: ALTERNATIVE LOCATIONS

Comments on the DEIS suggested that the BLM consider alternative locations for leasing rather than the Alton Coal Tract under consideration in Alternatives B, C, and K1. This alternative was not carried forward for detailed analysis because it would not meet the BLM's purpose and need, which is specifically associated with responding to the LBA submitted by ACD. Other locations may be considered by the BLM as a part of responding to other LBAs submitted for those locations. Separate NEPA processes would be needed to respond to the LBAs for those locations.

2.7.1.19 ALTERNATIVE V: LEASE ALL KNOWN RECOVERABLE COAL RESOURCES

Comments on the DEIS suggested that the BLM consider leasing all known recoverable coal resources rather than only those under consideration in Alternatives B, C, and K1. This alternative was not carried forward for detailed analysis because, much like Alternative U, it would not meet the BLM's purpose and need, which is specifically associated with responding to the LBA submitted by ACD. All known recoverable coal resources are available for leasing unless specifically considered unsuitable for surface mining and/or surface impacts from underground mining. However, at this time, the BLM has not received LBAs for all known recoverable coal resources that are considered suitable. Further, the total acreage of all known recoverable coal resources is too large to be developed in an efficient, economical, and orderly manner as a unit.

2.7.2 Options Considered but Eliminated from Detailed Analysis

Certain components of the federal action would be independent of the elements of any alternative. In the EIS, these were considered options, any one of which could be chosen in combination with any alternative and would not necessitate changes in the alternative, or vice versa. Those options that were considered but not carried forward for detailed analysis are described below.

2.7.2.1 KANAB FIELD OFFICE ROUTE 116 RELOCATION OPTIONS

Under SMCRA, the approval of surface-mining operations on lands within 100 feet of the outside line of the ROW for a public road requires a process resulting in a final decision by DOGM or the public road authority. At this juncture the coal underlying KFO Route 116, and underlying a buffer zone extending 100 feet on either side of the outer edges of the road, is currently considered unsuitable for mining. However, this EIS analysis assumes that an agreement to relocate the road would be reached. During the alternatives development process, several options for addressing SMCRA requirements with respect to KFO Route 116 were considered. These included the following:

- Option A: Permanently rerouting KFO Route 116 around (outside) the tract on adjacent lands
- Option B: Permanently closing KFO Route 116 without establishing an alternate, replacement route
- Option C: Closing KFO Route 116 for the duration of mining activity and reestablishing the road in its original (current) roadbed following mining activity

These options were eliminated from detailed analysis in the EIS for one or more of the following reasons: 1) Kane County would not agree to the proposed option; 2) the proposed option would result in more

impacts than KFO Route 116 relocation options being considered for detailed analysis in the alternatives, without providing substantially greater benefit; 3) the proposed option would permanently or for a substantial period of time (the life of the mine) cut off access to private lands, public rangelands, or both; and 4) SMCRA would not allow the option if it were chosen.

2.7.2.2 OTHER ROADS IN THE TRACT

In addition to KFO Route 116, roads on private land and on BLM-administered land exist in the tract (see list in Section 2.6.2). The BLM considered permanently closing roads on BLM-administered land. However, such closures would permanently restrict access to these lands by permittees and would eliminate roads used for recreation. Given the current frequent use of these roads by these users (especially permittees), BLM could not justify permanent closure. Further, some of the roads that would be closed under this option would restrict access of private landowners to their private surface estates.

2.7.2.3 POWER GENERATION OPTIONS

Approximately 2–3 mW of electrical energy output would be required at any one time for mining operations on the tract under the Proposed Action, Alternative C, or Alternative K1 (see Section 2.3.2.6). In addition to the use of diesel-powered generators to supply this energy, which is considered in detail, supplying power via a transmission line (three possible points of origin) or a combination of diesel-powered generators and a transmission line was considered. Transmission line options considered were as follows:

- Option A: Creating a transmission line extension from US-89 at the junction with KFO Route 116 near the town of Alton to the tract
- Option B: Creating a transmission line extension from Kanab to the tract
- Option C: Creating a transmission line extension from Todd's Junction in Garfield County to the tract

Option A was not carried forward for further analysis because this transmission line extension would only be able to supply the mine operation with approximately 500 kilowatts of energy, approximately 17%–25% of the power needed to operate the mine. Under this scenario, the successful bidder would need to use generators to meet the remaining energy needs (75%–83%) of the mine. The quantity of electrical energy that could be supplied under this option would not justify the cost of investing in construction of the transmission line given the need to continually use diesel-powered generators to supply most of the energy.

Option B was not carried forward for further analysis due to the high cost of transmission line construction ($15,000,000–$20,000,000, according to estimates provided by Garkane Energy), and the fact that this option would only provide approximately 1 mW of energy for mining operations (approximately 33%–50% of the power needed to operate the mine). According to estimates provided by ACD, the cost of transmission line construction would never be paid back over the life of the mine; conducting mining operations solely with the use of diesel-powered generators is estimated to be cheaper over the life of the mine than transmission line construction. Also, under this option, the successful bidder would still need to use diesel-powered generators to supply 50%–67% of the energy required for mining operations.

The reasonably foreseeable Garkane Energy 138-kilovolt transmission line between Tropic and Hatch would create an opportunity to supply power to the mining operation via a transmission line originating at Todd's Junction (Option C). According to estimates provided by Garkane Energy, this transmission line would be able to supply 2–3 mW of energy to the tract, and the cost of transmission line construction would be a fraction of that under Option B. This option would be viable assuming that 1) the successful bidder, in coordination with Garkane Energy, could obtain ROWs across all private land, as necessary, between Todd's Junction and the tract in a timely fashion (or at all) and 2) Garkane Energy could guarantee that 2–3 mW of energy would be supplied to the tract for the projected life of the mine. If either

one of the aforementioned assumptions is violated, this option would no longer be viable. For this reason, it would be speculative to consider this as an option in this EIS, and it was therefore eliminated from detailed analysis.

2.8 Comparison of Alternatives

The following tables (Table 2.8.1 and Table 2.8.2) compare the No Action Alternative, Proposed Action, Alternative C, and Alternative K1. Table 2.8.1 contains a summary comparison of the alternatives and Table 2.8.2 contains a summary comparison of direct and indirect impacts. The tables are presented to give a concise summary of the alternatives in a comparative form. The environmental consequences are fully analyzed in Chapter 4, Environmental Consequences. Under NEPA, all federal agencies are required to provide a detailed statement on

- the direct and indirect environmental impacts of the Proposed Action and alternatives to the Proposed Action, including the No Action Alternative;
- any adverse environmental impacts that cannot be avoided;
- the relationship between short-term uses of the environment and the maintenance and enhancement of long-term productivity;
- any irreversible and irretrievable commitments of resources; and
- the cumulative impacts of the action, when added to other past, present, and RFFAs.

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Table 2.8.1. Summary Comparison of Alternatives

Item	Alternative A (No Action)	Alternative B (Proposed Action)	Alternative C (Reduced Tract Acreage and Seasonal Restrictions)	Alternative K1 (Reduced Tract Acreage)
Recoverable coal reserves (short tons)[*]	0	44,900,000	39,200,000	30,800,000
Federal mineral lease (acres)[†]	3,581	3,581	3,178	2,114
Private surface lease (acres)[‡]	1,296	1,296	893	880
Federal surface lease (acres)	2,280	2,280	2,280	1,235
Projected annual coal production (short tons)	0	2,000,000	2,000,000	2,000,000
Projected life of the mine (years)	0	25	21	16
Projected surface disturbance from pits (acres)	0	1,750	1,454	869
Projected surface disturbance from centralized facilities (acres)	0	36	36	36
Projected surface disturbance from dispersed facilities (acres)	0	160	135	92
Projected surface disturbance from KFO Route 116 relocation	0	47 (17 actual road + 30 ROW)	37 (13 actual road + 24 ROW)	16
Total projected surface disturbance (acres)	0	1,993	1,662	1,012
Projected surface disturbance during active mining (acres/number of pits)[§]	0	120/1	240/2	120/1
Projected permanent disturbance from EODA (acres/number of EODAs)	0	0/0[¶]	40–60/1	0/0
Projected area of underground mining and surface impacts due to subsidence (acres)[**, x]	0	613 (+166 outside the tract)	613 (+166 outside the tract)	613 (+166 outside the tract)
Projected annual water use (gallons)	0	8,112,000	8,112,000	8,112,000
Projected power needs (mW) and method of delivery	0	2–3 diesel-powered generators	2–3 diesel-powered generators	2–3 diesel-powered generators
Normal operating hours (hours/days per week/days per year)	0/0/0	24/5–7/260–365	24/5–7/260–365	24/5–7/260–365
Projected number of employees	0	160	160	160
Projected truck traffic (truck round-trips per day between the tract and the loadout location)	0	153	153	153
Special timing restrictions in place for Block S	n/a	None	February 15–March 15 (lekking); March 15–July 15 (nesting/brooding)	None

[*] Under the No Action Alternative, coal present (approximately 59,600,000 tons) would not be mined, and therefore these coal resources would not represent coal reserves.

[†] Federal mineral lease acres represent the total acres present in the tract whether or not they are leased. Private surface and federal surface acres do not add to total federal mineral lease acres due to errors explained in Table 2.3.1.

[‡] Private surface lease acres represent the total private surface acres present in the tract whether or not they would be leased.

[§] This refers to areas with open surface-mining pits from which coal is being removed and/or areas where topsoil and/or overburden is being removed.

[¶] If BLM decides to hold a competitive lease sale for the tract under the Proposed Action, and there is a successful bidder other than ACD, one EODA would be required under this alternative.

[x] The projected area of underground mining operations is calculated as the approximate location where underground coal recovery would begin to the tract boundary.

[**] See Chapter 4 Section 4.6 Geology and Minerals for a further explanation of surface impacts due to subsidence.

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Impacts can be beneficial or adverse, and can be a primary result of an action (direct) or a secondary result (indirect). They can be permanent (irreversible), long term (occurring or remaining after the cessation of coal mining and during, or continuing, into the period following the reclamation and monitoring period), or short term (the period when the development of the mine and the mining of coal would occur). The level of impacts may also vary. The basis for conclusions regarding significance are the criteria set forth by the CEQ (40 CFR 1508.27) and the professional judgment of the specialists doing the analyses. Impacts can be significant during mining but be reduced to less-than-significant levels following completion of reclamation or mitigation. Definitions of the magnitude of impacts associated with the No Action Alternative, the Proposed Action, Alternative C, and Alternative Kl are presented, as appropriate, in Chapter 4, Environmental Consequences. A summary of impacts is provided in Table 2.8.2.

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Table 2.8.2. Summary of Impacts

Section	Resource	Alternative A (No Action)	Alternative B (Proposed Action)	Alternative C (Reduced Tract Acreage and Seasonal Restrictions)	Alternative K1 (Reduced Tract Acreage)
4.2	**Aesthetic Resources: Noise**	No impacts to aesthetic resources (noise) would occur under the No Action Alternative.	Vibration impacts and increased ambient noise levels in and near the tract and along the coal haul transportation route would occur for the life of the mine (25 years) under the Proposed Action.	Vibration impacts and increased ambient noise levels in and near the tract and along the coal haul transportation route would occur for the life of the mine, except that under Alternative C, the noise associated with mining would be located further from the town of Alton and the life of the mine would be 21 years.	Vibration impacts and increased ambient noise and vibration levels in and near the tract and along the coal haul transportation route would occur for the life of the mine, except that under Alternative K1, the noise associated with mining would be located further from the town of Alton, and the life of the mine would be 16 years.
	Aesthetic Resources: Visual Resources	No impacts to aesthetic resources (visual) would occur under the No Action Alternative.	Under the Proposed Action, short-term modifications would occur to the basic elements of form, line, color, and texture from surface-mining disturbances and presence of facilities. If the 120-acre tracks of coal are removed and rehabilitated, the existing character of the landscape would be gradually restored. The level of change to the landscape would be consistent with visual resource management Class IV objectives.	Under Alternative C, impacts would be the same as those described under the Proposed Action, except that a greater acreage of visual contrasts at any one time would result during mining operations, fewer total acres would be disturbed, mining would be located further from the town of Alton, and the life of the mine would be 21 years.	Under Alternative K1, impacts would be the same as those described under the Proposed Action, except that fewer total acres would be disturbed, mining would be located further from the town of Alton, and the life of the mine would be 16 years.
	Aesthetic Resources: Night Sky	No impacts to aesthetic resources (night sky) would occur under the No Action Alternative.	There would be a perceptible increase in nighttime skyglow from artificial lighting used during mining operations under the Proposed Action. This effect would persist for 25 years. Potential skyglow visible from Yovimpa Point within Bryce Canyon National Park would be less than that produced by several small towns in the general area. Additionally, potential skyglow visible from Brian Head Peak outside of Cedar Breaks National Monument would be much less than skyglow produced by St. George and Cedar City, Utah.	Under Alternative C, impacts would be the same as those described under the Proposed Action, except that the effect would persist for 21 years.	Under Alternative K1, impacts would be the same as those described under the Proposed Action, except that the effect would persist for 16 years.
4.3	**Air Resources: PM_{10}**	Under the No Action Alternative, no impacts with respect to PM_{10} would occur as a function of mining. Existing and future emissions sources would result in concentrations of PM_{10} within the NAAQS.	Under the Proposed Action, existing and future emissions sources would result in concentrations of PM_{10} within the NAAQS.	Under Alternative C, existing and future emissions sources may result in concentrations of PM_{10} exceeding the NAAQS.	Under Alternative K1, existing and future emissions sources would result in concentrations of PM_{10} within the NAAQS.
	Air Resources: $PM_{2.5}$	Under the No Action Alternative, no impacts with respect to $PM_{2.5}$ would occur as a function of mining. Existing and future emissions sources would result in concentrations of $PM_{2.5}$ within the NAAQS.	Under the Proposed Action, existing and future emissions sources would result in concentrations of $PM_{2.5}$ within the NAAQS.	Under Alternative C, existing and future emissions sources would result in concentrations of $PM_{2.5}$ within the NAAQS.	Under Alternative K1, existing and future emissions sources would result in concentrations of $PM_{2.5}$ within the NAAQS.
	Air Resources: NO_2	Under the No Action Alternative, no impacts with respect to NO_2 would occur as a function of mining. Existing and future emissions sources would result in concentrations of NO_2 within the NAAQS.	Under the Proposed Action, existing and future emissions sources would result in concentrations of NO_2 within the NAAQS.	Under Alternative C, existing and future emissions sources would result in concentrations of NO_2 within the NAAQS.	Under Alternative K1, existing and future emissions sources would result in concentrations of NO_2 within the NAAQS.
	Air Resources: Volatile organic compounds	Under the No Action Alternative, no impacts with respect to volatile organic compound (VOCs) would occur as a function of mining. Existing and future emissions sources would continue to have impacts.	Under the Proposed Action, VOC emissions would be small compared to regional sources. Impacts with respect to VOCs would be well within regulatory limits.	Under Alternative C, VOC emissions would be small compared to regional sources. Impacts with respect to VOCs would be well within regulatory limits.	Under Alternative K1, VOC emissions would be small compared to regional sources. Impacts with respect to VOCs would be well within regulatory limits.
	Air Resources: CO	Under the No Action Alternative, no impacts with respect to CO would occur as a function of mining. Existing and future emissions sources would result in concentrations of CO within the NAAQS.	Under the Proposed Action, existing and future emissions sources would result in concentrations of CO within the NAAQS.	Under Alternative C, existing and future emissions sources would result in concentrations of CO within the NAAQS.	Under Alternative K1, existing and future emissions sources would result in concentrations of CO within the NAAQS.
	Air Resources: SO_2	Under the No Action Alternative, no impacts with respect to SO_2 would occur as a function of mining. Existing and future emissions sources would result in concentrations of SO_2 within the NAAQS.	Under the Proposed Action, existing and future emissions sources would result in concentrations of SO_2 within the NAAQS.	Under Alternative C, existing and future emissions sources would result in concentrations of SO_2 within the NAAQS.	Under Alternative K1, existing and future emissions sources would result in concentrations of SO_2 within the NAAQS.
	Air Resources: CO_2	Under the No Action Alternative, no impacts with respect to CO_2 would occur as a function of mining. Existing and future emissions sources would continue to have impacts with respect to CO_2.	Under the Proposed Action, impacts with respect to CO_2 would occur as a function of mining. Existing and future emissions sources would continue to have impacts with respect to CO_2.	Under Alternative C, impacts with respect to CO_2 would occur as a function of mining. Existing and future emissions sources would continue to have impacts with respect to CO_2.	Under Alternative K1, impacts with respect to CO_2 would occur as a function of mining. Existing and future emissions sources would continue to have impacts with respect to CO_2.

Table 2.8.2. Summary of Impacts

Section	Resource	Alternative A (No Action)	Alternative B (Proposed Action)	Alternative C (Reduced Tract Acreage and Seasonal Restrictions)	Alternative K1 (Reduced Tract Acreage)
	Air Resources: Hazardous air pollutants (benzene, toluene, xylenes, formaldehyde, acetaldehyde, and acrolein)	Under the No Action Alternative, no impacts with respect to HAPs would occur as a function of mining. Existing and future emissions sources would continue to have impacts.	Under the Proposed Action, the potential emissions of HAPs would be well below threshold exposure levels. No adverse impacts are anticipated.	Under Alternative C, the potential emissions of HAPs would be well below threshold exposure levels. No adverse impacts are anticipated.	Under Alternative K1, the potential emissions of HAPs would be well below threshold exposure levels. No adverse impacts are anticipated.
	Air Resources: Near-field Visibility	Under the No Action Alternative, no impacts with respect to visibility would occur as a function of mining. Existing and future emissions sources would continue to have impacts with respect to visibility.	Under the Proposed Action, the maximum impacts inside of Bryce Canyon National Park from a potential mine plume would be less than the VISCREEN acceptance criteria for both color change (Delta E) and contrast.	Under Alternative C, the maximum impacts inside of Bryce Canyon National Park from a potential mine plume would be less than the VISCREEN acceptance criteria for both color change (Delta E) and contrast.	Under Alternative K1, the maximum impacts inside of Bryce Canyon National Park from a potential mine plume would be less than the VISCREEN acceptance criteria for both color change (Delta E) and contrast.
	Air Resources: Far-field Visibility	Under the No Action Alternative, no impacts with respect to visibility would occur as a function of mining. Existing and future emissions sources would continue to have impacts with respect to visibility.	Under the Proposed Action, there are no extinction changes exceeding 10% in any of the Class I/Class II areas. Zion National Park has three extinction changes that exceed 5%.	Under Alternative C, there are no extinction changes exceeding 10% in any of the Class I/Class II areas. Zion National Park has three extinction changes that exceed 5%.	Under Alternative K1, impacts would be equal to or less than those from the Proposed Action.
	Air Resources: Deposition	Under the No Action Alternative, no impacts with respect to deposition would occur as a function of mining. Existing and future emissions sources would continue to have impacts with respect to deposition.	Under the Proposed Action, impacts for sulfur and nitrogen deposition are below the deposition analysis thresholds (DATs) in all cases, except for nitrogen deposition in Bryce Canyon National Park, which exceeds the DAT.	Under Alternative C, impacts for sulfur and nitrogen deposition are below the DATs in all cases, except for nitrogen deposition in Bryce Canyon National Park, which exceeds the DAT.	Under Alternative K1, impacts would be equal to or less than those from the Proposed Action.
	Air Resources: Greenhouse Gases	Under the No Action Alternative, no impacts with respect to greenhouse gases (GHG) would occur as a function of mining. Existing and future emissions sources would continue to have impacts with respect to GHG.	Under the Proposed Action, annual GHG emissions (CO_2) would be approximately 0.014% of estimated 2010 global GHG emissions (this includes off-site end user combustion of the coal produced from the tract).	Under Alternative C, annual GHG emissions (CO_2) would be approximately 0.014% of estimated 2010 global GHG emissions (this includes off-site end user combustion of the coal produced from the tract).	Under Alternative K1, impacts would be equal to or less than those from the Proposed Action.
4.4	**Cultural Resources**	No impacts to cultural resources, beyond those that occur due to existing uses of the area, would occur under the No Action Alternative. In addition, management of cultural resources on BLM-managed lands within the tract would continue at the discretion of the BLM under the KFO RMP (BLM 2008b).	Under the Proposed Action, 75 archaeological sites eligible for the NRHP would be completely or partially removed by pit disturbance. In addition, the following would occur under this alternative: • Four NRHP-eligible archaeological sites would be completely or partially destroyed by construction of centralized facilities. • As many as two NRHP-eligible archaeological sites would be completely or partially destroyed by the relocation of KFO Route 116. • Approximately five NRHP-eligible archaeological sites would be completely or partially destroyed by the construction of dispersed facilities. • Underground mining could impact previously unidentified archaeological sites through subsidence. • An unknown number of previously unidentified archaeological sites could be impacted by pit disturbance, construction of centralized or dispersed facilities, or KFO Route 116 relocation. • Sites not directly impacted by surface mining or facilities construction would be subject to indirect effects from vandalism, looting, or unintentional destruction for the 25-year mine life. • Native American TCPs would be subject to adverse effects to their integrity of setting, feeling, and association due to visual, auditory, and other atmospheric impacts from mining activity for the 25-year mine life. • Panguitch Historic District and Utah Heritage Highway 89/Mormon Pioneer Heritage Area would be subject to adverse effects to their integrity of setting, feeling, and association due to an incremental increase in coal truck traffic for the 25-year mine life	Under Alternative C, 69 NRHP-eligible archaeological sites would be completely or partially destroyed by pit disturbance. In addition, the following would occur under this alternative: • Four NRHP-eligible archaeological sites would be completely or partially destroyed by construction of centralized facilities. • As many as two NRHP-eligible archaeological sites would be completely or partially destroyed by the relocation of KFO Route 116. • Approximately five NRHP-eligible archaeological sites would be completely or partially destroyed by the construction of dispersed facilities. • Underground mining could impact previously unidentified archaeological sites through subsidence. • An unknown number of previously unidentified archaeological sites could be impacted by pit disturbance, construction of centralized or dispersed facilities, or KFO Route 116 relocation. • Sites not directly impacted by surface mining or facilities construction would be subject to indirect effects from vandalism, looting, or unintentional destruction for the 21-year mine life. • Native American TCPs would be subject to adverse effects to their integrity of setting, feeling, and association due to visual, auditory, and other atmospheric impacts from mining activity for the 21-year mine life. • Panguitch Historic District and Utah Heritage Highway 89/Mormon Pioneer Heritage Area would be subject to adverse effects to their integrity of setting, feeling, and association due to an incremental increase in coal truck traffic for the 21-year mine life.	Under Alternative K1, 29 NRHP-eligible sites would be completely or partially destroyed by pit disturbance. In addition, the following would occur under this alternative: • Four NRHP-eligible archaeological sites would be completely or partially destroyed by construction of centralized facilities. • As many as two NRHP-eligible archaeological sites would be completely or partially destroyed by the relocation of KFO Route 116. • Approximately four NRHP-eligible archaeological sites would be completely or partially destroyed by the construction of dispersed facilities. • Underground mining could impact previously unidentified archaeological sites through subsidence. • An unknown number of previously unidentified archaeological sites could be impacted by pit disturbance, construction of centralized or dispersed facilities, or KFO Route 116 relocation. • Sites not directly impacted by surface mining or facilities construction would be subject to indirect effects from vandalism, looting, or unintentional destruction for the 16-year mine life. • Native American TCPs would be subject to adverse effects to their integrity of setting, feeling, and association due to visual, auditory, and other atmospheric impacts from mining activity for the 16-year mine life. • Panguitch Historic District and Utah Heritage Highway 89/Mormon Pioneer Heritage Area would be subject to adverse effects to their integrity of setting, feeling, and association due to an incremental increase in coal truck traffic for the 16-year mine life.

Table 2.8.2. Summary of Impacts

Section	Resource	Alternative A (No Action)	Alternative B (Proposed Action)	Alternative C (Reduced Tract Acreage and Seasonal Restrictions)	Alternative K1 (Reduced Tract Acreage)
4.5	**Fire Management**	No impacts to fire management would occur under the No Action Alternative.	Under the Proposed Action, approximately 1,975 acres of vegetation would be removed during mining and construction activities, which would result in the greatest risk of human-caused wildfires of all the alternatives. The revegetation of this entire acreage with suitable native and non-native species and the suppression of cheatgrass (*Bromus tectorum*) would lead to reduced fire regime conditions class ratings in these areas. 6.5 miles of new roads would be constructed due to the relocation of KFO Route 116. This increase in new roads would result in an increased risk of human-caused wildfires from construction activities. The construction of centralized and dispersed facilities on 196 acres under the Proposed Action could lead to an increased risk of human-caused wildfires from construction activities in undisturbed vegetation. In addition, increased movement to and from the tract by construction equipment and coal haul trucks would increase the risk of fuel leakage and/or sparking that could lead to wildfires in the tract and adjacent transportation corridors. An estimated 153 coal haul vehicle round-trips per day are expected.	Impacts would be similar to those described under the Proposed Action, except that approximately 1,650 acres of vegetation would be removed during mining and construction activities and 4.6 miles of new roads would be constructed due to the relocation of KFO Route 116. This is more than the No Action but fewer than the Proposed Action. There would be an overall greater risk of human-caused wildfires compared to the No Action but a lesser risk compared to the Proposed Action due to fewer acres disturbed and a shorter time period when activities would take place (21 years instead of 25 years). The construction of centralized and dispersed facilities on 171 acres under Alternative C could lead to an increased risk of human-caused wildfires from construction activities in undisturbed vegetation. In addition, increased movement to and from the tract by construction equipment and coal haul trucks would increase the risk of fuel leakage and/or sparking that could lead to wildfires in the tract and adjacent transportation corridors. An estimated 153 coal haul vehicle round-trips per day are expected.	Impacts would be similar to those described under the Proposed Action, except that approximately 1,005 acres of vegetation would be removed during mining and construction activities and 2 miles of new roads would be constructed due to the relocation of KFO Route 116. This is more than the No Action but fewer than the Proposed Action and Alternative C. There would be an overall greater risk of human-caused wildfires compared to the No Action but a lesser risk compared to the Proposed Action and Alternative C due to fewer acres disturbed and a shorter time period when activities would take place (16 years instead of 25 or 21 years). The construction of centralized and dispersed facilities on 128 acres under Alternative K1 could lead to an increased risk of human-caused wildfires from construction activities in undisturbed vegetation. In addition, increased movement to and from the tract by construction equipment and coal haul trucks would increase the risk of fuel leakage and/or sparking that could lead to wildfires in the tract and adjacent transportation corridors. An estimated 153 coal haul vehicle round-trips per day are expected.
4.6	**Geology and Minerals**	No impacts to geological or mineral resources would occur from surface mining under the No Action Alternative.	Under the Proposed Action, changes in topography, physiography, and stratigraphy would result from 1,750 acres of surface mining.	Under Alternative C, changes in topography, physiography, and stratigraphy would result from 1,454 acres of surface mining.	Under Alternative K1, changes in topography, physiography, and stratigraphy would result from 869 acres of surface mining.

Table 2.8.2. Summary of Impacts

Section	Resource	Alternative A (No Action)	Alternative B (Proposed Action)	Alternative C (Reduced Tract Acreage and Seasonal Restrictions)	Alternative K1 (Reduced Tract Acreage)
		No impacts to geological or mineral resources would occur from underground mining under the No Action Alternative.	Under the Proposed Action, subsidence and changes to stratigraphy would result from 613 acres of underground mining.	Impacts would be the same as those described under the Proposed Action.	Impacts would be the same as those described under the Proposed Action.
		No impacts to geological or mineral resources would occur from subsidence under the No Action Alternative.	Under the Proposed Action, subsidence would occur within 613 acres within the tract. Approximately 166 acres of subsidence would occur within the angle of influence outside the tract.	Impacts would be the same as those described under the Proposed Action.	Impacts would be the same as those described under the Proposed Action.
		No fault hazards from underground mining would occur under the No Action Alternative.	Slight fault hazard would occur from underground mining under the Proposed Action.	Impacts would be the same as those described under the Proposed Action.	Impacts would be the same as those described under the Proposed Action.
		No impacts to geological or mineral resources would occur from landslides under the No Action Alternative.	A risk to structures would occur on or near landslide deposits under the Proposed Action.	Impacts would be the same as those described under the Proposed Action.	Impacts would be the same as those described under the Proposed Action.
		No coal would be removed under the No Action Alternative.	Removal of 44.9 million tons of coal would occur under the Proposed Action.	Removal of 38.1 million tons of coal would occur under Alternative C.	Removal of 30 million tons of coal would occur under Alternative K1.
		Under the No Action Alternative, no impacts to geological or mineral resources would occur from fluid mineral removal due to high fluid mineral potential.	Decreased likelihood of fluid mineral removal due to mining activities would occur under the Proposed Action.	Impacts would be the same as those described under the Proposed Action.	Impacts would be the same as those described under the Proposed Action.
		No impact to burnt shale would occur under the No Action Alternative.	Possible burial of burnt shale resources would occur under the Proposed Action.	Impacts would be the same in nature as those described under the Proposed Action, but would be smaller in magnitude because of the reduced acreage of mining.	Impacts would be the same in nature as those described under the Proposed Action, but would be smaller in magnitude than the Proposed Action and Alternative C because of the reduced acreage of mining.
		No impact to gravel would occur under the No Action Alternative.	Possible burial of gravel resources would occur under the Proposed Action.	Impacts would be the same in nature as those described under the Proposed Action, but would be smaller in magnitude because of the reduced acreage of mining.	Impacts would be the same in nature as those described under the Proposed Action, but would be smaller in magnitude than the Proposed Action and Alternative C because of the reduced acreage of mining.
		No impact to septarian nodules would occur under the No Action Alternative.	Possible damage or burial of septarian nodules would occur under the Proposed Action.	Impacts would be the same in nature as those described under the Proposed Action, but would be smaller in magnitude because of the reduced acreage of mining.	Impacts would be the same in nature as those described under the Proposed Action, but would be smaller in magnitude than the Proposed Action and Alternative C because of the reduced acreage of mining.
		Underground coal fires have the potential to occur through spontaneous combustion. Historical reviews and site visits have not shown any indication of past coal mine fires near the Alton Coal Tract.	Underground coal fires have the potential to occur through spontaneous combustion. Historical reviews and site visits have not shown any indication of past coal mine fires near the Alton Coal Tract. There is an increased risk of coal fires under the Proposed Action due to more coal being exposed to oxygen. Surface mining has occurred in the Alton Coal Tract in the past, and there is no evidence of fires during mining.	Impacts would be the same as those described under the Proposed Action.	Impacts would be the same as those described under the Proposed Action.
4.7	**Hazardous and Solid Waste**	No Impacts to hazardous and solid waste would occur under the No Action Alternative.	Under the Proposed Action, movement to and from the tract by service vehicles and coal haul trucks would have the potential to increase the risk of fuel leakage or solid waste spills in the tract and adjacent transportation corridors. Accidental or inadvertent leakages from storage tanks would also be possible. Spills would have adverse effects on soil, water, vegetation, and wildlife resources. Potential impacts would be mitigated through standard operating procedures and through the creation of other plans and policies that relate to hazardous materials disposal, transport, and emergency response.	Impacts would be the same as those described under the Proposed Action with the following exceptions. The acreage of dispersed facilities constructed would be fewer than under the Proposed Action (135 instead of 160), and therefore the associated risks, such as fuel leakage and storage tank leakage, would be smaller under this alternative. Mining activities under this alternative would take place over the course of 21 years, which is four years shorter than under the Proposed Action.	Impacts would be the same as those described under the Proposed Action with the following exceptions. The acreage of dispersed facilities constructed would be fewer than under the Proposed Action (92 instead of 160), and therefore the associated risks, such as fuel leakage and storage tank leakage, would be smaller under this alternative. Mining activities under this alternative would take place over the course of 16 years, which is nine years shorter than under the Proposed Action.
4.8	**Land Use and Access**	Land uses would continue in their current condition under the No Action Alternative.	Under the Proposed Action, 2,280 acres of federal land and 1,296 acres of private land would be unavailable for grazing and recreation access during mining activities (life of mine). Agriculture, tourism, and recreation activities would also be prohibited or restricted during the 25-year mine life.	Under Alternative C, 2,280 acres of federal land and 893 acres of private land would be unavailable for grazing and recreation access while mining activities were occurring. Impacts would be slightly fewer than the Proposed Action with 403 fewer acres available for mining. Agriculture, tourism, and recreation activities would also be prohibited or restricted during the 21-year mine life.	Under Alternative K1, 1,235 acres of federal land and 880 acres of private land would be unavailable for grazing and recreation access while mining activities were occurring. Impacts would be slightly fewer than the Proposed Action, with 1,462 fewer acres available for mining. Agriculture, tourism, and recreation activities would also be prohibited or restricted during the 16-year mine life.

Table 2.8.2. Summary of Impacts

Section	Resource	Alternative A (No Action)	Alternative B (Proposed Action)	Alternative C (Reduced Tract Acreage and Seasonal Restrictions)	Alternative K1 (Reduced Tract Acreage)
4.9	**Livestock Grazing**	No impacts would occur to grazing from the No Action Alternative. Grazing would continue in its current condition.	Impacts under the Proposed Action would consist of the temporary loss of forage as a result of restricted access, spread of noxious weeds, and/or decreased palatability from construction dust on 1,975 acres; the temporary loss of water sources and range improvements, such as fences and cattle guards; the loss of 3,220 animal unit month (AUMs) within seven allotments over the life of the mine and reclamation period; and livestock mortality from vehicle collisions.	Impacts under Alternative C would be the same as the Proposed Action, except that there would be restricted access for 31 years (due to the timeframe associated with reclamation), resulting in impacts to 1,650 acres of vegetation and 2,852 AUMs.	Impacts under Alternative K1 would be the same as the Proposed Action, except that there would be restricted access for 26 years (due to the timeframe associated with reclamation), resulting in impacts to 1,005 acres of vegetation and 2,392 AUMs.
4.10	**Paleontology**	No impacts to paleontological resources would occur under the No Action Alternative.	Impacts to paleontological resources under the Proposed Action could occur on approximately 1,750 acres of land that would be disturbed for pits, 196 acres of disturbance for centralized and dispersed facilities, and 17 acres of disturbance to relocate KFO Route 116. Impacts would include destruction/loss of paleontological resources in situ as well as educational opportunities arising from discovery.	Impacts to paleontological resources under Alternative C could occur on approximately 1,454 acres of land that would be disturbed for pits, 171 acres of disturbance for centralized and dispersed facilities, and 13 acres of disturbance to relocate KFO Route 116. Adverse impacts would include destruction/loss of paleontological resources in situ. Beneficial impacts would include educational opportunities arising from discovery.	Impacts to paleontological resources under Alternative K1 could occur on approximately 869 acres of land that would be disturbed for pits, 128 acres of disturbance for centralized and dispersed facilities, and 5.6 acres of disturbance to relocate KFO Route 116. Adverse impacts would include destruction/loss of paleontological resources in situ. Beneficial impacts would include educational opportunities arising from discovery
4.11	**Recreation**	Recreation would not be impacted as a function of mining under the No Action Alternative. Presently occurring land uses would continue to interact with recreation trends in the analysis area under this alternative.	The Proposed Action would result in a loss of 3.576 acres of lands available for dispersed recreation from mining over the 25-year mine life. This represents 0.4% of all lands available for big game hunting in the PPMA. Approximately 13 miles of designated OHV routes would be temporarily removed over the life of the mine, representing a 0.7% decrease in OHV routes within the BLM-KFO. In addition, displacement of recreational users onto 92,573 acres of adjacent public lands would affect recreational experiences of users on those lands. Approximately 3.9% of the recreation analysis area would be directly or indirectly affected by mine-related actions.	Alternative C would result in a loss of 3,173 acres of lands available for dispersed recreation from mining over the 21-year mine life. This represents 0.3% of all lands available for big game hunting in the PPMA. Impacts to OHV routes would be the same as the Proposed Action. In addition, displacement of recreational users onto 92,573 acres of adjacent public lands would affect recreational experiences of users on those lands. Approximately 3.4% of the recreation analysis area would be directly or indirectly affected by mine-related actions.	Alternative K1 would result in a loss of 2,114 acres of lands available for dispersed recreation from mining over the 16-year mine life. This represents 0.2% of all lands available for big game hunting in the PPMA. Impacts to OHV routes would be the same as the Proposed Action. In addition, displacement of recreational users onto 92,573 acres of adjacent public lands would affect recreational experiences of users on those lands. Approximately 2.3% of the recreation analysis area would be directly or indirectly affected by mine-related actions.
4.12	**Socioeconomics**	Socioeconomic conditions would be similar to current conditions under the No Action Alternative.	The Proposed Action would result in 160 direct jobs, 320 indirect jobs, $6.5 million in annual wages, $1.49 billion total recovery value, $186.62 million total royalty revenue, and $93.31 million royalty revenue disbursed to the State of Utah. Additional taxes, fees, and payments would result, based on production amount. The Proposed Action would result in adverse impacts to known recreation uses in the area (hunting and OHV use); current sense of community, social well-being, and tourism-related businesses; population, housing, and public health and safety. Disproportionate environmental justice impacts would occur to the town of Alton related to noise and visual resources as a result of proposed mining activities.	Under Alternative C, socioeconomic impacts would be similar to the Proposed Action. Alternative C would result in $1.25 billion total recovery value, $156.66 million total royalty revenue, and $78.33 million total revenue disbursed to the State of Utah. Shortening the life of the mine by four years would result in an approximately 16% decrease in additional taxes, fees, and payments based on production amount. Disproportionate environmental justice impacts would occur to the town of Alton related to air quality, noise, and visual resources as a result of proposed mining activities.	Under Alternative K1, **s**ocioeconomic impacts would be similar to the Proposed Action. Alternative K1 would result in $95.04 million total recovery value, $119.36 million total royalty revenue, and $59.68 million total revenue disbursed to the State of Utah. Shortening the life of the mine by nine years would result in an approximately 36% decrease in additional taxes, fees, and payments based on production amount. Disproportionate environmental justice impacts would occur to the town of Alton related to noise and visual resources as a result of proposed mining activities.
4.13	**Soils**	No impacts to soils would occur under the No Action Alternative.	Under the Proposed Action, 1,993 acres of soils would be disturbed by surface mining and by the construction of related facilities and roads. Of this total, 1,750 acres of soil resources would be disturbed by surface mining, and 243 acres would be disturbed by related activities, including the construction of centralized and dispersed facilities, the relocation and construction of roads, and the grading of road ROWs. Impacts under the Proposed Action would be considerably greater than would occur under the No Action Alternative due to the large-scale removal and replacement of soils that would occur during proposed surface-mining operations (which would not occur under the No Action Alternative). Surface-mining activities under the Proposed Action would drastically disturb soil resources through the large-scale removal, stockpiling, and replacement of soils during surface mining. A total of 1,750 acres of soils would be removed to its full depth where surface mining takes place, and topsoil and suitable subsoil would be stockpiled for reclamation. The disturbance (impact) caused by removing and replacing soils, as described above, would be long term. Most of the impacts (caused by facilities, some roads, etc.) would be long term, persisting for the life of the mine.	Under Alternative C, 1,662 acres of soils would be disturbed by surface mining and the construction of related facilities and roads. Of this total, 1,454 acres of soil resources would be disturbed by surface mining, and 208 acres would be disturbed by other related activities, including the construction of centralized and dispersed facilities, the relocation and construction of roads, and the grading of road ROWs. Impacts under Alternative C would be of the same nature as under Proposed Action, but to a lesser degree.	Under Alternative K1, 1,012 acres of soils would be disturbed by surface mining and the construction of related facilities and roads. Of this total, 869 acres of soil resources would be disturbed by surface mining, and 144 acres would be disturbed by other related activities, including the construction of centralized and dispersed facilities, the relocation and construction of roads, and the grading of road ROWs. Impacts under Alternative K1 would be of the same nature as under Proposed Action and Alternative C, but to a lesser degree.
4.14	**Transportation**	No impacts to transportation would occur under the No Action Alternative.	Under the Proposed Action, there would be a 2% increase in commuter traffic and coal truck traffic through Cedar City. Additional coal truck traffic would cause a 4% increase in traffic through Hatch and Panguitch.	Impacts under Alternative C would be the same as those described under the Proposed Action, except that the life of the mine would be 21 years instead of 25 years.	Impacts under Alternative K1 would be the same as those described under the Proposed Action, except that the life of the mine would be 16 years instead of 25 years.

Table 2.8.2. Summary of Impacts

Section	Resource	Alternative A (No Action)	Alternative B (Proposed Action)	Alternative C (Reduced Tract Acreage and Seasonal Restrictions)	Alternative K1 (Reduced Tract Acreage)
4.15	**Vegetation**	No impacts to vegetation would occur under the No Action Alternative.	Under the Proposed Action, 1,733 acres of vegetation would be removed by surface mining (of the 3,556 acres of vegetation in the tract). In addition, approximately 47 acres of vegetation would be removed for the relocation of KFO Route 116, approximately 36 acres of vegetation would be removed for centralized facilities, and approximately 160 acres of vegetation would be removed for dispersed facilities. Under the Proposed Action, the acres of land susceptible to weed invasion would be increased by approximately 2,266 acres, and all disturbed acres would be reclaimed and revegetated during the 25-year mine life and a 10-year restoration period.	Impacts under Alternative C would the same as those described under the Proposed Action, but to a lesser degree. Under Alternative C, 1,454 acres of vegetation would be removed by surface mining (of the 3,162 acres of vegetation in the tract). In addition, approximately 36 acres of vegetation would be removed for the relocation of KFO Route 116, approximately 36 acres of vegetation would be removed for centralized facilities, and approximately 135 acres of vegetation would be removed for dispersed facilities. Under Alternative C, the acres of land susceptible to weed invasion would be increased by approximately 1,887, and all disturbed acres would be reclaimed and revegetated during the 21-year mine life and a 10-year restoration period.	Impacts under Alternative K1 would the same as those described under the Proposed Action, but to a lesser degree. Under Alternative K1, 861 acres of vegetation would be removed by surface mining (of the 2,052 acres of vegetation in the tract). In addition, approximately 16 acres of vegetation would be removed for the relocation of KFO Route 116, approximately 36 acres of vegetation would be removed for centralized facilities, and approximately 92 acres of vegetation would be removed for dispersed facilities. Under Alternative K1, the acres of land susceptible to weed invasion would be increased by approximately 1,136 acres, and all disturbed acres would be reclaimed and revegetated during the 16-year mine life and a 10-year restoration period.
4.16	**Water Resources: Stream channel**	No stream relocation would occur under the No Action Alternative.	Under the Proposed Action, 0.49–0.81 mile of Robinson Creek would be relocated, potentially affecting stream function, associated riparian corridor, and water quality.	Impacts would be the same as those described under the Proposed Action.	Impacts would be the same as those described under the Proposed Action.
	Water Resources: Surface water	No change in surface water quality or quantity would occur under the No Action Alternative.	Under the Proposed Action, approximately 29 acre-feet of runoff water would be captured annually from pits and centralized facilities. In addition, small sediment loads to streams would occur from dispersed facilities and road ROW, and a loss of instream dilution could increase the concentration of total dissolved solids over the state water quality standard of 1,200 mg/L. Under the Proposed Action, reduced instream flows could result in less water available for irrigation downstream. In addition, a small risk of surface water contamination from accidental spills to 13.8 miles of stream that are within 100 feet of the reasonably foreseeable coal haul transportation route could occur, as well as a small increase in fine particles in streams associated with deposition of fugitive dust and coal dust.	Under Alternative C, approximately 24 acre-feet of runoff water would be captured annually from pits and centralized facilities. Sediment load, total dissolved solids, instream flow, and accidental spill-related impacts would be the same as those described under the Proposed Action, except for a shorter period of time.	Under Alternative K1, approximately 14 acre-feet of runoff water would be captured annually from pits and centralized facilities. Sediment load, total dissolved solids, instream flow, and accidental spill-related impacts would be the same as those described under the Proposed Action, except for a shorter period of time.
	Water Resources: Groundwater	No change in groundwater quality or quantity would occur under the No Action Alternative.	Under the Proposed Action, there would be a loss of 25 acre-feet of groundwater per year used for dust suppression for 25 years (625 acre-feet total), and a groundwater loss of 116 acre-feet per year due to evaporation in pits for 25 years (2,900 acre-feet). Groundwater loses would be up to approximately 6% of the total estimated groundwater available in the zone from which groundwater would be extracted for use in mining operations. Approximately 32.3 acre-feet of groundwater would be intercepted in mine pits annually. The potential for significant impacts to groundwater quality is also low because of the lack of groundwater resources in some mining blocks, the lack of groundwater resources in the coal zones of some mining blocks, and the already poor quality of groundwater resources in some mining blocks.	Under Alternative C, there would be a loss of 25 acre-feet of groundwater per year used for dust suppression for 21 years (525 acre-feet), and a groundwater loss of 233 acre-feet per year due to evaporation in pits for 21 years (4,893 acre-feet). Groundwater loses would be up to approximately 5% of the total estimated groundwater available in the zone from which groundwater would be extracted for use in mining operations. Approximately 32.3 acre-feet of groundwater would be intercepted in mine pits annually. The potential impacts to groundwater quality would be the same as those described under the Proposed Action.	Under Alternative K1, there would be a loss of 25 acre-feet of groundwater per year used for dust suppression for 16 years (400 acre-feet), and a groundwater loss of 116 acre-feet per year due to evaporation in pits for 16 years (1,856 acre-feet). Groundwater loses would be up to approximately 4% of the total estimated groundwater available in the zone from which groundwater would be extracted for use in mining operations. Approximately 32.3 acre-feet of groundwater would be intercepted in mine pits annually. The potential impacts to groundwater quality would be the same as those described under the Proposed Action.
	Water Resources: Wetlands, riparian areas, floodplains, and AVFs	No impacts to wetlands, riparian areas, floodplains, or AVFs would occur under the No Action Alternative.	Under the Proposed Action, approximately 32.5 acres of wetlands would be removed by surface-mining operations. Total disturbance to riparian areas would be 11.0 acres. Approximately 8.0 acres of AVFs would be disturbed due to construction of dispersed facilities. Impacts to these areas would include loss of habitat, destabilization of streambanks, floodplain storage and attenuation, water filtration, and groundwater recharge. Floodplains have the potential to be affected along approximately 60,565 linear feet of ephemeral and intermittent drainages within the surface mining areas of the coal zone associated with this alternative. Approximately 17,102 linear feet of perennial (including 96 linear feet of Kanab Creek), intermittent, and ephemeral drainages are within the underground mining area.	Under Alternative C, approximately 0.03 acre of wetlands would be removed by the relocation of KFO Route 116. Total disturbance to riparian areas would be 10.1 acres. Approximately 7.4 acres of AVFs would be disturbed due to construction of dispersed facilities. Impacts to these areas would include loss of habitat, destabilization of streambanks, floodplain storage and attenuation, water filtration, and groundwater recharge. Floodplains have the potential to be affected along approximately 52,660 linear feet of ephemeral and intermittent drainages within the surface mining areas of the coal zone associated with this alternative. Approximately 17,102 linear feet of intermittent and ephemeral drainages are within the underground mining area.	Under Alternative K1, approximately 0.03 acre of wetlands would be removed by the relocation of KFO Route 116. Total disturbance to riparian areas would be 11.4 acres. Approximately 9.0 acres of AVFs would be disturbed due to construction of dispersed facilities. Impacts to these areas would include loss of habitat, destabilization of streambanks, floodplain storage and attenuation, water filtration, and groundwater recharge. Floodplains have the potential to be affected along approximately 37,161 linear feet of ephemeral and intermittent drainages within the surface mining areas of the coal zone associated with this alternative. Approximately 17,102 linear feet of intermittent and ephemeral drainages are within the underground mining area.

Table 2.8.2. Summary of Impacts

Section	Resource	Alternative A (No Action)	Alternative B (Proposed Action)	Alternative C (Reduced Tract Acreage and Seasonal Restrictions)	Alternative K1 (Reduced Tract Acreage)
	Water Resources: Subsidence	No impacts to water resources would occur from subsidence under the No Action Alternative.	Under the Proposed Action, subsidence would occur on 613 acres within the tract. Approximately 166 acres of subsidence would occur within the angle of influence outside the tract. Potential subsidence-related water resources impacts include potential changes to surface drainage and deterioration of surface-water quality as well as changes to groundwater levels, flow, and quality	Impacts would be the same as those described under the Proposed Action.	Impacts would be the same as those described under the Proposed Action.
4.17	**Wildlife: General**	No Impacts to wildlife, as a function of mining the tract, would occur under the No Action Alternative.	Direct and indirect impacts under the Proposed Action would occur to wildlife from habitat fragmentation, alteration, loss, and displacement due to surface disturbance, noise, ground vibration, night lighting, and increased risk of vehicle mortality associated with approximately 153 coal haul truck round-trips per day. In addition, surface mining, infrastructure, and road development would remove 1,975 acres (55%) of wildlife habitats within the 3,576-acre tract. Approximately 36 acres of habitats would be disturbed for the relocation of KFO Route 116. Approximately 29 acres of crucial summer habitat for mule deer would be disturbed under the Proposed Action. This represents 21% of this habitat in the tract and 0.03% of this habitat in the herd management unit (HMU). Approximately 1,803 acres of substantial value summer habitat for mule deer would be disturbed under the Proposed Action. This represents 52% of this habitat in the tract and 0.9% of this habitat in the HMU. Approximately 1,808 acres of substantial value summer habitat for Rocky Mountain elk would be disturbed under the Proposed Action. This represents 52% of this habitat in the tract and 2.2% of this habitat in the HMU. Approximately 25 acres of substantial value year-long habitat for Rocky Mountain elk would be disturbed under the Proposed Action. This represents 35% of this habitat in the tract and 0.01% of this habitat in the HMU. Surface water on the tract is limited, and flow rates in the larger streams on the tract (Kanab Creek and Lower Robinson Creek) are too minimal to support fish populations. Thus, impacts to fish species in the tract are unlikely to occur. Mining activities under the Proposed Action would occur 24 hours a day and six days a week over the 25-year mine life. All disturbed acres would be reclaimed and revegetated concurrently with mining and over the 10-year restoration period. Impacts on wildlife from coal truck traffic would include the potential for wildlife mortality along highways and would vary according to the individual's size, mobility, and movements. Large, nocturnal species and migratory species such as mule deer, elk, and pronghorn would be at the greatest risk. An increase in vehicle collision mortality of raptors and other bird species could also occur due to birds scavenging roadkill, and would be proportional to the volume of other animal mortalities.	The nature of impacts under Alternative C would be the same as under the Proposed Action but would differ in acreages and timing. Direct impacts under this alternative would occur from the removal of 1,650 acres (52%) of wildlife habitats within the 3,173-acre tract. Approximately 44 acres would be disturbed for the relocation of KFO Route 116. Approximately 1,526 acres of substantial value summer habitat for mule deer would be disturbed under Alternative C. This represents 50% of this habitat in the tract and 0.7% of this habitat in the HMU. Approximately 1,501 acres of substantial value summer habitat for Rocky Mountain elk would be disturbed under the Alternative C. This represents 48% of this habitat in the tract and 2% of this habitat in the HMU. Approximately 25 acres of substantial value year-long habitat for Rocky Mountain elk would be disturbed under Alternative C. This represents 35% of this habitat in the tract and 0.01% of this habitat in the HMU. Surface water on the tract is limited, and flow rates in the larger streams on the tract (Kanab Creek and Lower Robinson Creek) are too minimal to support fish populations. Thus, impacts to fish species in the tract are unlikely to occur. In addition, mining activities would occur 24 hours a day and six days a week over the 21-year mine life. All disturbed acres under this alternative would be reclaimed and revegetated concurrently with mining and over the 10-year restoration period. Potential impacts from coal truck traffic would be the same as those described under the Proposed Action, but would be shorter in duration because of the shorter mine life.	The nature of impacts under Alternative K1 would be the same as under the Proposed Action but would differ in acreages and timing. Direct impacts under this alternative would occur from the removal of 1,005 acres (48%) of wildlife habitats within the 2,114-acre tract. Approximately 16 acres would be disturbed for the relocation of KFO Route 116. Approximately 920 acres of substantial value summer habitat for mule deer would be disturbed under Alternative K1. This represents 46% of this habitat in the tract and 0.4% of this habitat in the HMU. Approximately 920 acres of substantial value summer habitat for Rocky Mountain elk would be disturbed under Alternative K1. This represents 44% of this habitat in the tract and 1% of this habitat in the HMU. Surface water on the tract is limited, and flow rates in the larger streams on the tract (Kanab Creek and Lower Robinson Creek) are too minimal to support large fish populations. Thus, impacts to fish species in the tract are unlikely to occur. In addition, mining activities would occur 24 hours a day and six days a week over the 16-year mine life. All disturbed acres under this alternative would be reclaimed and revegetated concurrently with mining and over the 10-year restoration period. Potential impacts from coal truck traffic would be the same as those described under the Proposed Action, but would be shorter in duration because of the shorter mine life.

Table 2.8.2. Summary of Impacts

Section	Resource	Alternative A (No Action)	Alternative B (Proposed Action)	Alternative C (Reduced Tract Acreage and Seasonal Restrictions)	Alternative K1 (Reduced Tract Acreage)
4.18	**Wildlife: Special Status Species**	No Impacts to special status species as a function of mining the tract would occur under the No Action Alternative.	Direct and indirect impacts under the Proposed Action would occur to special status species from habitat fragmentation, alteration, loss, and displacement due to surface disturbance, noise, ground vibration, night lighting, and increased risk of vehicle mortality associated with approximately 153 coal haul truck round-trips per day. In addition, surface mining, infrastructure, and road development would remove 1,975 acres (55%) of special status species habitats within the 3,576-acre tract. Approximately 36 acres of habitats would be disturbed for the relocation of KFO Route 116. Approximately 1,992 acres of Greater Sage-grouse occupied habitat would be disturbed under the Proposed Action. This represents 56% of this habitat in tract and 0.7% of this habitat in the SGMA. Approximately 914 acres of pygmy rabbit and kit fox habitat would be disturbed under the Proposed Action. This represents 57% of pygmy rabbit and kit fox habitat in the tract. Mining activities under the Proposed Action would occur 24 hours a day and six days a week over the 25-year mine life. All disturbed acres would be reclaimed and revegetated concurrently with mining and over the 10-year restoration period. Coal truck traffic impacts to special status species such as pygmy rabbit, Utah prairie-dog, and kit fox could include increased loss of individuals from vehicle collisions, increased predator abundance along roadways because of roadkills, and increased fragmentation in and among populations because of road barrier effects of increased traffic. Special status bat species could be displaced from habitat because of increased traffic noise and disruption of roosting or foraging habitat because of an increase in nighttime vehicle traffic. Special status raptor species could experience more vehicle strikes because increased roadkills would attract raptors to the coal haul route. Special status migratory bird and amphibian species could also experience an increase in vehicle strikes along the coal haul route. Coal truck traffic impacts to sage-grouse could include increased mortality from vehicle collisions, increased predator activity along the coal haul route because of increased roadkill, and disruption of courtship behavior or prevention of hens from locating lekking areas because of increased noise and vibration from coal truck traffic.	The nature of impacts under Alternative C would be the same as under the Proposed Action but would differ in acreages and timing. Direct impacts under this alternative would occur from the removal of 1,650 acres (52%) of special status species habitats within the 3,173-acre tract. Approximately 44 acres would be disturbed for the relocation of KFO Route 116. Approximately 1,661 acres of Greater Sage-grouse occupied habitat would be disturbed under Alternative C. This represents 53% of this habitat in tract and 0.6% of this habitat in the SGMA. Approximately 742 acres of pygmy rabbit and kit fox habitat would be disturbed under Alternative C. This represents 54% of pygmy rabbit and kit fox habitat in the tract. In addition, mining activities would occur 24 hours a day and six days a week over the 21-year mine life. All disturbed acres under this alternative would be reclaimed and revegetated concurrently with mining and over the 10-year restoration period. Coal truck traffic impacts would be the same as those described under the Proposed Action.	The nature of impacts under Alternative K1 would be the same as under the Proposed Action but would differ in acreages and timing. Direct impacts under this alternative would occur from the removal of 1,005 acres (48%) of special status species habitats within the 2,114-acre tract. Approximately 16 acres would be disturbed for the relocation of KFO Route 116. Approximately 1,012 acres of Greater Sage-grouse occupied habitat would be disturbed under Alternative K1. This represents 49% of this habitat in tract and 0.4% of this habitat in the SGMA. Approximately 327 acres of pygmy rabbit and kit fox habitat would be disturbed under Alternative K1. This represents 50% of pygmy rabbit and kit fox habitat in the tract. In addition, mining activities would occur 24 hours a day and six days a week over the 16-year mine life. All disturbed acres under this alternative would be reclaimed and revegetated concurrently with mining and over the 10-year restoration period. Coal truck traffic impacts would be the same as those described under the Proposed Action.

CHAPTER 3. AFFECTED ENVIRONMENT

CHAPTER 3. AFFECTED ENVIRONMENT

3.1 Introduction

This chapter presents the existing environment, including the cultural, physical, biological, social, and economic resources, values, and uses, that would be affected by the Proposed Action and alternatives. The affected area consists of the Alton Coal Tract and the reasonably foreseeable coal haul transportation route, as identified in the Interdisciplinary Team Analysis Record Checklist (Appendix G) and presented in Chapters 1 and 2 of this impact statement. This chapter provides the baseline for comparison of impacts and consequences described in Chapter 4. Management issues identified by the BLM, public scoping, and interdisciplinary analysis of the area have guided the material presented herein.

3.1.1 General Setting

The tract is in Kane County, Utah, approximately 0.10 mile south of the town of Alton and 2.9 miles east of US-89. The tract occurs at approximately 6,900 feet above sea level in the semiarid foothills of the Colorado Plateau Semidesert Province (Woods et al. 2001a) of south-central Utah. The tract is in the Alton Amphitheater between the Paunsaugunt Plateau to the northeast, Long Valley (Virgin River) to the west, and approximately 5.0 miles north and northwest of the Grand Staircase-Escalante National Monument. Mean annual precipitation in the town of Alton was approximately 16 inches from 1928 to 2006, and mean annual temperature for this same time period was 60.2 degrees Fahrenheit (°F) (2006). The Colorado Plateau province receives most of its precipitation in the form of snow during the winter months; summers are generally hot and dry with a mid- to late-summer monsoon period when frequent thunderstorms occur (2006). The tract is characterized by a series of low-rising hills and benches cut by the north-south-running Kanab Creek and by long diagonal washes that flow from the surrounding mountain ranges. Vegetation in the tract is typical of the Great Basin and includes large open areas of bunchgrass, perennial grasses, and sagebrush interspersed with dense stands of juniper and pinyon pine. Tall fir trees are apparent on the more rugged mountains to the northwest of the tract. Generally, the vegetation cover is continuous across most of the tract, broken by two-track dirt roads and fence lines. A map of the tract in relation to surrounding towns, highways, existing and potential fee coal areas, and other area landmarks is presented in Map 1.1.

Under the Proposed Action, the tract includes approximately 3,576 acres of land. All coal resources within the tract are federally (BLM) owned and managed. Approximately 2,280 surface acres of the tract are under BLM management, and the remaining 1,296 surface acres are under private ownership. Under Alternative C and Alternative K1, the tract comprises approximately 3,173 acres and 2,114 acres of land, respectively. As under the Proposed Action, all coal resources under these tract configurations are federally (BLM) owned and managed. Surface ownership under Alternative C and Alternative K1 is split between the BLM (2,280 acres under Alternative C and 1,235 acres under Alternative K1) and private owners (893 acres under Alternative C and 880 acres under Alternative K1). Coal reserves are known to occur beneath approximately 1,750, 1,454, and 869 acres of the tract under the Proposed Action, Alternative C, and Alternative K1, respectively.

The entirety of the reasonably foreseeable coal haul transportation route (hereafter referred to simply as the coal haul transportation route) also occurs in southern Utah, more specifically in Kane, Garfield, and Iron counties near Alton, Hatch, Panguitch, and Cedar City. The total length of the route is approximately 115 miles (see Map 2.5). Existing vehicle traffic consists of local residents; tourists to Bryce Canyon National Park, Dixie National Forest, and BLM-administered lands; and commercial truck traffic. Transportation infrastructure associated with the tract and the reasonably foreseeable coal haul transportation route includes numerous unimproved, dirt roads, KFO Route 116, US-89, SR-20, I-15, and SR-56. The Union Pacific Railroad 21-mile branch to the Salt Lake City-Los Angeles line is west of Cedar City, Utah, and is the nearest railroad facility to the tract.

3.1.2 Supplemental Authorities and Other Resources, Values, and Uses Brought Forward for Analysis

Decisions related to the tract could affect supplemental authorities as listed in the BLM NEPA Handbook H-1790-1 (2008c) in addition to other resources, values, and uses identified during public and agency scoping. Table 3.1.1 lists the supplemental authorities and other resources, values, and uses brought forward for analysis. Some supplemental authorities and other resources, values, and uses identified during public and agency scoping were not brought forward for detailed analysis. These are also listed in Table 3.1.1, including a brief explanation for their omission from the EIS analysis.

Table 3.1.1. Supplemental Authorities and other Resources, Values, and Uses Considered for the Alton Coal Environmental Impact Statement

Analysis Element (supplemental authority)*	**Brought Forward for Analysis**	**Explanation/ Rationale**
Aesthetic resources (soundscape, visual resources, and nighttime lighting)	Yes	Potentially affected
Air resources (air quality) (42 USC 7401 et seq.)	Yes	Potentially affected
Cultural resources (Native American religious concerns) (16 USC 470; 42 USC 1996)	Yes	Potentially affected
Fire management	Yes	Potentially affected
Geology and minerals	Yes	Potentially affected
Hazardous materials and hazardous and solid waste (43 USC 6901 et seq.; 43 USC 9615)	Yes	Potentially affected
Historic trails	No	Not present
Land use and access	Yes	Potentially affected
Livestock grazing (rangelands)	Yes	Potentially affected
Paleontology	Yes	Potentially affected
Prime and unique farmlands (30 USC 1201 et seq.)	No	Not present
Recreation	Yes	Potentially affected
Socioeconomics (social and economic conditions, public health and safety, EJ) (EO 12898)	Yes	Potentially affected
Soils	Yes	Potentially affected
Transportation	Yes	Potentially affected
Vegetation and special status plant species (invasive and noxious weeds; forests; threatened, endangered, and candidate species; State of Utah and BLM Utah sensitive species)	Yes	Potentially affected
Water Resources (surface-water quality and quantity, groundwater quality and quantity, wetlands/riparian areas, floodplains, AVFs) (EO 11990)	Yes	Potentially affected
Wildlife and special status animal species (threatened, endangered, and candidate species; State of Utah and BLM Utah sensitive species; migratory birds, fish habitat) (50 CFR 600; 67 *Federal Register* 2376, January 17, 2002)	Yes	Potentially affected
Wilderness areas, WSAs, and non-WSAs with wilderness characteristics (43 USC 1701 et seq.; 16 USC 1131 et seq.)	No	Not present
Wild and scenic rivers (16 USC 1271)	No	Not present
Areas of critical environmental concern (43 USC 1701 et seq.)	No	Not present
Native American Trust Resources	No	Not present

* Items (those brought forward for analysis) as listed under the heading “Analysis Element” correspond to section headings in Chapters 3 and 4 of this EIS. These may be the same as the supplemental authorities listed in (BLM 2008c) but not in all cases. Where headings have been changed or combined, the corresponding supplemental authorities and/or the component sections are listed in parentheses. Potential impacts to specially designated areas (such as Bryce Canyon National Park, Cedar Breaks National Monument, and Grand Staircase-Escalante National Monument) are considered under the resource areas of concern for these areas—aesthetic resources, air resources, and recreation.

An analysis area has been identified for each analysis element to analyze potential impacts on the resource. Although analysis areas may differ between resources, the analysis area is generally defined as the outermost boundary of an area that encompasses potential direct and indirect impacts that may result from the No Action Alternative, the Proposed Action, Alternative C, and Alternative K1. The analysis area for each resource brought forward for analysis is defined and described in the sections specifically addressing that resource.

3.1.3 Notes on Data Sources and Tract Acreage

Data and information used to describe the affected environment were gleaned from a variety of sources including internet sources, peer reviewed literature, government agency documents, current and historic permitting documents, and documents reporting the results of studies and data collection efforts completed for the EIS in specific. Key government agency documents from which data and information were extracted include larger scale planning documents, particularly the *Kanab Field Office Proposed Resource Management Plan and Final Environmental Impact Statement* (2008a) and the KFO RMP (BLM 2008b), previous EISs completed for the area (1979, 1980b), and smaller reports published by State of Utah and federal agencies (i.e., reports providing data and descriptions of particular resources). Documents included in the Coal Hollow PAP and reports completed by S. Petersen (ACD 2008; Petersen 2006), E. Petersen (Petersen Hydrologic 2007), and P. Collins (ACD 2008) were also used for applicable data and information given the proximity of this mine to the tract. A variety of data and information was also gathered from a PAP submitted by Utah International Incorporated (UII) to DOGM in July 1987. In this PAP, UII proposed to mine an area including the Alton Coal Tract. Finally, 11 "on the ground" studies have been completed for the affected area (tract and transportation route) in support of analyses specific to this EIS:

1. A traffic study on the reasonably foreseeable coal haul transportation route (Fehr & Peers Transportation Consultants 2013) (Appendix H)
2. A detailed inventory of cultural resources on the tract (Stavish 2008a, 2008c, 2006; Zweifel 2007)
3. A reconnaissance-level vegetation community and habitat type study (Appendix I)
4. A detailed survey for and study of special status vegetation species (see Appendix I)
5. A detailed survey for sandloving penstemon (see Appendix I)
6. A reconnaissance-level potential AVF study (see Appendix F)
7. A reconnaissance-level potential, jurisdictional wetland study (see Appendix I)
8. A detailed jurisdictional wetlands study and preliminary jurisdictional determination (see Appendix I)
9. A night sky darkness impact study (included as Appendix J)
10. An air resources dispersion modeling impact study (see the 2010 and 2014 Marquez Environmental Services documents included in Appendix K)
11. The *Alton Coal Tract LBA EIS Noise Modeling Report* (hereafter the noise modeling report, included as Appendix L)

The NOI published in the *Federal Register* (Volume 71, Number 228, Tuesday, November 28, 2006) noting the BLM's intent to prepare an EIS for the tract indicates a tract acreage of "3,581.27 acres more or less." In this analysis, a tract acreage of approximately 3,576 acres is used rather than the approximately 3,581.27 acres listed in the NOI. As explained in Table 1.1.1 and 2.3.1 in Chapters 1 and 2, respectively, the tract acreage was refined and determined for analysis using a variety of sources for boundary data, such as hardcopy maps provided by ACD, the USGS 7.5-minute quadrangle for the area, and a BLM shapefile of coal ownership. As a result of combining these relatively disparate sources of spatial data, and given that data sources are not survey accurate, approximately 5.0 acres of error was detected (hence a tract acreage of 3,576 acres rather than 3,581). Furthermore, the ownership lines from the map provided by ACD do not align well in all locales with the BLM boundary. Finally, some corrections and updates in acreages and other information have been made to develop this SDEIS.

3.2 Aesthetics Resources

Aesthetic resources are elements of the human environment that are perceived and enjoyed by people surrounding the Alton Coal Tract and along the reasonably foreseeable coal haul transportation route. The area of analysis for aesthetic resources possesses aesthetic qualities that are characterized by a visually diverse, rural landscape with few signs of modern development. Aesthetic resources are commonly considered visual resources, or things that are potentially seen with the naked eye. Because of the nature of the Proposed Action, aesthetic resources also include things that can be heard. The existing aesthetic resource conditions described in this SDEIS consist of the soundscape (natural sounds), visual resources (landscape), and the night sky (darkness).

3.2.1 Soundscape

The soundscape of an area is made up of both natural and human-created sounds. The soundscape is the area of analysis affected by changes in sound or vibration levels occurring in the tract. Sound occurs from vibrations radiating through air, water, or solid objects. For the purposes of this section, noise is defined as "unwanted sound" that interferes with normal activities or in some way reduces the quality of the environment. The natural and human-created sounds within a soundscape are characterized as being heard at noise-sensitive human receptors. A noise-sensitive human receptor is a place where sounds can be heard and may consist of residences, hospitals, libraries, recreation areas, churches, and similar locations. Exposure to prolonged, high levels of noise can result in temporary or permanent hearing loss or tinnitus (a ringing or roaring in the ears), and can also present safety issues. Although noise is known to have an effect on wildlife health and behavior, this section primarily considers sound and noise levels as they relate to the human environment. See Sections 4.17 and 4.18 for more information on how mine-related noise would affect wildlife and special status species on and near the tract.

3.2.1.1 SOUNDSCAPE ANALYSIS AREA

The soundscape analysis area consists of the towns of Alton, Panguitch, and Hatch; BLM-managed lands adjacent to the tract; Bryce Canyon National Park (Yovimpa Point, Farview Point, and Riggs Springs); the reasonably foreseeable coal haul route; and the reasonably foreseeable coal haul rail loadout location at the terminus of the reasonably foreseeable coal haul route and nearby residential area.

3.2.1.2 SOUND LEVEL CHARACTERISTICS

Humans experience sound based on frequency and amplitude. Frequency is defined as the number of pressure variations per second in the air. It is expressed in hertz (Hz). Humans can generally hear sound in the 20- to 20,000-Hz range. Amplitude is the magnitude of a sound and is usually expressed in dB, a dimensionless ratio of sound pressure to that of a reference pressure (usually 20 micropascals). The threshold of human hearing is 0 dB. Decibels are measured on a logarithmic scale. A change in sound level of 10 dB is perceived by the average person as doubling (or halving) the level of loudness. Because the human ear perceives sounds differently at low frequencies than at high frequencies, measured sound levels may be adjusted to correspond to human hearing. The A-weighted dB (dBA) is the adjusted unit of sound used to describe the human response to noise from industrial and transportation sources, including mining activities. Sound levels and characteristic impressions of common noise sources and environments are presented in Table 3.2.1.

Table 3.2.1. Common Sound Levels

Noise Source	Sound Level* (dBA)	Characteristic Impression	Relative Loudness†
Jet takeoff (50 feet)	140	Threshold of pain	64 times as loud
Rock concert near stage, jet takeoff (200 feet)	120	Uncomfortably loud	16 times as loud
Jet takeoff (2,000 feet)	100	Very loud	4 times as loud
Heavy diesel truck or motorcycle (25 feet)	90	–	2 times as loud
Garbage disposal (2 feet)	80	Moderately loud	Reference loudness
Vacuum cleaner (10 feet)	70	–	1/2 as loud
Light auto traffic (25 feet)	50	Quiet	1/8th as loud
Living room, bird calls	40	–	1/16th as loud
Library	30	Very quiet	–
Acoustic test chamber	10	–	–

Source: EPA (1974).

* For comparison purposes, the threshold of hearing is 0 (zero) dB.

† Relative loudness is the human judgment of different sound levels.

Although dBA indicates the level of noise at a single specific point in time, noise levels within a soundscape vary continuously and include sounds from a variety of sources. This variation can be accounted for using the equivalent continuous sound level (L_{eq}). The A-weighted L_{eq} therefore is the dBA average over some time interval. Because of the greater sensitivity to noise levels at night, 10 dBA are often added to any nighttime sounds before calculating an average using the day-night average sound level (L_{dn}). Natural ambient sound levels (L_{nat}) are derived by subtracting out all human-caused, mechanical, or electrical sounds from collected sound level data. Noise data gathered by the NPS are presented in both L_{eq} and L_{nat}.

3.2.1.3 FEDERAL REGULATORY NOISE STANDARDS

The following identifies federal laws and regulations that are pertinent to the evaluation of the mine-related activities and analysis of soundscape impacts. There is no state or local noise control program in the analysis area; therefore, federal standards and regulations would apply. Where two or more federal regulatory standards or guidelines overlap, the standard or guideline with the most stringent criteria would take precedence.

Numerous laws and guidelines at the federal level are relevant to the assessment of noise and vibration impacts. These include the following:

- Noise Control Act of 1972, as amended (Public Law [PL] 92-574, 42 USC 4901 et seq.)
- U.S. Department of Transportation Federal Highway Administration (FHWA) guidelines that specifically address traffic noise (23 CFR 772)
- U.S. Department of Housing and Urban Development (HUD) guidelines (24 CFR 51.101)
- MSHA occupational noise exposure health standards (30 CFR 62.130)
- MSHA surface-mining activity performance standards regulating the use of explosives (24 CFR 816.61 to 816.68)
- Occupational Safety and Health Administration (OSHA) Occupational Noise Exposure; Hearing Conservation Amendment (*Federal Register* 48[46]:9738–9785)

Each of these federal laws and regulations and their applicability to the mine-related activities are discussed in further detail below.

3.2.1.3.1 U.S. Environmental Protection Agency, Noise Control Act of 1972

The federal Noise Control Act of 1972 recognizes that uncontrolled noise can impact the health and welfare of the nation's population. The act further declares that it is United States' policy to promote an environment free from noise that jeopardizes the health or welfare of the nation's population (EPA 1974). In 1974, the EPA released a document identifying a 24-hour exposure level of 70 L_{dn} (day-night sound level) as the level of environmental noise to prevent measurable hearing loss over a lifetime (EPA 1974). The same document identifies L_{dn} levels of 55 dBA outdoors and 45 dBA indoors to prevent annoyance. Therefore, mine activity noise levels of 55 dB L_{dn} or above outdoors for residential land use and 45 dBA L_{dn} or above indoors for residential land use would be considered above the regulatory threshold.

3.2.1.3.2 U.S. Department of Transportation, Federal Highway Administration

The FHWA has issued regulations for noise evaluation in 23 CFR 772, *Procedures for Abatement of Highway Traffic Noise and Construction Noise*. The main objectives of 23 CFR 772 are "to provide procedures for noise studies and noise abatement measures, to help protect the public health and welfare, to supply noise abatement criteria, and to establish requirements for information to be given to local officials for use in the planning and design of highways approved pursuant to Title 23, United States Code." According to FHWA regulations, a traffic noise impact occurs when the predicted traffic noise level approaches or exceeds the noise abatement criteria for the specified land use. In addition, an impact occurs when the predicted traffic noise level substantially exceeds the existing noise level.

Noise level impact criteria may be based on a threshold, the change in noise level from the existing noise level, or both. Table 3.2.2 shows the FHWA-defined noise abatement criteria for various land use categories. Noise levels in excess of any of the applicable-use FHWA noise thresholds from traffic increases associated with mine activities would be above the regulatory threshold.

Table 3.2.2. Noise Abatement Criteria

Land Use Category	Noise Level L_{Aeq1h}* (dBA)	Description of Land Use
A	57 (exterior)	Land on which serenity and quiet are of extraordinary significance and serve an important public need, and where the preservation of those qualities is to continue to serve its intended purpose. Such areas could include amphitheaters, particular parks, or open spaces that are recognized by appropriate local officials for activities requiring special qualities of serenity and quiet.
B	67 (exterior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, picnic areas, playgrounds, active sports areas, and parks.
C	72 (exterior)	Developed lands, properties, or activities not included in Categories A and B above.
D	–	Undeveloped lands.
E	52 (interior)†	Residences, motels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums.

Source: 23 CFR 772.

Note: FHWA-defined land use categories and noise abatement criteria (23 CFR 772).

* L_{Aeq1h} is the one-hour equivalent sound level.

† The interior sound level (activity) applies to 1) indoor activities for those parcels where an exterior noise-sensitive activity is identified, and 2) those situations where the exterior activities will not be affected by the noise, but the interior activities will be affected.

3.2.1.3.3 U.S. Department of Housing and Urban Development

A goal in the *Noise Guidebook* (HUD 1985) is that outdoor residential areas follow the EPA guideline of 55 dBA L_{dn} (24 CFR 51.101(a)(8)). This guideline is outlined in the 1974 EPA report discussed in the EPA Noise Control Act discussion above (EPA 1974). However, for the purposes of meeting HUD regulations, sites with an L_{dn} of 65 dBA and below are acceptable and allowed. Although the EPA has set 55 dBA L_{dn} as the basic goal, other federal agencies (including HUD), in consideration of their own program requirements and goals as well as the difficulty of achieving a goal of 55 dBA L_{dn}, have settled on the 65-dBA L_{dn} level as their standard.

At 65 dBA L_{dn}, HUD has determined that activity interference is kept to a minimum and annoyance levels are still low. It is also a level that can realistically be achieved. Following the federal lead, most local jurisdictions that have adopted noise standards have adopted 65 dBA L_{dn} as the breakpoint for acceptability. Table 3.2.3 summarizes the HUD acceptability standards. Mine activity–related noise of 65 dBA L_{dn} or greater for residential areas would be in excess of the HUD noise standards.

Table 3.2.3. U.S. Department of Housing and Urban Development Site Acceptability Standards

Rating	Day-night Average Noise Level (dBA)	Special Approvals and Requirements
Acceptable	Not exceeding 65*	None
Normally unacceptable	Above 65 dBA but not exceeding 75	Special approvals,† environmental review,† attenuation‡
Unacceptable	Above 75	Special approvals,‡ environmental review,‡ attenuation

* Acceptable threshold may be shifted to 70 dBA in special circumstances pursuant to 24 CFR 51.105(a).

† See 24 CFR 51.104(b) for requirements.

‡ 5 dBA additional attenuation required for sites above 65 dBA but not exceeding 70 dBA, and 10 dBA additional attenuation required for sites above 70 dBA but not exceeding 75 dBA (24 CFR 51.104[a]).

3.2.1.3.4 U.S. Occupational Safety and Health Administration, Occupational Health and Safety Act

The Occupational Health and Safety Act of 1970 established hearing conservation noise exposure regulations for workers (29 CFR 1910). The purpose of the act is to assure safe and healthful working conditions. Worksite noise levels are regulated by 29 CFR 1910.95, which deals with occupational noise exposure. This section limits the noise pressure level to 90 dBA continuous exposure for an eight-hour day. If workers are exposed to an eight-hour time-weighted average of 85 dBA or greater, then a worker hearing protection program that includes baseline and periodic hearing testing, availability of hearing protection devices, and training in hearing damage prevention is required.

3.2.1.3.5 U.S. Department of Labor, Mine Safety and Health Administration

Hearing loss has been a health risk faced by many mine workers. In 1999, MSHA published new health standards for occupational noise exposure. These standards apply to all surface and underground metal, nonmetal, and coal mines. The purpose of these mandatory standards is to prevent occupational, noise-induced hearing loss among miners. The standards establish several circumstances where mine operators must take action (30 CFR 62.130). They are as follows:

- If miners are exposed to 85 dBA or more over an eight-hour period, they are required to enroll in a hearing protection program.

- If miners are exposed to 90 dBA or more over an eight-hour period, they must use feasible engineering and administrative controls to reduce noise levels.
- If miners are exposed to 105 dBA or more over an eight-hour period, they must ensure that they use both ear plug and earmuff-type hearing protectors.
- Miners must not be exposed to sound levels exceeding 115 dBA at any time.

Additionally, MSHA regulations governing the use of explosives for mines specify maximum limits for blasting noise and vibration at "any dwelling, public building, school, church, or community or institutional building" according to the levels presented in Tables 3.2.4 and 3.2.5 (30 CFR 816.67(b)(i)). Exceedances of blasting regulations for noise or vibration from mine blasting would be considered above the regulatory threshold.

Table 3.2.4. Federal Airblast Noise Limits

Lower Frequency Limit of Measuring System (Hz [+ / - 3 dB])	Maximum Level (dB linear)
0.1 Hz or lower (flat response)	134 peak
2 Hz or lower (flat response)	133 peak
6 Hz or lower (flat response)	129 peak
C-weighted (slow response)	105 peak dBC*

Source: Adapted from table in 30 CFR 816.67(b).

* The "C" in dBC refers to C-weighted sound levels (instead of A-weighted or linear; C indicates no weighting).

Table 3.2.5. Federal Blasting Vibration Limits

Distance from the Blasting Site (feet)	Maximum Allowable Peak Particle Velocity for Ground Vibration (inches per second)
0–300	1.25
301–5,000	1.00
5,001 and beyond	0.75

Source: Adapted from table in 30 CFR 816.67(d)(2).

3.2.1.3.6 Additional Thresholds

Additionally, airblast and vibration adverse impacts and awareness/annoyance thresholds are presented in *Alton Coal Tract LBA EIS Noise Modeling Report* (see Appendix L). Mine-related blasting noise and vibration emissions will be compared against the airblast and vibration thresholds presented in Table 3.2.6.

Table 3.2.6. Airblast and Vibration Blasting Threshold Values

Airblast Threshold	**Sound Pressure Level (dB linear)**	**Source**
Lowest threshold for building damage and human disturbance	134	30 CFR 816.67(b)
Barely noticeable threshold for humans	100	Richards and Moore (2009)
Vibration Threshold	**Peak Particle Velocity (inches per second)**	**Source**
Lowest threshold for building damage	0.500	Chae (1978); Siskind et al. (1980)
Lowest threshold for human awareness (outdoors)	0.035	Wiss and Nichols (1974)
Lowest threshold for human awareness (indoors)	0.004	Jones & Stokes (2004)

3.2.1.4 AMBIENT AND EXISTING NOISE LEVELS IN THE ANALYSIS AREA

On September 15 and 16, 2008, existing, outdoor sound levels were measured at seven points in and near the town of Alton: three points in Alton, one point in Hatch, and three points in Panguitch. Measurements were recorded for each location on environmental noise data sheets (SWCA 2008). Locations were selected to be representative of sensitive noise receptors and existing noise levels within the area of analysis. The elements of sound along the entire reasonably foreseeable coal haul transportation route, from the tract to the Iron Springs loadout, vary from day to night, and vary across seasons. Typical noise sources include motorized vehicle traffic, ranch machinery, aircraft traffic overhead, and wind.

In the town of Alton, sound levels were measured at three separate locations adjacent to surface streets in the town (Map 3.1). Five-minute to 15-minute measurements were used to determine an average. Average daytime levels ranged from 41 dBA L_{eq} at the south end of Alton to 55 dBA L_{eq} within the town at the corner of 100 West and 100 North.

In the town of Hatch, the sound level was measured at one location, 50 feet from the centerline of US-89, on the northeast side of a church (see Map 3.1). The average daytime level was recorded at 64 dBA L_{eq} over a period of 15 minutes.

In the town of Panguitch, the sound level was measured at three separate locations (see Map 3.1). The first was 40 feet from the centerline of Main Street. The sound level at this site was recorded for 24 hours from a sound meter placed 10 feet above ground level on a utility pole. The 24-hour average was 67 dBA L_{eq}. The two remaining measurements were taken for 15 minutes from locations adjacent to surface streets within the town. Average daytime levels at both locations were 64 dBA L_{eq}.

Background levels presented in the noise analysis use data from Bryce Canyon National Park noise level surveys were gathered by NPS personnel from 2009 to 2012 for three areas in the park (Farview F, Yovimpa F, and Riggs Spring B ("F" represents "Front-country" and "B" represents "Back-country"; Map 3.2). Modeled tract noise was compared to the most conservative background values from these three areas analyzed in Bryce Canyon:

- 31.8 dBA L_{nat} (53.0 dBA L_{eq}) for Farview F
- 27.1 dBA L_{nat} (42.0 dBA L_{eq}) for Yovimpa F
- 24.5 dBA L_{nat} (40.0 dBA L_{eq}) for Riggs Spring B

No data were gathered for ambient sound levels surrounding the reasonably foreseeable rail loadout location near Cedar City. Therefore, for conservatism, baseline conditions at this site were assumed to be those of the lowest recorded value for Bryce Canyon (40.0 dBA L_{eq} at Riggs Spring B).

3.2.1.5 MODELING AND NOISE RECEPTOR SITE LOCATIONS IN THE SOUNDSCAPE ANALYSIS AREA

Receptors in Bryce Canyon National Park are 13.5 or more miles (21.7 kilometers [km]) away from the tract. The reasonably foreseeable rail loadout location is approximately 50 miles (80.5 km) from the tract, and receptors in a small community 4.5 miles (7.2 km) northeast of the loadout location are approximately 45 miles from the tract. Receptors on Dixie National Forest are 1.0–4.0 miles (1.6–6.4 km) away from the tract. Residents of Alton and nearby ranches are within 0.1 mile (0.2 km) of the tract (the northwest portion of the tract, or Block NW) and within 2.0 miles (3.2 km) of the proposed location of the centralized facilities. In addition, noise was modeled along portions of the reasonably foreseeable coal haul transportation route where sensitive receptors could be impacted (i.e., within the town boundaries of Alton, Hatch, and Panguitch). This transportation route included local roadways in the town of Alton from the mining tract boundary to Alton Road, from Alton Road to US-89, and approximately 3.7 miles (6.0 km) of US-89 running north from the intersection of Alton Road and US-89. Modeling for the town of Panguitch, approximately 37 miles from the tract, took into account approximately 4.6 miles (7.4 km) of US-89, including the portion of US-89 that runs through the town. Modeling for the town of Hatch, approximately 22 miles from the tract, modeled approximately 3.8 miles (6.2 km) of US-89 (including the portion running through town). Sensitive receptors (residences, schools, churches, etc.) occur in various locations within 40 feet of the reasonably foreseeable coal haul transportation route within these towns. See Map 3.2 for the receptor locations.

Because noise and vibration from blasting activities can extend several miles or more, and because noise from heavy machinery and coal haul trucks would extend a few hundred feet or less, the analysis area varies under different aspects of mining operations. Noise emissions from mobile and stationary sources were modeled out to a distance of approximately 3.1 miles (5.0 km) from the proposed mining blocks. The roadway noise emissions were modeled out to a distance of approximately 0.6 mile (1.0 km) from the existing roadways. Blasting noise and vibration were evaluated at specific points of concern (i.e., points within Bryce Canyon National Park and the town of Alton). The maximum extent out to which vibration and noise regulatory thresholds and lowest identified thresholds of human annoyance/awareness could be exceeded from blasting events was also calculated.

3.2.1.6 SOUNDSCAPE MANAGEMENT OBJECTIVES

The BLM has no management prescriptions for the reduction of noise or protection of soundscapes (BLM 2008a). NPS management policies and objectives direct parks to provide for natural quiet and solitude as outlined in various planning documents and Director's Order #47 (Soundscape Preservation and Noise Management, signed on December 1, 2000). Bryce Canyon National Park in particular is recognized for the importance of the natural quiet that the park offers. Maintaining natural soundscapes is a management objective for Bryce Canyon National Park (NPS 1983, 1987). At Bryce Canyon National Park, the soundscape has been studied for over 10 years, with intensive monitoring over the last three summers (2009–2011) at locations throughout the park, including Yovimpa Point. The baseline conditions for the park are well documented and were used to assist the BLM in their soundscape analysis.

3.2.2 Visual Resources

Visual resources (the landscape) consist of landform (topography and soils), vegetation, bodies of waters (lakes, streams, and rivers), and human-made structures (roads, buildings, and modifications of the land, vegetation, and water). These elements of the landscape can be described in terms of their form, line, color, and texture. Normally, the more variety of elements in a landscape, the more interesting or scenic the landscape becomes, if the elements exist in harmony with each other. The BLM manages landscapes for varying levels of protection and modification, giving consideration to other resources values and uses and the scenic quality of the landscape.

3.2.2.1 VISUAL RESOURCES ANALYSIS AREA

The visual resources analysis area consists of lands where potential alteration of the landscape from the proposed tract may be discerned. It consists of areas in and adjacent to the tract, the Grand View and Paunsaugunt trails on the Dixie National Forest, and the town of Alton (Map 3.3). The tract is not visible from viewpoints within Bryce Canyon National Park (there is no direct line of sight); however, Bryce Canyon is considered part of the analysis area and a viewshed (line of sight) analysis is included in Chapter 4. Additionally, because no landscape change along the reasonably foreseeable coal haul transportation route is proposed, it is not considered part of the visual analysis area.

3.2.2.2 CHARACTERISTIC LANDSCAPE

The tract lies in the Alton Amphitheater south of the town of Alton in Kane County, Utah, between the Paunsaugunt Plateau to the northeast, Long Valley (Virgin River) to the west, and the Gray Cliffs of the west edge of the Grand Staircase-Escalante National Monument to the south. The tract is characterized by a series of low-rising hills and benches cut by the north-south-running Kanab Creek, and by long diagonal washes that flow from the surrounding mountain ranges. Vegetation in the tract is typical of the Great Basin and includes large, open areas of bunchgrass; perennial grass, forbs, and shrubs; and gray-green sagebrush interspersed with dense stands of darker green juniper and pinyon pine (see Section 4.15 for a full description of vegetation resources in the tract). Tall fir trees are apparent on the more rugged mountains to the northwest. Vegetation cover is continuous across most of the tract, broken by two-track dirt roads and fence lines.

The landscape of the tract has been partially modified by human development and activities. Dirt roads, dispersed ranches, agricultural fields, barbed wire fence lines, and large blocks of vegetation treatments have resulted in changes to the landscape of the tract. The graded dirt road (KFO Route 116) is a reddish tan band that traverses north–south along the length of the tract. Several ranches and homes surrounded by large cottonwood trees are east of KFO Route 116 outside the southeast edge of the tract. Green fields and meadows occur south of Alton and in the low-lying areas between the tract and the foothills of the Paunsaugunt Plateau. Barbed wire fences lined with tall, decadent sagebrush and rabbitbrush dissect the tract in various directions. Approximately 750 acres, or 21% of the tract, have undergone mechanical vegetation treatments. Large, geometric vegetation treatment areas where trees and shrubs have been mechanically knocked over occur throughout the tract, leaving down, grayish white trunks and limbs interspersed with minimal grasses and shrubs. The geometric lines of the agricultural fields and vegetation treatments are large, and they are not readily apparent from locations within the tract. However, they are visible from the elevated viewpoints along the Dixie National Forest trails on the Paunsaugunt Plateau.

Although the tract has been modified by the activities described above, the setting is natural and remains largely undeveloped with few visible buildings and structures. Tree-covered mountains and white-, tan-, and red-colored cliffs border the tract to the north and east. In the background, east of the tract, the bright, colorful, and jagged cliffs of the Paunsaugunt Plateau on the Dixie National Forest increase the sense of a natural and undeveloped landscape.

3.2.2.3 VISUAL RESOURCES INVENTORY AND VISUAL RESOURCE MANAGEMENT OBJECTIVES

Through the land use planning process, BLM sets objectives for the management of landscape preservation and change. All lands are placed into one of four classes that identify the degree of acceptable landscape change or alteration, giving consideration to the scenic value of the landscape and other resource values and uses of the land. Class I objectives are established in areas where no landscape change is desired. Class IV objectives are set for landscapes where the BLM manages for uses that will result in substantial landscape changes (e.g., mining, energy development, wind farms). Classes II and III allow for varying degrees of landscape preservation and change in between Classes I and IV.

The visual resource management (VRM) class objectives for the tract were established in the KFO RMP (BLM 2008b). Lands in the tract have been allocated to VRM Class IV management objectives (Map 3.4). The 1,296 acres of private land in the tract is not managed under any VRM class objectives. The objective of Class IV is to provide for management activities that require major modifications to the existing character of the landscape. These activities may dominate the view and may be the major focus of viewer attention.

3.2.3 Nighttime Lighting and the Extent of Skyglow

A natural lightscape is defined by the NPS Air Resources Division as "a place or environment characterized by the natural rhythm of sun and moon cycles, clean air, and of dark nights that are unperturbed by artificial lights" (NPS 2008d). Dark night skies are a part of the everyday experience of residents of Alton as well as part of the experience and expectation of visitors seeking recreation opportunities at NPS-managed lands. Bryce Canyon National Park has long been considered a leader in the protection and interpretation of dark skies. Park management also emphasizes the preservation of dark skies and astronomy through an extensive interpretive program, hosting dozens of astronomy educational programs throughout the year, including an annual astronomy festival held in late June.

3.2.3.1 SKYGLOW ANALYSIS AREA

The area of analysis for skyglow includes the tract's surrounding lands that could be affected by changes in artificial lighting occurring from the Proposed Action and alternatives. Because lighting can disperse through the atmosphere and may extend further than 12 miles, the analysis area consists of the town of Alton, Dixie National Forest, Bryce Canyon National Park, Cedar Breaks National Monument, and Zion National Park. Because mine-related traffic would occur along existing roads associated with the reasonably foreseeable coal haul transportation route and would be intermittent and in motion, no attempt was made to model lighting produced, and the coal haul transportation route is not considered in the area of analysis for skyglow.

3.2.3.2 EXISTING DARK SKY CONDITIONS

There are several methods available for measuring skyglow and for measuring the brightness of night skies. Amateur[1] astronomers use limiting magnitude to measure the brightness of the night sky. Limiting magnitude describes the faintest stars that can be seen with the unaided eye. Amateur astronomers

[1] Use of the term *amateur* is intended to distinguish between the types of astronomical observations made at Bryce Canyon (observations made with the human eye and/or telescope in a uniquely dark sky environment) and professional astronomical observations made at observatories using high technology equipment with varying background lighting conditions (the Whipple Observatory, for example, is situated near Tucson, a considerable source of light pollution). The relative sensitivity of dark-adapted human vision and to broad-spectrum sources is a factor of critical importance in the much-darker environment of southern Utah and for the types of visual uses at Bryce Canyon. The nature of night use and observations at Bryce Canyon is much different than professional astronomical observation, and is based heavily on visual appearance of the entire sky and landscape rather than the sensitivity of astronomical instrumentation to skyglow at angles considerably above the horizon (where most astronomical observation occurs).

compare the night sky to a star chart with known magnitudes. Limiting magnitude is then determined by the faintest star from the chart that is visible to the naked eye. Site-specific data on the darkness of the night skies over the tract were not available; therefore, the brightness of the night sky is based on the known limiting magnitude and night sky observations from Bryce Canyon National Park and Cedar Breaks National Monument. The night skies from viewpoints in Bryce Canyon National Park (e.g., Rainbow and Yovimpa points) have a limiting magnitude rating of 7.4. They are judged by NPS employees to be as dark as world class astronomical research locations (NPS 2008b). These dark night skies are the result of good air quality, low humidity, high elevation, and minimal sources of light pollution and skyglow.

Night sky conditions have been recorded by the NPS from both Yovimpa Point in Bryce Canyon National Park and from Brian Head Peak near Cedar Breaks National Monument (Moore 2008). Night sky conditions are also recorded from both the east entrance and Lava Point within Zion National Park. Due to its proximity to St. George, Utah and Las Vegas, Nevada, night skies are brighter at Zion National Park than at Bryce Canyon National Park and Cedar Breaks National Monument. However, most of the visitation experience in Zion National Park occurs at lower elevations and within steep-walled canyons, minimizing the amount of potential light pollution that reaches visitors.

Yovimpa Point is near the south end of Bryce Canyon National Park and is approximately 13 miles from the tract. From Yovimpa Point, there are apparent increases in night sky brightness resulting from natural air glow and from artificial light sources from 11 towns and cities surrounding the park, including Alton, Utah as well as Fredonia and Page, Arizona. In the area of sky opposite the tract, there is no apparent increase in skyglow from artificial light sources observed from Yovimpa Point. The greatest source of skyglow observed from Yovimpa Point comes from Cedar City, Utah, approximately 48 miles the northwest of the tract (included as Appendix J).

Brian Head Peak is approximately 1.0 mile north of Cedar Breaks National Monument and 26.5 miles northwest of the tract. It has greater night sky brightness than that visible from Yovimpa Point. The night sky brightness comes primarily from the artificial light sources of Cedar City and St. George, Utah. The zenith of the night sky above Brian Head Peak appears approximately 6% brighter than under natural conditions, with brightness increasing closer to the horizon toward Cedar City and St. George. In addition, there are up to seven other cities and towns generating visible light domes surrounding Brian Head Peak (included as Appendix J).

Amateur astronomers can qualitatively rank the brightness of the night sky using the Bortle Dark-Sky Scale, a numeric nine-level measure of the night sky brightness of a specific location (Table 3.2.7) (Bortle 2001). Under optimal conditions, Bryce Canyon National Park is assumed to have a Bortle Dark-Sky rating Class 3, equaling that of a rural sky. Because there are few sources of artificial light between the park and the tract, it is further assumed that the tract is a Bortle Dark-Sky rating Class 3.

Table 3.2.7. Bortle Dark-Sky Scale

Class	Title	Naked Eye Limiting Magnitude	Description
1	Excellent dark sky site	7.6–8.0	Zodiacal light, gegenschein, zodiacal band visible; M33 direct vision naked-eye object; Scorpius and Sagittarius regions of the Milky Way cast obvious shadows on the ground; airglow is readily visible; Jupiter and Venus affect dark adaptation; surroundings basically invisible.
2	Typical truly dark site	7.1–7.5	Airglow weakly visible near horizon; M33 easily seen with naked eye; highly structured summer Milky Way; distinctly yellowish zodiacal light bright enough to cast shadows at dusk and dawn; clouds only visible as dark holes; surroundings still only barely visible silhouetted against the sky; many Messier globular clusters still distinct naked-eye objects.
3	Rural sky	6.6–7.0	Some light pollution evident at the horizon; clouds illuminated near horizon, dark overhead; Milky Way still appears complex; M15, M4, M5, M22 distinct naked-eye objects; M33 easily visible with averted vision; zodiacal light striking in spring and autumn, color still visible; nearer surroundings vaguely visible.
4	Rural/ suburban transition	6.1–6.5	Light pollution domes visible in various directions over the horizon; zodiacal light is still visible, but not even halfway extending to the zenith at dusk or dawn; Milky Way above the horizon still impressive, but lacks most of the finer details; M33 a difficult averted vision object, only visible when higher than 55°; clouds illuminated in the directions of the light sources, but still dark overhead; surroundings clearly visible, even at a distance.
5	Suburban sky	5.6–6.0	Only hints of zodiacal light are seen on the best nights in autumn and spring; Milky Way is very weak or invisible near the horizon and looks washed out overhead; light sources visible in most, if not all, directions; clouds are noticeably brighter than the sky.
6	Bright suburban sky	5.1–5.5	Zodiacal light is invisible; Milky Way only visible near the zenith; sky within 35° from the horizon glows grayish white; clouds anywhere in the sky appear fairly bright; surroundings easily visible; M33 is impossible to see without at least binoculars; M31 is modestly apparent to the unaided eye.
7	Suburban/ urban transition	5.0 at best	Entire sky has a grayish white hue; strong light sources evident in all directions; Milky Way invisible; M31 and M44 may be glimpsed with the naked eye, but are very indistinct; clouds are brightly lit; even in moderate-sized telescopes the brightest Messier objects are only ghosts of their true selves.
8	City sky	4.5 at best	Sky glows white or orange (you can easily read without additional lighting); M31 and M44 are barely glimpsed by an experienced observer on good nights; even with telescope, only bright Messier objects can be detected; stars forming familiar constellation patterns may be weak or completely invisible.
9	Inner city sky	4.0 at best	Sky is brilliantly lit with many stars forming constellations invisible and many weaker constellations invisible; aside from Pleiades, no Messier object is visible to the naked eye; only objects to provide fairly pleasant views are the Moon, the Planets, and a few of the brightest star clusters.

Source: Adapted from Bortle 2001.

Light pollution is defined as the illumination of the night sky caused by artificial light sources (Bortle 2001). Effects of light pollution consist of a decrease in the visibility of stars and other natural night sky features, as well as disruption to natural lightscapes. Light pollution is caused by artificial light sources that are directed upward or sideways. Light then scatters throughout the atmosphere resulting in skyglow. Other factors that influence skyglow consist of humidity, snow cover, cloud cover, and increased PM in the air. Another form of light pollution is the glare that results from direct lighting.

Artificial light sources in the area of analysis include residential, commercial, and some street lighting from the towns of Tropic, Hatch, and Alton, as well as campgrounds and other developed facilities within Bryce Canyon National Park and Dixie National Forest. Because there are so few sources of light pollution, the night skies in the area of analysis are some of the darkest skies in the continental United States (NPS 2008b).

Dark Sky Partners provided a calculation of the predicted average sky luminance (ASL), both for total skyglow and artificial skyglow only, in the updated technical report presented in Appendix J. The ASL is a measure of luminance of the sky as seen from the observer's location, and it is useful in describing the quality of the entire hemisphere of the sky instead of just a particular segment of the sky. Luminance is the brightness per unit area of the sky (typically measured in nanoLamberts [nL], or mag/arcsec^2).

Background ASL values were measured by NPS staff at Bryce Canyon National Park on two occasions. On November 17, 2004, NPS staff measured a value of 101 nL from Yovimpa Point and estimated that 95 nL could be attributed to natural skyglow (6 nL to artificial skyglow). Again on March 14, 2007, NPS staff measured a value of 67 nL from Yovimpa Point and estimated that 59 nL could be attributed to natural skyglow and 8 nL to artificial. The November 17 results are for a relatively bright natural sky, whereas the March 14 results are for a night with an unusually faint natural skyglow. The NPS measurements include trees near the horizon that block part of the sky; therefore, the artificial contribution may be underestimated. The uncertainties in these measurements are approximately 5%. The natural sky condition chosen for modeling of 72.71 nL by Dark Sky Partners is reasonable and within the values measured by the NPS of 67 nL and 101 nL. Additionally, the quantity of artificial light (9.09 nL) used to initialize the model is reasonable given the measured values of 6 nL and 8 nL.

3.2.3.3 LIGHTSCAPE MANAGEMENT OBJECTIVES

The BLM does not set management objectives for night skies and lightscapes through the land use planning process. The NPS will preserve, to the greatest extent possible, the natural lightscapes of parks. The NPS also works with park visitors, neighbors, and other agencies to prevent and minimize the intrusion of artificial lights on the night skies of national parks (NPS 2008d). Natural skyglow does occur, and can result from such things as moonlight, the Milky Way, low clouds, and airglow. Airglow is the emission of light from the Earth's upper atmosphere. NPS's policy is to consider the best 20% of night sky conditions, as recorded during night sky monitoring, when evaluating action alternatives.

3.3 Air Resources

The air quality of a given airshed or region is determined by the topography, meteorology, location of air pollutant sources, and type, quantity, and combination of air pollutants. The calculated or measured concentrations of various pollutants are compared to established standards to evaluate the impact of a given source on regional air quality.

The air resources analysis area consists of an approximately 150-km area surrounding the Alton Coal Tract (Map 3.5). The following sections address the local weather and climate, the air quality regulatory requirements, and the existing air quality of the air resources analysis area (i.e., the near-field and far-field modeling domains as depicted in Map 3.5).

3.3.1 Climate and Weather

Utah's weather and climate are governed by altitude, latitude, and major mountain chains. These three characteristics also affect the dispersion potential of air emissions. In general, the main chain of the Rocky Mountains provides a barrier from cold Arctic weather, whereas the Sierra Nevada and Cascade Mountains often prevent low-level, Pacific-storm moisture from reaching Utah. The proximity of the tract to the Wasatch Range and Plateau strongly influences its weather. The prevailing winds of the Pahvant Range and the Tushar and Brian Head mountains are westerly, and storms moving into Utah from the west encounter the south-central mountains. This mountainous terrain causes the air to rise and cool (orographic lifting), which squeezes out moisture that would otherwise pass over the area. These mountain chains also act as barriers to air mass flow and are responsible for the aridity of areas east of the mountains, which are characterized by hot, dry summers and cold, dry winters.

Synoptic (large scale) flow dominates the airflow on the mesa all along the Wasatch Plateau. In the absence of strong prevailing winds, wind movement within the valleys, canyons, and gulches is extremely complex. The terrain features suggest that there is a daily exchange of downslope and upslope flows oriented along the valley axis, which is controlled by surface heating and cooling. Downslopes (i.e., drainage flows) last longer and occur during the evening, night, and early morning hours, whereas upslope flows occur mid-day, when temperatures are at their high. Significant diurnal drainage flows can be expected along the south-central mountains. Drainage flows (slope and valley winds) commonly occur with local topographical features and may be accompanied by temperature inversions.

Daily and annual air temperatures differ considerably throughout the area and can vary greatly depending on elevation, as evidenced by monitoring data from the Western Regional Climate Center (WRCC) and from the National Oceanic and Atmospheric Administration (NOAA). Temperature recorded near the tract has annual, mean daily highs and lows ranging from 60.0°F to 31.1°F, respectively. July is the hottest month, with mean daily highs and lows ranging from 82.2°F to 50.0°F, respectively (WRCC 2010). At a higher elevation nearby, the recorded annual, mean daily temperature at Bryce Canyon National Park is 40.6°F and the annual normal highs and lows range from 54.6°F to 26.6°F. July is the hottest month with a mean daily temperature of 62.5°F, with mean daily highs and lows ranging from 78.3°F to 46.6°F (NOAA 2004).

Average annual precipitation in the area is 16.6 inches (WRCC 2010). This value compares well with the Bryce Canyon National Park data, which show average annual precipitation of 16.4 inches (NOAA 2004).

Complete weather data at the tract are not available. Based on direction from the UDAQ, data recorded at the Cedar City Station at the airport in Cedar City, Utah, approximately 43 miles northwest of the tract, are considered representative of the tract's location (UDAQ 2008). These data comprise the only complete weather dataset available for air dispersion modeling near the tract and the reasonably foreseeable coal haul transportation route. Although a meteorological station is near the Coal Hollow

Mine, its placement is 2 meters above ground rather than 10 meters—the required height for data to be used for modeling. In addition, only wind speed and wind direction data are collected at this station; estimation of hourly stability class for modeling would require using the data from Cedar City. Therefore, the data collected at the Coal Hollow Mine are not adequate for use in a dispersion model. Cedar City is warmer than Alton and has an annual, mean daily temperature of 50.5°F, with annual, normal highs and lows ranging from 64.4°F to 36.5°F. July is the hottest month with a mean daily temperature of 73.6°F, with mean daily highs and lows ranging from 89.4°F to 57.8°F (NOAA 2004).

Wind data collected from Cedar City indicate that prevailing winds are from the south-southwest. A representative windrose is shown in Figure 3.3.1. A distinct bimodal trend is not apparent at this location.

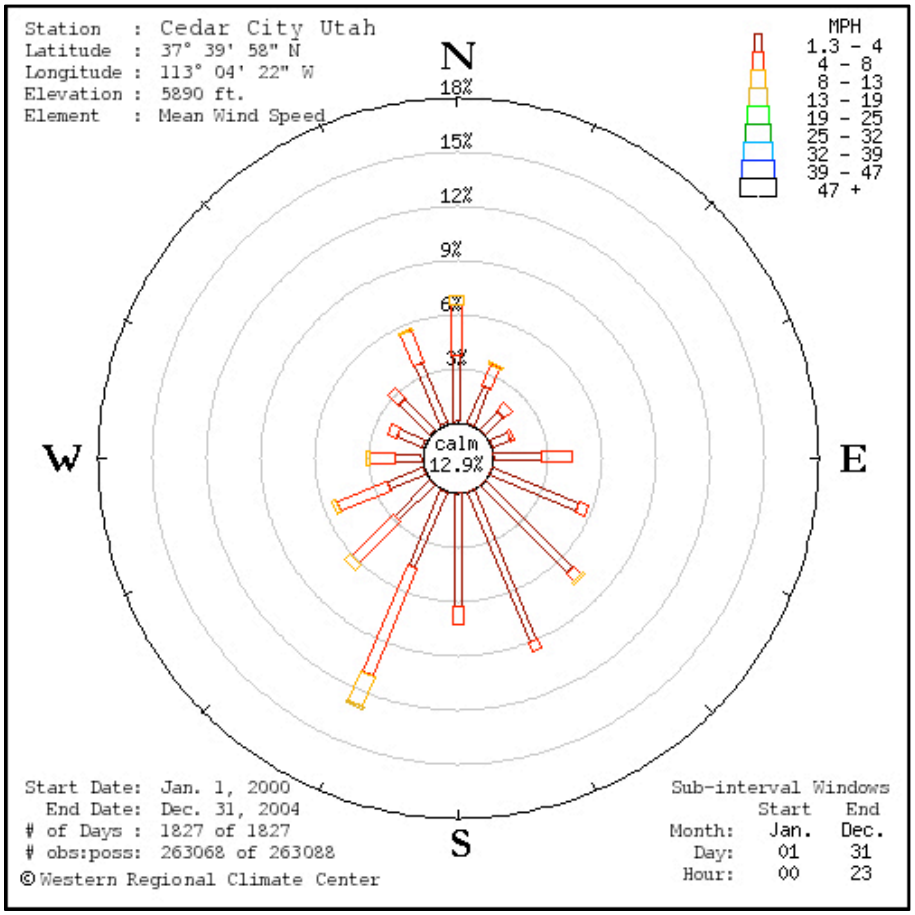

Figure 3.3.1. Windrose generated from Cedar City weather data (Community Environmental Monitoring Program 2011).

3.3.2 Regulatory Requirements

3.3.2.1 NATIONAL AMBIENT AIR QUALITY STANDARDS

EPA established NAAQS for six pollutants known as "criteria" pollutants. They are carbon monoxide (CO), NO_2, ozone (O_3), lead (Pb), sulfur dioxide (SO_2), and PM. PM is defined as fine particulates with a nominal aerodynamic diameter of 10 micrometers or less (PM_{10}), and fine particulates with a nominal aerodynamic diameter of 2.5 micrometers or less ($PM_{2.5}$). The primary standards for the criteria pollutants are health-based standards. They are set at levels to protect the health of the most sensitive individuals in the population: the very young, the very old, and those with respiratory problems or other ailments. The EPA also established secondary standards for the criteria pollutants. These are the quality of life standards that are the same as the primary standards or less stringent than the primary standards. All of the standards are expressed as concentration and duration of exposure, and most address both short-term and long-term exposure.

NAAQS for the criteria pollutants are presented in Table 3.3.1 (40 CFR 50.1–50.17). With the exception of the PM_{10} values, which are from the UDAQ state permitting documents for the Coal Hollow Mine, recorded concentrations and their associated locations are presented to show that NAAQS pollutant concentrations around the state are generally low at locations similar to the tract. These concentrations are not indicative of air quality at the tract. PM_{10} is currently being monitored at Coal Hollow Mine, and monitoring results are discussed in Chapter 4, Section 4.3.3.1.

When a designated air quality area or airshed within a state exceeds a NAAQS, that area may be designated as a "nonattainment" area. Areas with levels of a criteria pollutant below the health-based standard are designated as "attainment areas." It is possible for a geographic area to be an attainment area for one criteria pollutant, but a nonattainment area for another. To determine whether an area meets the NAAQS, air-monitoring networks have been established and are used to measure ambient air quality. Monitoring sites, by design, are in areas where high concentrations within a region are expected to occur. The Utah air quality map shows the monitoring station locations within the State of Utah (Map 3.6).

Table 3.3.1. Environmental Protection Agency National Ambient Air Quality Standards and Recorded Concentrations

Pollutant	Standard Value[*, **]	Recorded Concentration[‡]	Location[‡]
CO			
8-hour average	9 ppm (10 mg/m^3)[†]	1 ppm (1,150 µg/m^3) (estimate)	Kane County
1-hour average	35 ppm (40 mg/m^3)[†]	1 ppm (1,150 µg/m^3) (estimate)	
NO_2			
Annual arithmetic mean	0.053 ppm (100 µg/m^3)[†]	17 µg/m^3 (estimate)	Kane County
1-hour average	0.1 ppm (188 µg/m^3) [†]	n/a	
O_3			
1-hour average	0.12 ppm (235 µg/m^3)[†, ††]	n/a[††]	Canyonlands National Park[¥]
8-hour average	0.075 ppm (effective 5/27/2008)	0.072 ppm	
Pb			
Quarterly average	1.5 µg/m^3	0.08 µg/m^3	Magna, Salt Lake County[¥¥]
PM_{10}			
Annual arithmetic mean	Revoked[§]	23 µg/m^3	UDAQ
24-hour average	150 µg/m^3	72 µg/m^3	

Table 3.3.1. Environmental Protection Agency National Ambient Air Quality Standards and Recorded Concentrations

Pollutant	Standard Value[*, **]	Recorded Concentration[‡]	Location[‡]
$PM_{2.5}$			
Annual arithmetic mean	12.0 µg/m^3[§]	2.8 µg/m^3 [§§]	Bryce Canyon[§§]
24-hour average	35 µg/m^3[§]	9.5 µg/m^3 [§§]	
SO_2			
Annual arithmetic mean	0.03 ppm (80 µg/m^3)[†]	5 µg/m^3 (estimate)	Kane County[‡]
24-hour average	0.14 ppm (365 µg/m^3)[†]	10 µg/m^3 (estimate)	
1-hour average	75 ppb	n/a	
3-hour average (secondary standard)	0.5 ppm (1,300 µg/m^3)[†]	20 µg/m^3 (estimate)	

[*] CO = primary standard; NO_2, O_3, Pb, and PM = primary and secondary standards; SO_2 = annual arithmetic mean.
Mean and 24-hour average are primary standards, 3-hour average is a secondary standard.
ppm = parts per million; ppb = parts per billion.

[†] Parenthetical value is an approximate equivalent concentration in micrograms per cubic meter (µg/m^3) or milligrams per cubic meter (mg/m^3).

[‡] Data from (2008, 2010). PM_{10} value is from the UDAQ state permitting for the Coal Hollow Mine.

[¥] Data from (NPS 2008a). The recorded value is based on the 4th high.

[§] Effective December 14, 2012. Annual mean averaged over three years; 24-hour, 98th percentile averaged over three years.

[**] The 1-hour NO_2 NAAQS became effective April 12, 2010. The final 1-hour SO_2 NAAQS was signed on June 2, 2010.

[††] Data from 40 CFR 50.1–50.17. Applies only in limited areas; as of June 15, 2005, EPA revoked the 1-hour O_3 standard in all areas except the fourteen 8-hour O_3 nonattainment Early Action Compact areas. The tract is not in an Early Action Compact area.

[¥¥] Data from (EPA 2005a).

[§§] Data from (NPS 2008c). $PM_{2.5}$ background is from the Bryce Canyon National Park IMPROVE Site. The most recent three-year average design values are from 2008.

3.3.2.1.1 Air Quality and Human Health

Air pollution poses known risks to human health. EPA regulates criteria air pollutants and hazardous (or toxic) air pollutants because they are considered harmful to public health and the environment at concentrations above established standards.

Of the six criteria pollutants, PM and O_3 present the most widespread health risks. Studies have linked PM exposure to health problems such as irrigation of the airways, coughing, difficulty breathing, reduced lung function, aggravated asthma, chronic bronchitis, irregular heartbeat, nonfatal heart attacks, and some cancers (EPA 2013f). Research has found that certain populations are more vulnerable to these health effects, such as people with pre-existing heart or lung diseases, children, and older adults. Research has also confirmed links between exposure to $PM_{2.5}$ and increases in respiratory health problems, hospitalizations, and premature death (EPA 2013f).

Specifically for coal workers, exposure to coal mine dust causes various pulmonary diseases, including coal workers' pneumoconiosis and chronic obstructive pulmonary disease. These lung diseases can bring about impairment, disability, and premature death (Department of Health and Human Services 2011).

Atmospheric PM comprises many different chemical components that vary by location and time. In addition, fine- and coarse-fraction PM particles have fundamentally different sources and composition. Based on studies conducted throughout most of the United States, sulfate, ammonium, and hydrogen ions; elemental carbon, secondary organic compounds, and primary organic species from cooking and combustion; and certain metals, primarily from combustion processes, are found predominately in fine particles of ambient PM (EPA 2005b). Crustal-related materials, such as calcium, aluminum, silicon, magnesium, and iron, and primary organic materials such as pollen, spores, and plant and animal debris, are found predominately in coarse particles of ambient PM. Some components, such as potassium and

nitrate, may be found in both fine and coarse particles (EPA 2005b). Many PM components can be linked with differing health effects, but the evidence is not yet sufficient to allow differentiation of those components that are more closely related to specific health outcomes (EPA 2012f). Therefore, health effects from particular components of PM cannot be separated out at this time.

Breathing O_3 can trigger a variety of health problems such as chest pain, coughing, throat irritation, and congestion. It can worsen bronchitis, emphysema, and asthma. Ground-level O_3 also can reduce lung function and inflame the linings of the lungs. Repeated exposure to O_3 may permanently scar lung tissue (EPA 2012d).

Exposure to CO can cause harmful health effects by reducing oxygen delivery to the body's organs and tissues. At extremely high levels, CO can cause death (EPA 2012c). Current scientific evidence links short-term NO_2 exposures (ranging from 30 minutes to 24 hours) with adverse respiratory effects, such as airway inflammation in healthy people and increased respiratory symptoms in people with asthma. Also, studies show a connection between breathing elevated short-term NO_2 concentrations with increased visits to emergency departments and hospital admissions for respiratory issues, especially asthma (EPA 2013d). Current scientific evidence links short-term exposures to SO_2 (ranging from 5 minutes to 24 hours) with adverse respiratory effects, including bronchoconstriction and increased asthma symptoms. Studies also show a connection between short-term exposure and increased visits to emergency departments and hospital admissions for respiratory illnesses, particularly in at-risk populations such as children, the elderly, and asthmatics (EPA 2012g).

Depending on the level of exposure, lead can adversely affect the nervous system, kidney function, immune system, reproductive and developmental systems, and the cardiovascular system. Lead exposure also affects the oxygen carrying capacity of the blood. Infants and young children are especially sensitive to even low levels of lead, which may contribute to behavioral problems, learning deficits, and lowered IQ (EPA 2012e).

With regard to hazardous air pollutants (HAPs), people exposed at sufficient concentrations and durations may have an increased chance of getting cancer or experiencing other serious health effects. These health effects can include damage to the immune system, as well as neurological, reproductive (e.g., reduced fertility), developmental, respiratory, and other health problems (EPA 2012a).

Because NAAQS are the legal guidelines that have been established to protect human health and the environment from criteria air pollutants, the air quality analysis in Chapter 4 examines compliance with the NAAQS. Action alternatives that are compliant with the NAAQS are assumed to be protective of human health and the environment. HAP emissions have been compared with known health exposure levels (from the EPA's Integrated Risk Information System) to provide an assessment of potential impacts on human health.

3.3.2.2 CLASS I AREAS AND CLASS II AREAS

Clean air designations were established under the federal CAA Title I, Part C, Prevention of Significant Deterioration (PSD) of Air Quality. Generally, the Class I air quality and land use classification is the designation for clean, pristine airsheds and would permit little or no development, and the Class II designation is applied to all other clean airsheds (in attainment of the NAAQS) where development is permitted under state authority. Class I areas include national parks larger than 6,000 acres, national wilderness areas larger than 5,000 acres, and international parks and national memorial parks larger than 5,000 acres. Except for fires and wind erosion, the only potential for adverse air quality impacts in Class I areas is from anthropogenic pollutants transported into these areas by large-scale winds, local winds, or both. Areas in the United States that have ambient air quality concentrations greater than those specified in the NAAQS are designated as nonattainment areas; the remainder of the country is designated Class II.

3.3.2.3 PREVENTION OF SIGNIFICANT DETERIORATION

In addition to the NAAQS discussed above, the EPA promulgated PSD regulations to further protect and enhance air quality. The PSD regulations use an incremental approach and are intended to help maintain good air quality in areas that attain the national standards and to provide special protections for national parks. These increments establish the maximum increase in pollutant concentration allowed above a baseline level. Complete consumption of an increment would impose a restriction to growth for the affected area. It does not necessarily indicate an adverse health impact. PSD permits are required for major, new stationary sources of emissions that emit 250 tons (100 tons for some specific sources) or more per year of a criteria air pollutant where the source is in an attainment or unclassifiable area. Increment consumption for major sources is tracked by the State of Utah as permits are issued. The maximum allowable PSD increments over baseline are in Table 3.3.2.

Table 3.3.2. Prevention of Significant Deterioration of Air Quality Increments: Maximum Allowable Increase ($\mu g/m^3$)

Pollutant	Averaging Time	Class I	Class II
PM_{10}	24 hour	8	30
$PM_{2.5}$	Annual	n/a	n/a
	24 hour	n/a	n/a
SO_2	Annual	2	20
	24 hour	5	91
	3 hour	25	512
NO_2	Annual	2.5	25

3.3.2.4 AIR QUALITY–RELATED VALUES

Federal land managers have identified AQRVs to be protected in federal areas such as national parks and national forest Class I areas. AQRVs are scenic, cultural, physical, biological, ecological, or recreational resources that may be affected by a change in air quality, as defined by the federal land manager. Specific AQRVs of concern are dependent on a number of variables, including the evolving state of the science, project-specific pollutants, site-specific management concerns, and the existing condition of the AQRVs. Refer to Section 3.3.3 Existing Air Quality for a discussion of specific AQRVs (visibility, acid deposition, acid neutralizing capacity, flora, and fauna).

3.3.2.5 GLOBAL CLIMATE CHANGE

Scientific investigation continues concerning the rise in global mean temperatures, the causes of this rise, and whether a warming trend will continue. Greenhouse gases (GHGs) have been identified as a contributor to the rise in global mean temperatures. Ongoing scientific research has identified the potential impacts of anthropogenic (from human activities) GHG emissions and changes in biologic carbon sequestration on the global climate. Through complex interactions on a regional and global scale, these changes are likely causing a net warming effect of the atmosphere, primarily by decreasing the amount of heat radiated by the earth back into space, much as glass traps heat over a greenhouse.

GHGs absorb infrared radiation and trap its heat in the atmosphere. Many gases exhibit GHG properties; some occur naturally, such as carbon dioxide (CO_2), CH_4, water vapor, O_3, and nitrous oxide (N_2O). Others are synthetic, such as chlorofluorocarbons, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. Some of the naturally occurring GHGs are also produced by anthropogenic activities. The

study of global climate change is complex because there are many factors that may contribute to changes in the earth's temperature, including the emission of GHGs, as well as the earth's ability to remove these gases from the atmosphere through mechanisms such as photosynthesis and ocean uptake. Analysis of climatic change comprises several factors, including GHG emissions, land use management practices, and the albedo effect (i.e., the cycle of increased temperature resulting from the increased absorption of normally reflected light).

The predominant GHGs emitted in the United States are CO_2, CH_4, N_2O, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. In the United States, anthropogenic GHG emissions come primarily from burning fossil fuels, which accounted for 94% of CO_2 emissions in 2011. Globally, the United States accounted for approximately 18% of the CO_2 added to the atmosphere through the combustion of fossil fuels in 2010 (EPA 2013c).

CH_4 emissions from landfills, coal mines, oil and natural gas operations, and agriculture accounted for 9% of United States GHG emissions in 2011. N_2O emitted from agricultural and industrial activities, as well as during the combustion of fossil fuels and solid waste, accounted for 5% of total 2011 GHG emissions. Several human-made fluorinated gases accounted for 2% of the total (EPA 2013e).

GHG inventories are usually reported in terms of "CO_2 equivalents" to account for the relative global warming potential (GWP), or a given pollutant's ability to trap heat. For example, CH_4 has a GWP of 21, meaning it is 21 times more effective at trapping heat than CO_2. N_2O has a GWP of 310, meaning it is 310 times more effective at trapping heat than CO_2. Hydrofluorocarbons range from 140 to 11,700 GWP, whereas perfluorinated compounds range from 6,500 to 9,200 GWP.

There are many regional sources that may contribute to global climate change, including those sources presented in Table 3.3.3. It is likely that all of the sources discussed above for the United States would be found near the tract or within the State of Utah.

3.3.3 Existing Air Quality

3.3.3.1 BACKGROUND AIR QUALITY AND REGIONAL SOURCES

Existing air quality near the tract is expected to be typical of undeveloped regions in the western United States. Limited data collected in typical undeveloped areas indicate that ambient pollutant levels are usually near or below measurable limits. Locations vulnerable to decreasing air quality include areas adjacent to surface-disturbing activities, such as energy and mineral development projects, farm tilling, and local population centers affected by residential emissions.

Data from the 2011 UDAQ statewide emissions inventory report for Kane County and Utah are shown in Table 3.3.3. The report summarizes criteria pollutant levels in tons per year (TPY) by source type. The data illustrate that emissions in Kane County are a small percentage of statewide totals.

The greatest sources of NO_x and PM_{10} in Kane County are onroad mobile sources (automobiles and trucks traveling on established roads) and area sources (small mobile and stationary sources such as gas stations or wood burning).

Local sources of air pollution include automobiles, trains, generators, and wood burning stoves and fireplaces (in the winter). These sources typically generate CO, NO_2 and other NO_x, volatile organic compounds (VOCs), and PM_{10}. Additionally, O_3, a highly reactive form of oxygen, typically forms when NO_x and VOC emissions from these sources react with sunlight on hot, still days. With the removal of leaded gasoline in the marketplace, and the absence of industries such as nonferrous smelters and battery plants, airborne-lead pollution is not an issue of concern in the area. In fact, lead is currently monitored only in Salt Lake County, Utah (EPA 2005a).

The tract is classified as attainment for all criteria pollutants. No state monitoring stations exist near the tract. Background air quality levels are derived from several sources, as identified in the footnotes of Table 3.3.1. Concentrations are also presented in Figure 3.3.2.

Table 3.3.3. 2011 Summary of Emissions by Source (tons per year) for Kane County and Utah

Location	Source	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_x	VOC
Kane County	Area source	1,329.38	42.03	617.53	226.83	23.62	498.46
	Nonroad mobile	1,968.02	87.02	21.43	19.85	0.54	695.11
	Onroad mobile	1,662.00	506.70	24.06	20.06	1.72	157.98
	Point source	4.24	18.14	17.44	2.54	2.97	0.60
	Biogenics	9,133.20	0.00	0.00	0.00	0.00	47,897.91
	Wildfires	21.24	0.60	2.57	2.31	0.00	3.63
	Total	**14,118.08**	**654.50**	**683.04**	**271.59**	**28.85**	**49,253.69**
Utah Total	Area source	35,123.64	8,379.32	37,990.71	9,935.03	949.72	49,702.14
	Nonroad mobile	129,500.14	19,507.12	1,627.11	1,533.44	759.02	22,628.88
	Onroad mobile	284,789.60	68,109.31	3,489.90	2,732.85	332.82	25,282.43
	Point source	28,181.29	69,519.51	9,356.69	4,771.06	25,109.88	5,667.66
	Biogenics	136,583.55	0.00	0.00	0.00	0.00	754,396.36
	Wildfires	11,562.59	329.18	1,399.03	1,259.13	0.00	1,975.10
	Total	**625,740.81**	**165,844.44**	**53,863.43**	**20,231.51**	**27,151.44**	**859,652.57**
Kane County Percentage of Utah		2.3%	0.4%	1.3%	1.3%	0.1%	5.7%

Source: UDAQ (2011).

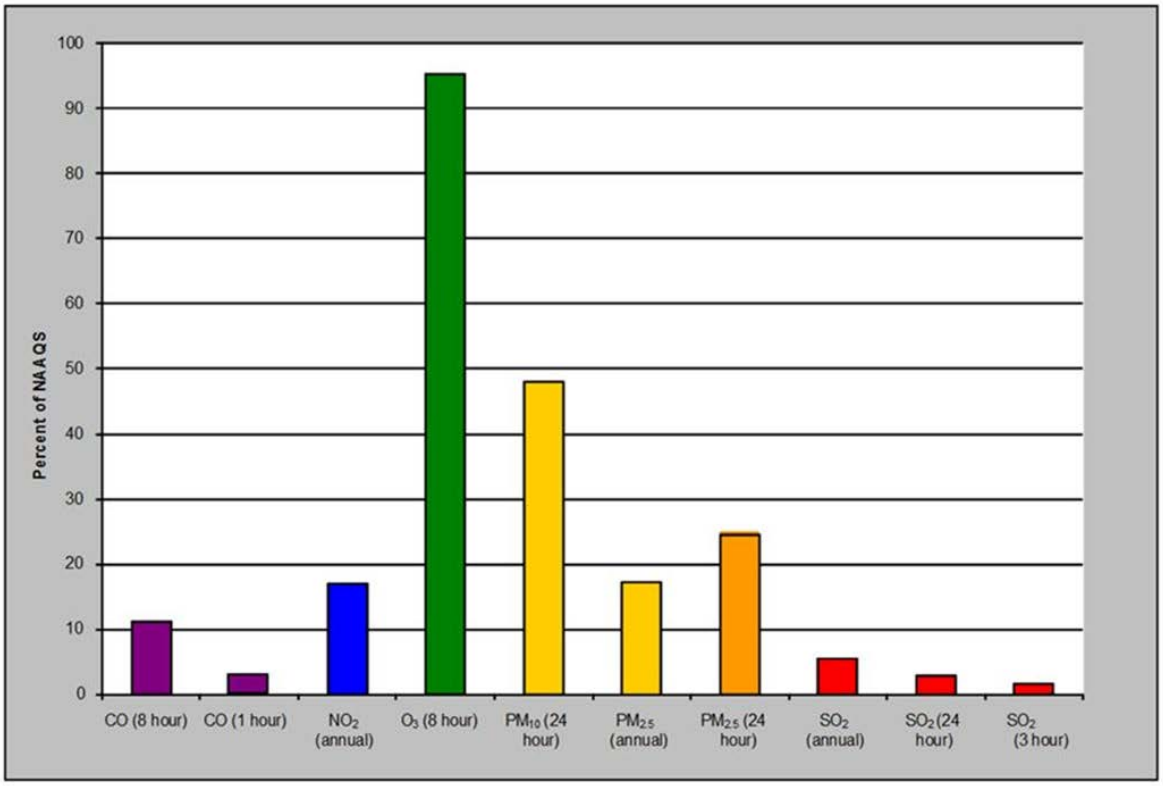

Figure 3.3.2. Background concentrations of criteria pollutants.

The location of the tract is designated as a Class II area for the criteria pollutants. There are several Class I and sensitive Class II parks near the tract, including Bryce Canyon, Zion, Capitol Reef, and Grand Canyon national parks (all Class I), and Grand Staircase-Escalante National Monument (Class II). The closest Class I area is Bryce Canyon National Park, which is approximately 16.1 km (10 miles) from the tract. This distance is measured from the tract to the southwest boundary of the park. There are many regional sources that may impact the Class I areas near the tract. Table 3.3.4 lists point source emissions sources within 50 km (31 miles) of the Class I areas with emissions greater than PSD thresholds (emissions greater than 250 TPY of an air pollutant), as they existed during a 1996 study with available updates noted in the table. PSD sources have the potential for significant impact, and more restrictive permitting requirements are generally imposed. No additional PSD sources were found as part of this air quality analysis. The largest contributors to air pollutant emissions in the region are power plants and generating stations (WRAP 1996).

Table 3.3.4. Sources Near the National Park Class I Areas: Bryce, Zion, Capitol Reef, Grand Canyon

Facility (Class I area in parentheses)	Emissions (TPY)				
	VOC	NO_x	SO_2	PM_{10}	$PM_{2.5}$
Carbon Power Plant Helper, Utah (Capitol Reef)*	18	3,380	6,765	221	38.8
Chemical Lime Co. Nelson Lime Plant, Arizona (Grand Canyon)	16.9	719	122.2	355.7	188.5
El Paso Natural Gas Co. Environmental AF, Arizona (Grand Canyon)	975.6	2,556.4	0.5	0	0
El Paso Natural Gas Company Flagstaff Co, Arizona (Grand Canyon)	28.9	1,068.2	0.2	0	0
El Paso Natural Gas Company Hackberry Co, Arizona (Grand Canyon)†	14.2	461.0	0.3	10.7	0
El Paso Natural Gas Company Williams Com, Arizona (Grand Canyon)	19.6	1,508.4	0.6	0	0
Hunter Power Plant, Castle Dale, Utah (Capitol Reef)*	130	19,869	7,029	1,226	583.2
Huntington Power Plant, Huntington, Utah (Capitol Reef)*	82	11,198	13,714	1,067	341.8
Intermountain Generation Station (Delta, Utah) (Capitol Reef)	0.4	19,688.3	3,758.8	100.5	19.0
Moab Compressor Station, Moab, Utah (Capitol Reef)	17.1	470.4	0	2.3	2.3
Navajo Power Plant, Page, Arizona (Bryce, Zion, Capitol Reef, Grand Canyon)‡	196.4	34,744	3,843	1,560.7	708.1
Phoenix Cement Portland Cement Plant, Arizona (Grand Canyon)	0	2,628.3	196.5	179	94.9
Reid Gardner, Nevada (Bryce, Zion, Grand Canyon)	49.8	14,288.3	3,547.1	874.1	874.1
Transwestern Pipeline Company, Arizona (Grand Canyon)	59.1	1,319.9	1.1	2	1.4

Source: WRAP (1996), except as noted below.

* VOC, NO_x, SO_2, and PM_{10} emissions updated data from USFS (2009).

† VOC, NO_x, SO_2, and PM_{10} emissions updated data from EPA (2009).

‡ O_x and SO_2 emissions updated with 2006 emissions data from Sourcewatch (2009).

Projected emissions for the Coal Hollow Mine are presented in Table 3.3.5. Based on the potential emissions, the facility would not be a major emissions source under the PSD or Title V programs. This mine would not be in operation during the operation of the tract.

Table 3.3.5. Coal Hollow Mine Potential to Emit

Emissions (TPY)					
VOC	NO_x	SO_2	PM_{10}	$PM_{2.5}$	CO
5.5	26.1	31.5	75.65	10.5	9.1

Note: Actual monitored quarterly PM_{10} values from the Coal Hollow Mine are presented in Section 4.3.3.1.

3.3.3.2 VISIBILITY

Visibility is the degree to which the atmosphere is transparent to visible light. Visibility is a measure of how far and how well one can see. Pollutant particles and aerosols scatter and absorb light, which impairs visibility (NPS 2012a). It is an important air quality value, particularly in scenic and recreational areas. Scenic vistas in most United States parklands can be diminished by haze, which reduces contrast, dilutes colors, and reduces the distinctness or visibility of distant landscape features. Visibility degradation in national park lands and forests is a consequence of broader, regional-scale visibility impairment from visibility-reducing particles and their precursors often carried long distances to these remote locations.

Sulfates, organic matter, elemental carbon (soot), nitrogen compounds, soil dust, and their interaction with water cause most anthropogenic visibility impairment. The causes and severity of visibility impairment vary over time and from one place to another, depending on weather conditions, sunlight, and the size and proximity of emission sources.

Visibility protection requirements are included in EPA PSD regulations, which require protection of AQRVs for Class I areas. These AQRV impacts are subjective and intended to be used as guidelines for assessing potential project impacts and not as definitive regulatory thresholds. A threshold change in light extinction of 5% or more contributes to regional haze visibility impairment, and a threshold change of 10% or more causes visibility impairment, as described in the Federal Land Managers Air Quality Related Values Work Group (FLAG) 2010 guidance (USFS et al. 2010). Unlike NAAQS standards and PSD increments, an exceedance of the threshold does not, by itself, cause a project to be halted. Regulatory factors and contextual considerations (e.g., current pollutant concentrations and AQRV impacts, air quality trends in the area, expected life of the source, stringency of the emission limits, emission changes in the area, and public comments) must also be evaluated. As discussed in the previous section, the Bryce Canyon, Zion, Capitol Reef, and Grand Canyon national parks (all Class I) and the Grand Staircase-Escalante National Monument (Class II) are near the tract. The State of Utah has addressed both visibility and regional haze in the Class I areas in two state implementation plans. The *Utah State Implementation Plan Section XVII Visibility Protection* report (State of Utah 1993) addresses visibility protection of Utah's natural features and uses a two-phased approach. The first phase implements a visibility monitoring strategy and considers direct plume impacts on visibility from proposed new sources. The second phase addresses the development of a long-term plan to show progress toward national visibility protection goals. This document is still in force but has not been revised since 1993.

More current information is available in the revised *Utah State Implementation Plan Section XX Regional Haze* (State of Utah 2008). This document contains measures addressing regional haze visibility impairment to ensure that the state makes reasonable progress toward national goals. The state has implemented long-term strategies to reduce regional haze resulting from various air pollution sources. For most Class I areas in the region, stationary source NO_x and PM emissions are not considered a major contributor to visibility impairment on the average 20% best and 20% worst days; although, on some of the worst days, nitrates and PM are the main components of visibility impairment. Pollutant projections affecting regional haze, as identified in the state implementation plan, include the following:

- 33% decrease in Utah sources and 53% decrease in SO_2 emissions for the nine states in the Grand Canyon Visibility Transport Commission (GCVTC) between 1996 and 2018
- 36% decrease in Utah sources and 57% decrease in NO_x emissions for the nine states in GCVTC between 1996 and 2018
- 38% decrease in Utah sources and 31% decrease in $PM_{2.5}$ emissions for the nine states in GCVTC between 1996 and 2018
- Visibility improvement for the 20% best and worst days for each of the Class I areas (Bryce Canyon, Zion, Capitol Reef, and the Grand Canyon national parks) between 1996 and 2018

The State of Utah's reductions in SO_2 are primarily due to that state's long-term strategy for stationary sources of SO_2 (State of Utah 2008). Reductions in NO_x and $PM_{2.5}$ have resulted from the implementation of new federal engine standards and fuel standards; however, stationary source NO_x emissions are projected to increase by 4% between 1996 and 2018 (State of Utah 2008). Although stationary source PM emissions are projected to increase, they likely cause less than 2% of the regional visibility impairment (State of Utah 2008).

The NPS Air Resources Division defines the desired condition for visibility as < 2 deciviews above natural conditions on average visibility days. From 2005 to 2009 at Bryce Canyon National Park, the average visibility was 3.7 deciviews above natural conditions and therefore did not meet the desired condition (NPS 2012a). From 2000 to 2009, visibility on the 20% clearest days did improve significantly, but remained unchanged on the 20% haziest days (NPS 2012a). Visitor surveys have consistently concluded that good visibility and clean air are very important to the park experience (NPS 2012a).

3.3.3.3 ACID DEPOSITION

Air pollution is produced when acid chemicals are incorporated into rain, snow, fog, mist, dust, or smoke. Some of this air pollution falls to the ground as acid deposition. Atmospheric deposition of air pollutants can increase the acidity of soils and water resources. The acid comes from sulfur oxides (SO_x), NO_x, products of burning coal and other fuels, and from certain industrial processes. Wet deposition refers to acidic rain, fog, snow, or mist. Dry deposition occurs when acid chemicals are incorporated into dust or smoke (usually in areas where the weather is dry). Title IV of the CAA sets a goal of reducing annual SO_2 emissions by 10 million tons below 1980 levels. To achieve these reductions, the law requires a two-phase tightening of the restrictions placed on fossil fuel–fired power plants.

Measurements of atmospheric deposition are currently being taken in Class I areas of Grand Canyon and Bryce Canyon national parks by the National Acid Deposition Program. The *2008 Annual Performance & Progress Report: Air Quality in National Parks* (NPS 2009a) indicates that rates of atmospheric deposition of nitrogen and sulfur in rain are relatively low in Bryce Canyon National Park, but are elevated above natural conditions. Trends analyses for both Bryce Canyon and Grand Canyon national parks show that the deposition of nitrogen and sulfur has no statistical trend between 1998 and 2007 (NPS 2009a). A March 2012 *Air Quality Resources at Bryce Canyon National Park* briefing paper contains more recent nitrogen and sulfur data (NPS 2012a). From 2005 to 2009, estimated wet nitrogen deposition in Bryce Canyon National Park was 1.7 kilogram (kg)/hectare(ha)/year, and estimated wet sulfur deposition was 0.7 kg/ha/year. The NPS's desired condition for both nitrogen and sulfur wet deposition is defined as < 1 kg/ha/year. Current total nitrogen deposition (wet plus dry) at Bryce Canyon National Park is estimated to be 2.5 kg/ha/year. From 2000 to 2009, nitrate decreased significantly and sulfate was relatively unchanged.

Kane County does not have significant sources of acid deposition; however, there are significant, nearby regional power plants that are listed in Table 3.3.4. Regional acid deposition sources in Utah include the Carbon Power Plant (Phase II acid rain source that has been issued a Phase I acid rain permit by the EPA for early NO_x reduction), the Hunter Power Plant (Phase II acid rain source), the Huntington Power Plant (Phase II acid rain source), and the Intermountain Generation Station (Group I [dry bottom, wall-fired, tangential boilers], Phase II acid rain source) (UDAQ 2009). Phase I began in 1995 and affected mostly coal-burning electric utility plants. Phase II sources consist of existing utility units serving generators with an output capacity of greater than 25 mW, and all new utility units (EPA 2012b). The acid deposition provisions for these facilities refer to coal-fired utility units that are subject to an acid rain emission limitation or reduction requirement for SO_2 under the CAA. Although there are significant acid deposition sources in the region, the tract would not be considered a significant acid deposition source.

3.3.3.4 FLORA AND FAUNA

Pollutant emissions from larger point sources may impact flora and fauna at the Class I areas; however, the sensitivity of ecosystem response to increased pollutant emissions from these particular sources is not well documented. Because emissions from the tract would be a small percentage of the existing regional sources, an in-depth review of these regional sources was not performed.

3.3.3.5 GENERAL CONFORMITY

To eliminate or reduce the severity and number of NAAQS violations in nonattainment areas and to achieve expeditious attainment of the NAAQS, the EPA promulgated the Conformity Rule (40 CFR 6, 51, 93). The Conformity Rule applies to federal actions and environmental analyses, in nonattainment areas, completed after March 15, 1994. This rule contains a variety of substantive and procedural requirements to show conformance with both the NAAQS and state implementation plans. The nonattainment/maintenance areas in Utah (Reiss 2013; UDAQ 2013b) are as follows:

- $PM_{2.5}$: part of Utah County; part of Cache County in Utah, and Franklin County in Idaho; and Salt Lake, Davis, and parts of Weber, Box Elder, and Tooele counties are nonattainment.
- PM_{10}: Salt Lake and Utah counties and Ogden (Weber County) are nonattainment.
- SO_2: Salt Lake County and the east portion of Tooele County (above 5,600 feet) are nonattainment. Redesignation is pending for Salt Lake County.
- CO: Ogden City (maintenance area redesignated in 2001); Salt Lake City (maintenance area redesignated in 1999); and Provo and Orem in Utah County (maintenance area redesignated 2006).
- O_3: Davis and Salt Lake counties (maintenance areas redesignated 1997).

The tract is in Kane County. This county is in attainment of the NAAQS for all criteria pollutants, as defined under the EPA.

3.3.3.6 GREENHOUSE GASES

According to the EPA, over the last century, the average annual temperature in the Southwest (defined as Utah, California, Nevada, parts of Colorado, Arizona, parts of New Mexico, and parts of Texas) has increased approximately 1.5°F (EPA 2013a). The average annual temperature is projected to rise an additional 2.5°F–8.0°F by the end of the century. Warming has already contributed to decreases in spring snowpack and Colorado River flows. Warming in the Southwest is projected to be greatest in the summer, and future warming is projected to produce more severe droughts in the region, with reductions in water supplies (EPA 2013a). In general, the EPA indicates the following:

- Increasing temperatures and more frequent, severe droughts will likely worsen existing competition for water resources.
- Drought, wildfire, changes in species' geographic ranges, invasive species, and pests will likely threaten native Southwest forests and ecosystems.
- It may become difficult for the Southwest's growing cities to attain air quality standards and meet energy and water demands.
- Climate change poses threats to the region's native peoples, infrastructure, agriculture, and recreational activities (EPA 2013a).

In Utah, the average temperature from approximately 1997 to 2007 was higher than observed during any comparable period of the past century and was roughly 2°F higher than the 100-year average (Blue Ribbon Advisory Council 2007). Utah is projected to warm more than the average for the entire planet and more than the coastal regions of the contiguous United States. The expected consequences of this warming are fewer frost days, longer growing seasons, and more heat waves. Ongoing GHG emissions at or above current levels will likely result in the following: 1) a decline in Utah's mountain snowpack and 2) a possible severe, prolonged, episodic drought (Blue Ribbon Advisory Council 2007).

Weather data collected over the past six or seven decades at Bryce Canyon National Park indicate a trend toward fewer days with complete freeze/thaw cycles, from an average of approximately 203 days in 1955 to approximately 177 days in 2010 (10-year averaging). Fewer frost days in long-term weather patterns could impact geologic processes in Bryce Canyon National Park. Annual mean minimum temperatures have increased from an average of approximately 25°F in 1955 to approximately 29°F in 2010; annual mean maximum temperatures have slightly decreased from an average of approximately 57°F to approximately 56°F during the same time period (10-year averaging). Annual total precipitation has decreased from approximately 110 inches to 80 inches from 1945 to 2010 (10-year averaging) (NPS/NOAA 2013). Temperature and precipitation changes could impact vegetation, soils, wildlife, and other resources in Bryce Canyon National Park.

Climate change analyses comprise several factors, including GHGs (which include CH_4 and CO_2), land use management practices, and the albedo effect (reflectivity of the surface, by vegetation or water). The tools necessary to quantify incremental climatic impacts of specific activities associated with those factors are presently unavailable (i.e., existing climate prediction models are not at a scale sufficient to estimate potential impacts of climate change within the analysis area). Research on how GHG emissions influence global climate change and associated effects has focused on the overall impact of emissions from aggregate regional or global sources. GHG emissions from single sources are small relative to aggregate emissions, and GHGs, once emitted from a given source, become well mixed in the global atmosphere and have a long atmospheric lifetime. The climate change research community has not yet developed specific tools for evaluating or quantifying end-point impacts attributable to the emissions of GHGs from a single source. Also, scientific literature that addresses the climate effects of individual, facility-level GHG emissions has not been identified. The current tools for simulating climate change generally focus on global and regional-scale modeling. Global and regional-scale models lack the capability to represent important small-scale processes. As a result, confidence in regional- and subregional-scale projections is lower than at the global scale. There is thus limited scientific capability in assessing, detecting, or measuring the relationship between emissions of GHGs from a specific single source and any localized impacts. As a consequence, impact assessment of effects of specific anthropogenic activities cannot be performed. Therefore, climate change analysis for the purpose of this document is limited to accounting for and disclosing the factors that contribute to climate change. Qualitative and/or quantitative evaluations of potential contributing factors within the planning area are included where appropriate and practicable.

The CEQ published the document *Draft NEPA Guidance on Consideration of the Effects of Climate Change and Greenhouse Gas Emissions* in February 2010. Although the BLM does not use draft guidance for analysis because of the potential for change before it is finalized, elements of the guidance are incorporated into the climate change analysis, including the quantification of emissions over the life of the project, inclusion of mitigation measures to reduce GHG emissions, and qualitative discussions of the link between GHG emissions and climate change.

3.4 Cultural Resources

Investigations to identify and evaluate cultural resources in the Alton Coal Tract were conducted in 2005 and 2008 by Montgomery Archaeological Consultants, Inc. on behalf of ACD (Stavish 2008a; Stavish 2007), and supplemental work was conducted by the BLM-KFO in 2007 (Zweifel 2007). The cultural resources identified on the tract during these investigations consist of prehistoric and historic archaeological sites. A programmatic agreement (PA) that defines the area of potential effects (APE) for the Alton Coal Tract LBA and that details the processes by which BLM will consider the effects of the undertaking on historic properties has been developed and is provided in Appendix M. As defined in the PA, the APE for the Alton Coal Tract LBA comprises the following:

- The entire proposed tract and a buffer extending 1 mile from the external boundaries of the tract
- The reasonably foreseeable haul route along US-89, SR-20, I-15, and SR-56 and a buffer extending 500 feet on each side of the haul route highway centerlines
- The Panguitch Historic District
- The town of Alton, Utah
- The town of Hatch, Utah

The APE, as defined in the PA, provides consideration for effects to cultural resources that may be affected by mine-related actions, include the Panguitch Historic District, which is listed on the NRHP, and Utah Heritage Highway 89 (also known as US-89) with its associated Mormon Pioneer Heritage Area.

3.4.1 Regional Overview

The tract lies in the Grand Staircase section of the Colorado Plateau Semidesert Province (Stokes 1986). An overview of the region's geology and soils, particularly with regard to the impact of surficial and bedrock units on the distribution of cultural resources in the area, is presented as Appendix C of the Montgomery Archaeological Consultants, Inc. 2005 inventory report (Lamm 2005 in Stavish 2007). The two most prominent geologic units in the region are alluvium and Tropic Shale. The 2005 report describes the possible natural impacts to cultural resources distributed on the alluvium. These include the localized slope failure or collapse of arroyo walls, the piping of finer grained sediments, the entrenching of drainages, and the potential for buried sites. Potential impacts to cultural resources distributed across the Tropic Shale include localized slope failure, surficial creep and slope wash on steeper slopes, and erosion of weathered bedrock on steep to gentle slopes. Moreover, the vertical erosion of in-situ sediments on the Tropic Shale may also distort the integrity of buried cultural resources.

3.4.1.1 CURRENT LAND USES AND IMPACTS

Current land uses in the Alton Amphitheatre and Sink Valley include farming, ranching, and mining. Over 20% of the land in the tract consists of agricultural lands, whereas cattle and other livestock graze on private farmlands and on BLM-managed pasturelands. Historic coal mining has also been conducted in the area, and three historic archaeological resources have been recorded: the Smirl Mine (42Ka4017), the Jacob A. Sorenson Mine (42Ka4019), and the Alton Mine (42Ka4091). The remnants of these mines have since been reclaimed by ongoing activities, and no evidence of their existence was documented during the 2005 cultural resource inventory (Stavish 2007).

3.4.2 Known Cultural Resources

3.4.2.1 CULTURAL-HISTORICAL OVERVIEW

A detailed review of the region's culture history and associated references is provided in Stavish (Stavish 2008b; Stavish 2007). Nonetheless, it is useful to recap that human occupation of the region is represented by the Paleoindian, Archaic, Formative, Protohistoric, and Historic cultural periods, possibly beginning as early as 11,500 years before present (BP) or earlier. Recorded sites in the tract likely date from the Early Archaic (beginning ca. 7800 BP) through Historic periods, and also include evidence for Middle and Late Archaic, Anasazi, Fremont, Numic (or Southern Paiute) activities and occupations.

3.4.2.2 ARCHAEOLOGICAL SITES IDENTIFIED IN THE TRACT

Details of the previously conducted cultural resource surveys in the tract are provided in Stavish (2008b). In all, 132 archaeological sites have been identified in the tract; Table 3.4.1 provides a list of these sites (from Stavish 2007; Stavish 2008a; Zweifel 2007).

Table 3.4.1. Recorded Archaeological Sites in the Tract

Site Number	Type	NRHP Eligibility	Land Status	Description
42KA1267	Multicomponent	Eligible	BLM	Numic lithic scatter and historic trash dump
42KA1313	Prehistoric	Eligible	BLM	Archaic, Anasazi Pueblo II, Numic temporary camp
42KA1314	Prehistoric	Eligible	BLM	Southern Paiute temporary camp, lithics, ground stone, ceramics
42KA2038	Prehistoric	Eligible	BLM	Southern Paiute
42KA2039	Prehistoric	Eligible	BLM	Late Archaic, Numic
42KA2040	Prehistoric	Eligible	Private	Southern Paiute lithic and pottery scatter
42KA2041	Prehistoric	Eligible	BLM, Coal Hollow	Anasazi, Southern Paiute
42KA2043	Prehistoric	Eligible	BLM, Coal Hollow	Numic lithic scatter
42KA2044	Prehistoric	Eligible	BLM, Coal Hollow	Archaic temporary camp
42KA2045	Prehistoric	Eligible	BLM	Archaic lithic scatter
42KA2047	Prehistoric	Eligible	BLM	Lithic scatter
42KA2048	Prehistoric	Eligible	BLM	Lithic scatter
42KA2049	Prehistoric	Eligible	BLM	Early Archaic lithic scatter
42KA2050	Multicomponent	Eligible	BLM	Archaic lithic scatter and historic herder camp
42KA2051	Prehistoric	Eligible	BLM, Private	Lithic scatter
42KA2052	Prehistoric	Eligible	BLM	Archaic lithic scatter
42KA2055	Prehistoric	Eligible	BLM	Archaic, Fremont, Southern Paiute
42KA2056	Prehistoric	Eligible	BLM	Fremont, Numic temporary camp
42KA2057	Prehistoric	Eligible	BLM	Anasazi, Southern Paiute
42KA2058	Multicomponent	Eligible	BLM	Late Archaic Lithic and Historic trash dump
42KA2059	Prehistoric	Eligible	BLM	Lithic scatter
42KA2065	Prehistoric	Eligible	BLM	Archaic, Anasazi, Fremont, Southern Paiute
42KA2066	Prehistoric	Eligible	BLM	Lithic scatter

Table 3.4.1. Recorded Archaeological Sites in the Tract

Site Number	Type	NRHP Eligibility	Land Status	Description
42KA3097	Prehistoric	Eligible	Other fee coal, private	Archaic, Anasazi, Southern Paiute lithic scatter
42KA3115	Prehistoric	Eligible	Private	Temporary camp. Lithic scatter
42KA3168	Prehistoric	Eligible	BLM	Anasazi artifact scatter
42KA3169	Prehistoric	Eligible	BLM	Anasazi, Paiute, Lithic and ceramic scatter with hearths
42KA3170	Prehistoric	Eligible	BLM	Anasazi lithic scatter
42KA3171	Prehistoric	Eligible	BLM	Anasazi temporary camp. Lithic scatter
42KA3172	Prehistoric	Eligible	BLM, Coal Hollow	Southern Paiute temporary camp. Lithic scatter, ceramics
42KA3174	Prehistoric	Eligible	BLM	Temporary camp. Lithic scatter, ground stone
42KA3175	Prehistoric	Eligible	BLM	Southern Paiute temporary camp. Lithic scatter, ground stone
42KA6072	Prehistoric	Not Eligible	Private	Lithic scatter
42KA6073	Prehistoric	Eligible	Private	Lithic scatter
42KA6074	Prehistoric	Eligible	Private	Lithic scatter
42KA6075	Prehistoric	Eligible	Private	Lithic scatter
42KA6076	Prehistoric	Eligible	Private	Lithic scatter
42KA6077	Prehistoric	Not Eligible	Private	Lithic scatter
42KA6078	Prehistoric	Not Eligible	BLM	Lithic scatter
42KA6079	Prehistoric	Not Eligible	BLM	Lithic scatter
42KA6080	Prehistoric	Eligible	BLM, other fee coal	Archaic, Numic temporary camp
42KA6081	Prehistoric	Eligible	BLM, private	Lithic scatter
42KA6082	Historic	Not Eligible	Private	Corral
42KA6083	Prehistoric	Eligible	BLM	Lithic scatter
42KA6084	Prehistoric	Eligible	BLM	Southern Paiute
42KA6085	Prehistoric	Not Eligible	BLM	Lithic scatter
42KA6086	Historic	Not Eligible	BLM, private	Bridge
42KA6087	Prehistoric	Eligible	BLM	Lithic scatter
42KA6088	Prehistoric	Not Eligible	BLM	Lithic scatter
42KA6089	Prehistoric	Eligible	BLM	Temporary camp
42KA6090	Prehistoric	Eligible	BLM	Temporary camp
42KA6091	Prehistoric	Eligible	BLM	Early Archaic temporary camp
42KA6092	Prehistoric	Eligible	BLM	Lithic scatter
42KA6093	Prehistoric	Eligible	Private	Lithic scatter
42KA6094	Prehistoric	Eligible	BLM	Early Archaic lithic scatter
42KA6095	Prehistoric	Not Eligible	BLM	Lithic scatter
42KA6096	Prehistoric	Not Eligible	BLM	Lithic scatter
42KA6097	Prehistoric	Eligible	BLM	Lithic scatter
42KA6098	Prehistoric	Eligible	BLM	Temporary camp

Table 3.4.1. Recorded Archaeological Sites in the Tract

Site Number	Type	NRHP Eligibility	Land Status	Description
42KA6099	Prehistoric	Not Eligible	BLM	Lithic scatter
42KA6100	Prehistoric	Not Eligible	BLM	Archaic lithic scatter
42KA6101	Prehistoric	Eligible	BLM	Lithic scatter
42KA6102	Prehistoric	Eligible	BLM	Lithic scatter
42KA6103	Prehistoric	Eligible	BLM	Lithic scatter
42KA6104	Prehistoric	Eligible	Coal Hollow, private	Archaic lithic scatter
42KA6109	Prehistoric	Eligible	BLM, Coal Hollow	Lithic scatter
42KA6110	Prehistoric	Eligible	BLM	Lithic scatter
42KA6111	Prehistoric	Not Eligible	BLM	Lithic scatter
42KA6112	Prehistoric	Eligible	BLM	Lithic scatter
42KA6113	Multicomponent	Eligible	BLM	Lithic scatter, Historic trash dump
42KA6114	Prehistoric	Eligible	BLM	Archaic lithic scatter
42KA6115	Prehistoric	Eligible	BLM	Archaic lithic scatter
42KA6116	Prehistoric	Eligible	BLM	Lithic scatter
42KA6117	Prehistoric	Eligible	BLM	Fremont lithic scatter
42KA6118	Prehistoric	Not Eligible	BLM	Lithic scatter
42KA6119	Prehistoric	Eligible	BLM	Lithic scatter
42KA6120	Prehistoric	Eligible	BLM	Lithic scatter
42KA6121	Prehistoric	Eligible	BLM	Lithic scatter
42KA6122	Prehistoric	Eligible	BLM	Lithic scatter
42KA6123	Prehistoric	Eligible	BLM	Lithic scatter
42KA6125	Prehistoric	Eligible	BLM	Lithic scatter
42KA6126	Prehistoric	Eligible	BLM, Coal Hollow	Anasazi, Southern Paiute temporary camp
42KA6127	Prehistoric	Eligible	BLM	Archaic lithic scatter
42KA6128	Prehistoric	Eligible	BLM	Lithic scatter
42KA6129	Prehistoric	Eligible	BLM	Archaic lithic scatter
42KA6130	Prehistoric	Eligible	BLM	Lithic scatter
42KA6131	Prehistoric	Not Eligible	BLM	Lithic scatter
42KA6132	Prehistoric	Not Eligible	BLM	Lithic scatter
42KA6133	Prehistoric	Eligible	BLM	Lithic scatter
42KA6134	Prehistoric	Eligible	BLM	Archaic lithic scatter
42KA6135	Multicomponent	Eligible	BLM	Southern Paiute, Historic trash scatter
42KA6136	Prehistoric	Eligible	BLM	Lithic scatter
42KA6137	Prehistoric	Eligible	BLM	Lithic scatter
42KA6138	Prehistoric	Eligible	BLM	Late Archaic, Southern Paiute
42KA6139	Prehistoric	Eligible	BLM	Temporary camp
42KA6307	Prehistoric	Eligible	Private	Lithic scatter
42KA6351	Prehistoric	Eligible	BLM	Archaic lithic scatter

Table 3.4.1. Recorded Archaeological Sites in the Tract

Site Number	Type	NRHP Eligibility	Land Status	Description
42KA6352	Prehistoric	Not Eligible	BLM	Lithic scatter
42KA6353	Prehistoric	Eligible	BLM	Lithic scatter
42KA6354	Prehistoric	Not Eligible	BLM	Lithic scatter
42KA6357	Prehistoric	Eligible	BLM	Archaic, Southern Paiute temporary camp
42KA6360	Prehistoric	Eligible	BLM	Archaic, Late Prehistoric lithic scatter
42KA6361	Prehistoric	Eligible	BLM	Archaic lithic scatter
42KA6477	Prehistoric	Eligible	Private	Lithic scatter
42KA6478	Prehistoric	Not Eligible	Private	Lithic scatter
42KA6479	Prehistoric	Eligible	Private	Lithic scatter
42KA6480	Prehistoric	Eligible	Private	Archaic lithic scatter
42KA6481	Prehistoric	Eligible	Private	Lithic scatter
42KA6482	Prehistoric	Eligible	Private	Lithic scatter
42KA6483	Historic	Not Eligible	Private	Camp
42KA6484	Historic	Not Eligible	Private	Dugout and corral and trash scatter
42KA6485	Prehistoric	Eligible	Private	Anasazi artifact scatter
42KA6486	Prehistoric	Eligible	Private	Anasazi, Fremont
42KA6487	Historic	Not Eligible	Private	Trash scatter
42KA6488	Prehistoric	Eligible	Private	Lithic scatter
42KA6489	Historic	Not Eligible	Private	Enclosure
42KA6490	Prehistoric	Eligible	Private	Lithic scatter
42KA6491	Prehistoric	Eligible	Private	Lithic scatter
42KA6492	Prehistoric	Eligible	Private	Anasazi artifact scatter
42KA6493	Prehistoric	Eligible	BLM, private	Anasazi, Protohistoric artifact scatter
42KA6494	Multicomponent	Eligible	Private	Middle Archaic, Anasazi, Protohistoric, Euro-American
42KA6495	Prehistoric	Eligible	Private	Virgin Anasazi Pueblo II rockshelter and artifact scatter
42KA6496	Prehistoric	Eligible	Private	Lithic scatter
42KA6497	Prehistoric	Eligible	Private	Archaic, protohistoric lithic scatter
42KA6498	Prehistoric	Eligible	Private	Lithic scatter
42KA6499	Multicomponent	Eligible	Private	Middle Archaic, Euro-American
42KA6500	Prehistoric	Eligible	Private	Anasazi artifact scatter
42KA6501	Prehistoric	Eligible	Private	Lithic scatter
42KA6502	Prehistoric	Eligible	Private	Lithic scatter
42KA6503	Prehistoric	Not Eligible	Private	Lithic scatter
42KA6504	Prehistoric	Not Eligible	Private	Lithic scatter
42KA6505	Prehistoric	Eligible	Coal Hollow, private	Late Archaic, Anasazi artifact scatter

Most archaeological sites (95%) identified in the tract are prehistoric, or contain prehistoric components and consist of lithic scatters from stone tool production, use, and maintenance. Table 3.4.2 provides a summary of the general cultural association of these sites (historic, prehistoric, or both, i.e., multicomponent) and their NRHP-eligibility assessment. Most recorded sites (81%) are eligible for the NRHP and are considered significant resources in terms of their potential to yield important historic or prehistoric information.

Table 3.4.2. Summary of Archaeological Site Types in the Tract

Cultural Association	Eligible	Not Eligible	Total
Historic	0	6	6
Multicomponent	7	0	7
Prehistoric	100	19	119
Total	**107**	**25**	**132**

Many of the recorded prehistoric and multicomponent sites contain components that can be associated with individual cultural periods or phases. Table 3.4.3 presents the numbers of such cultural components (i.e., occupations that date to an individual period or phase) that have been identified at sites recorded in the tract; because more than one component can be present at a site, the total number of components listed here is greater than the total number of sites in Tables 3.4.1 and 3.4.2 above.

Table 3.4.3. Identified Prehistoric Components at Archaeological Sites Recorded in the Tract

NRHP Eligibility	Archaic	Anasazi	Fremont	Numic	Unknown	Total
Eligible	30	18	5	26	53	132
Not Eligible	1	0	0	0	18	19
Total	**31**	**18**	**5**	**26**	**71**	**151**

3.4.2.3 CULTURAL RESOURCES ALONG THE REASONABLY FORESEEABLE COAL HAUL TRANSPORTATION ROUTE

In addition to impacts to archaeological sites in the tract, impacts to cultural resources along the reasonably foreseeable coal haul transportation route under the Proposed Action (see Map 2.5) must also be analyzed. Such resources include the Panguitch Historic District, which is listed on the NRHP, and the Utah Heritage Highway 89/Mormon Pioneer Heritage Area.

The Panguitch Historic District is roughly bordered by 500 North, 400 East, 500 South, and 300 West. The portion of the reasonably foreseeable coal haul transportation route through Panguitch that follows Center Street from 400 East to Main Street and then follows Main Street to 500 North would be in the historic district (Map 3.7). The district is significant for its association with the early settlement of Panguitch, originally an isolated pioneer outpost, and with the subsequent economic development of the area, which has focused on ranching and tourism (2006). It is also significant for its intact concentration of historic buildings, many of which are made from a characteristic, locally manufactured red brick.

The Utah Heritage Highway 89 and Mormon Pioneer Heritage Area were established by the National Heritage Areas Act of 2006 (2006). The portion of this area through which the reasonably foreseeable coal haul transportation route would pass would consist of the town of Alton, the roads that connect Alton to US-89, and the US-89 corridor to its junction with SR-20, including the communities of Hatch and Panguitch. The heritage area was established in recognition of the role that Mormon settlement played in the Euro-American colonization of the west and, among other things, in opening up "vast amounts of natural resources, including coal, uranium, silver, gold, and copper" (2006). As a legislatively established heritage area, the board of directors of the Utah Heritage Highway 89 Alliance is authorized to receive federal funds for purposes such as conserving, interpreting, and developing the historical, cultural, natural, and recreational resources in the heritage area, and expanding, fostering, and developing heritage businesses and products relating to the cultural heritage of the heritage area.

3.4.3 Native American Consultation

Initial consultation regarding the tract has taken place with the Kaibab Paiute, Southern Paiute, Hopi, Ute, Zuni, and Navajo tribes (Zweifel 2008). Cultural and religious concerns could arise among the tribes because archaeological resources have been identified in the tract. If such concerns are identified, consultation with tribes would occur. The PA developed for the Alton Coal Tract LBA instructs the BLM to continue tribal consultation, and tribes will have an opportunity to review the HPTP as part of the ongoing consultation process. Other considerations such as possible effects to TCPs will be incorporated into the HPTP, as necessary. TCPs can include, but are not limited to, natural landscape features, natural resource harvesting and processing areas, trails, and archaeological sites.

3.5 Fire Management

The analysis area for fire management is the tract and reasonably foreseeable coal haul transportation route. The *Southern Utah Support Area Fire Management Plan* (BLM 2005c) acts as the primary strategic document for fire management on and adjacent to the Alton Coal Tract. The overlying goal of the fire management plan is to describe specific actions authorized on the public lands to protect life and ensure public safety, to target resource goals and objectives, to reduce fuel loads, and to achieve and maintain healthy, functioning ecosystems (BLM 2005c). Protection of human life, including the lives of firefighters committed to an incident, is the mandated priority for all fire management activities.

In the fire management plan, land management areas are established. These areas are called fire management units (FMUs) and are defined by objectives, topographic features, access, protected values, political boundaries, fuel types, or major fire regimes. These units have dominant management objectives and have preselected fire management strategies assigned to accomplish these objectives. The tract is entirely in the Glendale Bench FMU (Map 3.8). The Glendale Bench FMU encompasses 118,618 acres, 67,423 of which are under BLM management. Approximately 2,280 acres of the FMU on the tract is on public lands.

3.5.1 Area Overview and Fire History

The tract occurs in the semiarid foothills of the Colorado Plateau Semidesert Province (Woods et al. 2001b). Precipitation in the FMU averages approximately 14–18 inches of water per year, as modeled by the Parameter-elevation Regressions on Independent Slopes Model (PRISM) from 1961 to1990 (2004). Most of this precipitation is in the form of snow during the winter months. Summers are generally hot and dry with a mid- to late-summer monsoon period when frequent thunderstorms occur (WRCC 2006).

The weather and fuel structure in the tract provide an opportunity for ignition from frequent summer storms. Lightning accounts for at least 78% of fire starts in the BLM-KFO area. Careless smoking, vehicle exhaust, escaped agricultural burning, and unattended campfires account for most human-caused fires in the Glendale Bench FMU. Sparking from vehicles or construction equipment is also responsible for starting some fires (BLM 2004). Naturally occurring fires are widely distributed in terms of frequency and severity.

Sensitive resources in the FMU that could be affected by wildfire include greater sage-grouse lekking, nesting, wintering, and brood-rearing habitat, deer and elk crucial summer ranges, the upper Kanab Creek watershed, and archeological resources. Unplanned wildfire may also affect communication sites, private residences, range improvements, special status species habitat, power lines, dispersed recreation opportunities, and ROWs (BLM 2005c).

3.5.2 Wildland-Urban Interface

Wildland fires pose the greatest threat to community residents, property, and firefighters when they occur in, or spread into, the WUI. WUIs are commonly defined as geographic areas where human habitation and developments intermix with wildland or vegetative fire (SWCA 2007b). The *Southwest Utah Regional Wildfire Protection Plan* (RWPP) does not consider the town of Alton as a state-identified community at risk of wildfire (FCAOG 2007b). However, the RWPP does identify WUI areas immediately west of Alton, along the length of US-89, as well as the Spencer Bench, Spencer Cliff Estates, and Stout Canyon area. The RWPP risk assessment identifies a high wildfire risk in these areas (FCAOG 2007b), which include portions of the reasonably foreseeable coal haul transportation route.

3.5.3 Fire Management Objectives and Planning Efforts

3.5.3.1 FIRE REGIME CONDITION CLASS

Fire regime condition class (FRCC) is an interagency, standardized tool for determining the degree of departure of an area or landscape from its historic to its present conditions (i.e., fire frequency in the area), including the effects of fire suppression and invasive species invasion. Assessing FRCC can help guide management objectives and set priorities for treatments. FRCC was assigned to classify vegetation on public lands in the state through review of cover types identified by Utah Southwest Regional Gap Analysis Project (SWReGAP) Analysis (Edwards et al. 1995) and elevation ranges (BLM 2008b). FRCCs are defined as follows:

- **FRCC 1:** Fire regimes are within a historical range and the risk of losing key ecosystem components is low. Vegetation attributes (species composition and structure) are intact and functioning within a historical range. Where appropriate, these areas can be maintained within the historical fire regime by treatments such as fire use.
- **FRCC 2:** Fire regimes have been moderately altered from their historical range. The risk of losing key ecosystem components (soil, vegetation structure, species composition, alteration of nutrient cycles, hydrologic regimes) is moderate. Fire frequencies have departed from historical frequencies by one or more return intervals (either increased or decreased), which results in moderate changes to one or more of the following: fire size, intensity, and severity, and landscape patterns. Vegetation attributes have been moderately altered from their historical range. Where appropriate, these areas may need moderate levels of restoration treatments, such as fire use and hand or mechanical treatments, to be restored to the historical fire regime.
- **FRCC 3:** Fire regimes have been significantly altered from their historical range. The risk of losing key ecosystem components is high. Fire frequencies have departed from historical frequencies by multiple return intervals. This results in dramatic changes to one or more of the following: fire size, intensity, and severity, and landscape patterns. Vegetation attributes have been significantly altered from their historical range. Where appropriate, these areas may need high levels of restoration treatments, such as hand or mechanical treatments, before fire can be used to restore the historical fire regime.

The dominant vegetation communities in the tract area are pinyon-juniper woodland, sagebrush/grassland, and treated sagebrush/grassland (Table 3.5.1). Annual and perennial grasses (pastureland), mountain brush, meadow wetlands, riparian, and rabbitbrush vegetation communities are also found in the tract. Acreages of vegetation are presented in Table 3.5.1 and Map 3.15 and FRCC is shown on Map 3.9.

Table 3.5.1. Acreages of Vegetation and Fire Regime Conditions Class in the Fire Management Unit/Tract

Vegetation Community	Acreage	Percentage of the Tract*	FRCC
Pinyon-juniper woodland	1,430.0	40.2%	3
Sagebrush/grassland	860.2	24.1%	3
Sagebrush/grassland (treated)	749.1	20.9%	3
Annual and perennial grasses (pastureland)	324.1	9.1%	3
Mountain brush	62.8	1.8%	3

Table 3.5.1. Acreages of Vegetation and Fire Regime Conditions Class in the Fire Management Unit/Tract

Vegetation Community	Acreage	Percentage of the Tract*	FRCC
Meadow	62.8	1.8%	3
Riparian	55.3	1.5%	3
Rabbitbrush	10.7	0.3%	3
Total	**3,555.0**	**99.7%**	–

* Unvegetated areas consist of 4.1 acres of open water and 17.4 acres of roads, or approximately 0.6% of the 3,576.6-acre tract.

3.5.3.2 DESIRED WILDLAND FIRE CONDITION

Desired wildland fire condition (hereafter referred to as the desired condition) is the description of the desired condition of a vegetative community as it relates to its susceptibility from severe fire effects (e.g., the loss of key ecosystem components such as soil, vegetation structure, species; or the alteration of key ecosystem processes such as nutrient cycles and hydrologic regimes).

The general desired condition is to have ecosystems that are at a low risk of losing ecosystem components following a wildland fire and that function within their historical range. A healthy ecosystem at low risk of losing key ecosystem components following a wildland fire would be considered at optimum desired condition.

In terms of desired condition outside the WUI, the trend is to move to a lower FRCC using the least intrusive method possible. In other words, the desired condition would involve moving lands in FRCC 3 to FRCC 2 and lands in FRCC 2 to FRCC 1. When feasible, this would occur through fire and nonfire treatments where wildland fire use is the preferred method of treatment. Inside the WUI, the general desired condition is less potential for values to be threatened by wildland fire, usually through modification of fuels. Therefore, because all of the lands in the tract fall in FRCC 3, the trend would be to move them to FRCC 2.

Fire management actions authorized for wildland fire activities, prescribed fire and nonfire fuel treatments, and emergency stabilization and restoration are based on desired condition. The Utah land use plan amendment for fire and fuels management addresses specific fire management objectives for each major vegetation community, and is designed to progress toward desired condition of public lands.

3.6 Geology and Minerals

3.6.1 Regional Overview and Analysis Area

The Alton Coal Tract is part of the Alton Coal Field, which is between the Kaiparowits Coal Field to the east and the Kolob Coal Field to the west. The tract is east of Long Valley and southwest of the Paunsaugunt Plateau. The geology, geologic history, stratigraphy, and structure of the tract have been described by Doelling and Graham (1972) and Tilton (2001) and are summarized in this section, along with geologic hazards, mineral resources potentially present in or near the tract, and underground coal fires.

The geology and minerals analysis area is primarily the Alton Coal Tract under all action alternatives. However, the area north and northeast of the tract's underground mining portion, extending 405 feet beyond the tract boundaries (an area of approximately 166 acres outside the tract boundary) along its north and northeast edge, is also included. This area is within what is known as the "angle of influence" and defines the extent of the surface area affected by ground movement that occurs from removing coal from an underground mine where overlying rock layers are no longer supported by underlying coal removed during mining.

3.6.2 Local Geology

3.6.2.1 TOPOGRAPHY AND PHYSIOGRAPHY

The tract is characterized by bench and slope topography. Topographic relief in the region is approximately 3,000 feet, with elevations ranging from approximately 9,300 feet on top of the Paunsaugunt Plateau to approximately 6,500 feet in the Kanab Creek valley bottoms.

The tract is southwest of the Paunsaugunt Plateau in the Alton Amphitheater, which is typified by broad, gently rolling hills and valleys and landforms with isolated bedrock outcrops. The west portion of the tract is transected by Kanab Creek, which runs north to south. The tract also includes the Robinson Creek drainage, which runs east to west.

In 1983, OSM reported that there are potential AVFs in the Alton Coal Field. Further, a reconnaissance-level survey was conducted on the tract in spring 2008 and confirms the presence of potential AVFs in portions of the tract (see Appendix F). See Section 3.16 for more information regarding AVFs.

3.6.2.2 STRATIGRAPHY

The geologic stratigraphy of the region in and near the tract consists of Jurassic, Cretaceous, and Quaternary age deposits of (from oldest to most recent) Navajo Sandstone, Carmel Formation, Dakota Formation, Tropic Shale, Straight Cliffs Formation, Wahweap and Kaiparowits formations, Claron Formation, and Quaternary deposits (see Figure 3.6.1 for a stratigraphic cross section of the area). The stratigraphy in and immediately adjacent to the tract includes the Dakota Formation, the Tropic Shale, the Straight Cliffs Formation, and various Quaternary deposits. In the Dakota Formation, two regionally important coal zones are present. These include the Smirl Coal Zone, which is near the upper formational contact with the Tropic Shale, and the Bald Knoll Coal Zone, which is approximately 200 feet below the Smirl Coal Zone near the base of the Dakota Formation (see Figure 3.6.1). The Bald Knoll Coal Zone is not of interest in this analysis because it would not be mined and, therefore, it is not further discussed.

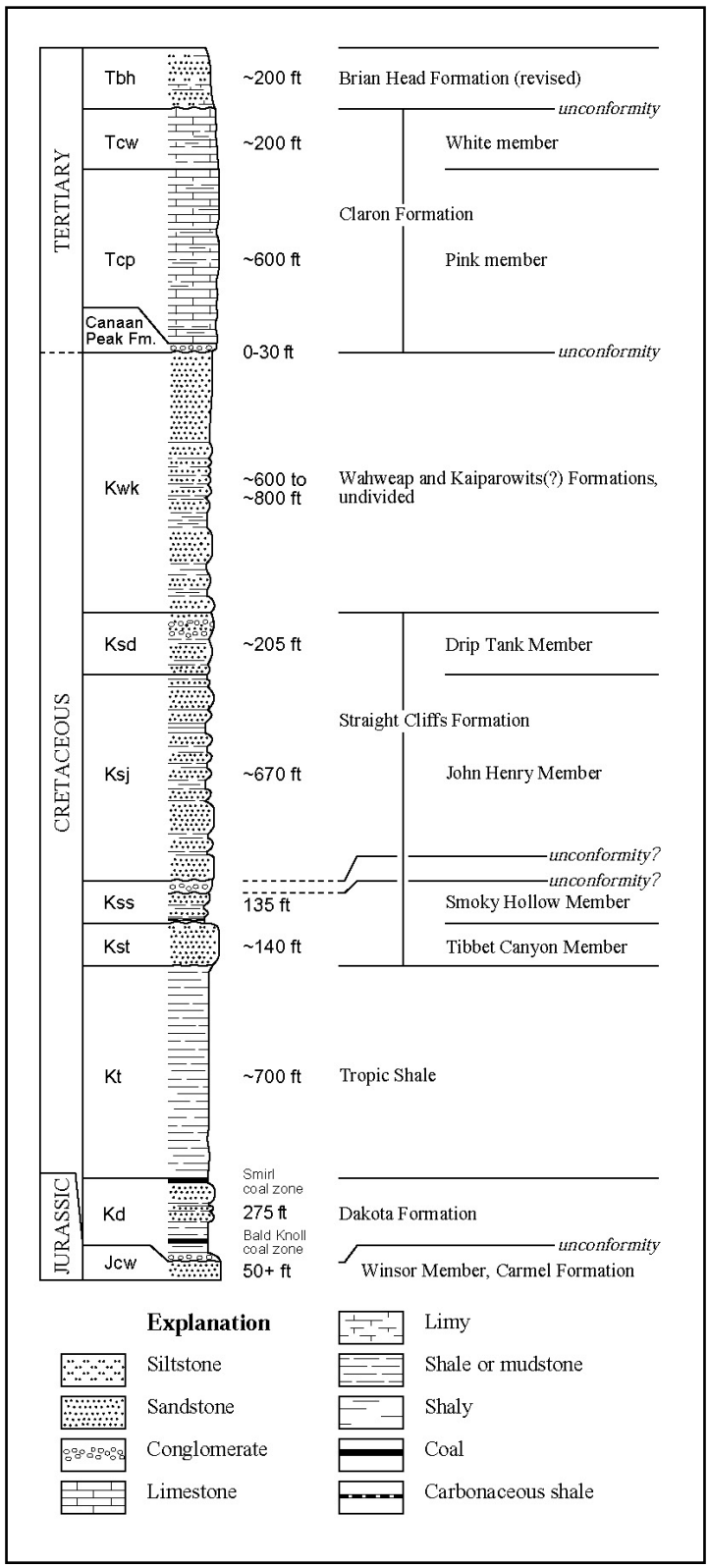

Figure 3.6.1a. Stratigraphic cross section of the stratigraphy in western Kane County (Part 1 of 2). (Tilton 2001)

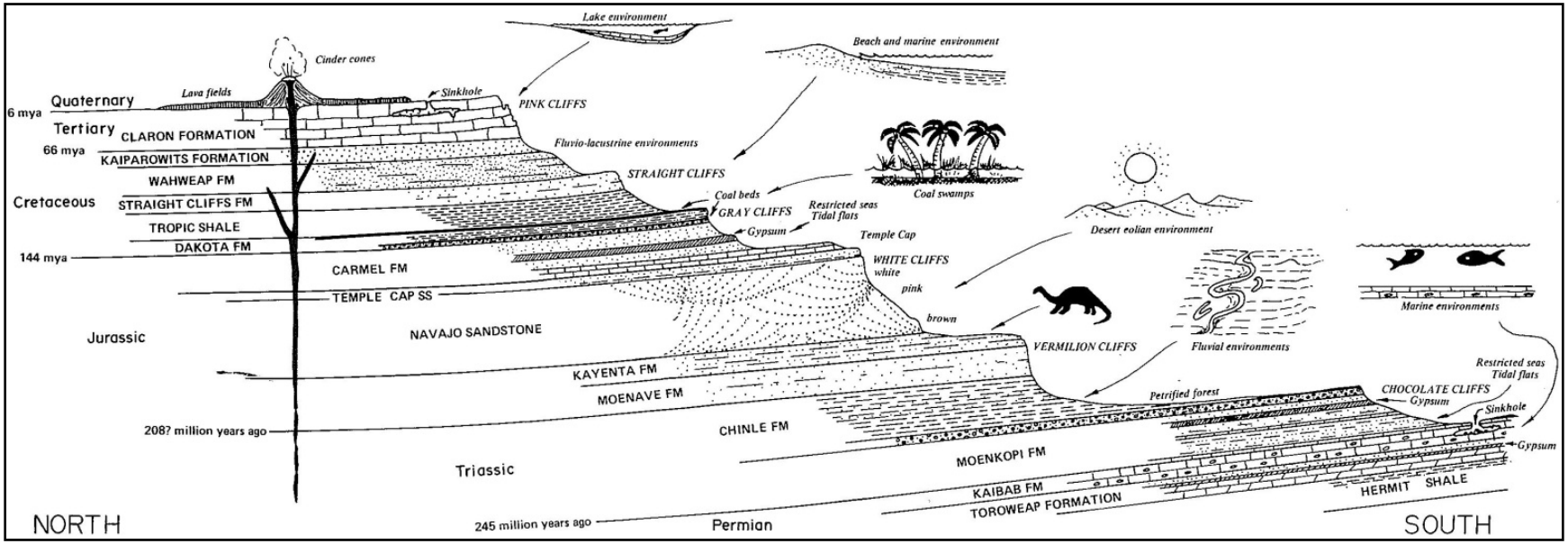

Figure 3.6.1b. Stratigraphic cross section of the stratigraphy in western Kane County (Part 2 of 2). (Doelling et al. 1989)

The degree of exposure of these formations depends primarily on the amount of weathering and erosion that has resulted in changes to the physical geology of the area over geologic time. The results of these geologic processes for the area are shown in Map 3.10. The Dakota Formation and Tropic Shale dominate the geology of the tract.

In areas where it has not been weathered or eroded, the Dakota Formation has a maximum thickness of approximately 275 feet. The Dakota Formation consists of alternating mudstone and sandstone layers with associated coal, bentonite, and conglomerate. The physical character and makeup of the Dakota Formation suggests marine and nonmarine depositions, including shallow subtidal, shoreface, distal coastal plain, and stream channel components. The Dakota Formation is a poor source of producible water because of its intricate interlayering, lensing, and interfingering of permeable and impermeable beds.

In areas where it has not been weathered or eroded, the Tropic Shale marine unit has a maximum thickness of approximately 700 feet. Marine fauna are locally visible, including ammonites and oysters. See Section 3.10 for more information on fossil resources in the area. In the tract, the Tropic Shale has mostly weathered and eroded to where the thickness ranges from zero to tens of feet. The Tropic Shale consists predominantly of gray and carbonaceous silty shale and claystone with a few marine sandstone beds mostly in its upper layer. The Tropic Shale typically weathers at the surface to a clayey soil that forms gentle slopes. The Tropic Shale acts as an impermeable layer that does not yield significant water or transmit significant water to the Dakota Formation (ACD 2008). Springs form in areas where the sandstone of the Straight Cliffs Formation or pediment gravel overlay the Tropic Shale (UII 1987b).

The Straight Cliffs Formation has four members. Immediately adjacent and north-northeast of the tract, these members have eroded. The Straight Cliffs Formation has been downdropped on the east side of the Bald Knoll Fault, creating the steep hillsides that border the east and northeast tract boundaries. The members consist primarily of sandstone and mudstone—with sandstone composing approximately 75% of the total composition—and erode to form cliffs and steep slopes above the Tropic Shale.

There are many delineated units of the Quaternary system. The units that are exposed in the tract consist of alluvium and landslide deposits. Alluvium fills the Kanab Creek, Robinson Creek, and other minor drainages. The alluvium, therefore, transects the entire north to south tract boundaries and expands to varying widths from the east to west tract boundaries. The alluvium ranges from 0 to 50 feet thick, but is up to 140 feet thick along the eastern margins of Sink Valley outside the tract (1979).

The landslide unit is along the northeast perimeter of the tract. It is characterized by unconsolidated knolls with deposits of mud and sand, and large blocks of sandstone. This unit is formed primarily from gravity-transported slide debris of the Straight Cliffs Formation and is less than or equal to 100 feet thick. AVFs are discussed in the water resources section.

The pediment gravel deposits are typically on gentle hills formed on the Tropic Shale. The gravels are poorly sorted and composed of cobbles and pebbles from the Canaan Peak and Claron formations.

3.6.3 Geologic Hazards

3.6.3.1 FAULTS

There are two major fault zones near the tract: the Sevier fault zone 1–2 miles west of the tract and the Paunsaugunt fault zone approximately 15 miles east of the tract. Both of these fault zones generally trend to the northeast and are considered normal faults with the downdropped block on the west. Displacements along the Sevier fault zone are approximately 1,000–2,000 feet, and along the Paunsaugunt fault zone, displacements are 100–800 feet (Doelling et al. 1989).

Three smaller, generally north-south-trending local faults occur between the Sevier and Paunsaugunt fault zones: Sink Valley Fault, Bald Knoll Fault, and Sand Pass Fault. The Sink Valley Fault runs parallel and along the southeast boundary of the tract with displacements on the order of tens of feet. The Bald Knoll Fault is 1.5–2.0 miles east of the tract, and the Sand Pass Fault is 2.0–3.0 miles west of the tract, each with less than 650 feet of displacement.

Seismic activity reports from two University of Utah seismograph stations in the region (Kanab and East Kanab) show that the region has not experienced significant, recent seismic activity. In the last few years there have been clusters of earthquake activity with magnitudes up to approximately 3.6 on the Richter Scale (Arabasz et al. 2006; University of Utah 2008).

The region surrounding the tract is on the edge of the intermountain seismic belt (Pechmann 2008). According to the USGS National Seismic Hazard Maps (2008), the region has a 2% probability of exceeding a peak horizontal acceleration of between 20% and 30% due to gravity. This is not a negligible or a high level of seismic hazard compared to other areas in Utah (such as the Wasatch Front), but it is above the 10% of gravity that is often assumed to be the threshold for damage to weak construction, such as unreinforced masonry buildings (Pechmann 2008). The coal mining process often induces seismic events due to subsidence and forces due to the removal of coal and overburden. However, the National Seismic Hazard Maps do not include mining-induced seismicity in their hazard ratings.

3.6.3.2 ACID-FORMING AND TOXIC-FORMING MATERIALS

Typical acid-forming materials in western coal mine environments consist of inorganic sulfide minerals, including pyrite and marcasite. Exposure to air and water may oxidize sulfur-bound compounds, causing the release of hydrogen (H+) ions in water, thus decreasing pH (creating acidic conditions). UII and ACD conducted geochemical analysis in the area in 1987 (1987b) and 2007–2008 (2008), respectively. The results from both surveys indicate that the acidic-forming potential is low for the tract because 1) the concentration of sulfur species is low, 2) the concentration of naturally neutralizing calcium carbonate is high, and 3) most of the sulfur species present are organic based, and therefore do not typically contribute to forming acidic conditions. USGS reports low levels of mercury, thorium, and uranium within Alton coals, but reports these levels to be of low concern (Bowers et al. 1976).

Selenium was not detected in any of the samples from the adjacent Coal Hollow Mine permit area, and concentrations of water-extractable boron were low (i.e., less than 3 milligrams (mg)/kg in all samples analyzed). Based on the geochemical analyses referenced above, acid-forming and toxic-forming materials that could result in the contamination of surface-water or groundwater supplies in the tract are generally not present (Petersen Hydrologic 2007).

Acid-forming and toxic-forming materials are not expected to represent a geologic or mineral hazard under the Proposed Action and will not be carried forward for detailed analysis in Chapter 4.

3.6.3.3 RADON

Radiation, as found in radon gas, comes from the natural (radioactive) breakdown of uranium in soil, rock, and water. ACD (2008) conducted a radon survey and showed no hazardous concentrations of radon in the adjacent Coal Hollow Mine permit area. Furthermore, Doelling et al. (1989: Plate 5) showed that the tract area did not have areas of “above background radiation” or uranium deposits.

The drill hole analysis completed by Applied Geotechnical Engineering Consultants (2007) for the adjacent Coal Hollow Mine indicates that there is no significant radon gas present in the Smirl Coal Zone in that location (Applied Geotechnical Engineering Consultants 2007). Assuming that the Smirl Coal

Zone within the Alton Coal Tract is similar to this zone within the Coal Hollow Mine area, no geologic hazard from radon is anticipated to occur under the Proposed Action because no unusual concentrations would be intercepted or released by mining activities on the tract. In addition, the surface mine would be naturally ventilated ("open air") during the mining process and any underground mining would also be ventilated according to DOGM and MSHA regulations and procedures. Therefore, radon is not carried forward for detailed analysis in Chapter 4.

3.6.3.4 LANDSLIDE

Quaternary landslide deposits composed of mud, sand, and blocks of sandstone are present in and adjacent to the tract (see Map 3.10). One area of landslide deposits is present east of the tract below the Straight Cliffs Formation. The thickness of the landslide deposits locally ranges from a few feet to more than 100 feet. The landslide deposits generally sustain more plant growth (usually oaks) than the surrounding undisturbed land because of the deposits ability to hold water (Tilton 2001).

3.6.4 Mineral Resources

3.6.4.1 LEASABLE MINERALS

3.6.4.1.1 Coal

The tract is in the Alton Coal Field. The tract contains approximately 46 million tons of recoverable coal in the Dakota Formation. The coal that would be mined is present as a single coal seam approximately 15 feet thick, referred to as the Smirl Coal Zone. Overburden above the Smirl Coal Zone ranges from 20 to 300 feet thick with an average thickness of 100 feet. It is composed primarily of Tropic Shale and Quaternary deposits (both described above).

The average quality of the coal in the Smirl Coal Zone is summarized in Table 3.6.1. The inherent moisture content of the coal is approximately 13%. Higher percentages of moisture lower the heating efficiency of coal. Ash content of coal is the noncombustible residue left after coal is burnt. The percentage of ash in the original weight for coal in the tract is approximately 10%. The fixed carbon percentage for the coal is approximately 50%, which is nonvolatile carbon minus ash. The volatile matter in coal refers to the components of coal, other than moisture, that are liberated at high temperatures in the absence of air. The fixed carbon content of the coal is the carbon found in the material that is left after volatile materials are driven off. These compounds include long-chain and aromatic hydrocarbons. The percentage of volatile matter of this coal is approximately 39%. The sulfur content of the coal is approximately 1.13%, which is lower than the average of 2%–3% for this type of coal (high-volatile subbituminous B). The lower the sulfur content is in coal, the less sulfur is emitted into the air during the burning of coal, and hence, the less sulfuric acid is formed. The coal in the Smirl Coal Zone has a heat content approximately 20 million British thermal units (BTU) per ton (10,019 BTUs per pound).

Table 3.6.1. Average Quality of the Coal in the Smirl Coal Zone

Thickness (feet)	Moisture (%)	Ash (%)	Fixed Carbon (%)	Volatile Matter (%)	Sulfur (%)	BTU/ton
15.3	13	10	50	39	1.13	~ 20 million (10,019 BTUs/pound)

Source: ACD (2004).

3.6.4.1.2 Oil and Gas

There is an oil and gas lease (UTU-079271) that includes the northeast area of the tract and extends to the area north and east of the tract (east of the Sink Valley Fault where the Straight Cliff Formation is exposed; see Map 3.10). In general, the BLM classifies this area as high potential for oil and gas development (2008b), and there are a handful of existing leases near the tract. Given the coal deposits (both the Smirl Coal Zone and the Bald Knoll Coal Zone) in the area, there is also a potential for the occurrence of coalbed CH_4; though there are no existing proposals to develop this resource.

3.6.4.2 SALABLE MINERALS

3.6.4.2.1 Burnt Shale

The geological map for the tract shows three gravel resource sites (see Map 3.10), which are in Sections 13, 24, and 31, Township 30 South, Range 6 West. The BLM-KFO reports that these are authorized community pits that are open to the public for purchase of burnt shale aggregate. Most of these pits have been in operation since the late 1970s and are nearly depleted. Other known burnt shale resources exist west of the tract. Recent interest in the development of these resources has been shown.

3.6.4.2.2 Gravel

As mentioned in the stratigraphy section above, there are pediment gravels in the tract. These gravel deposits are derived mostly from the erosion of the Claron and Canaan Peak formations and consist of quartzite pebbles and cobbles. These deposits are considered to be salable by the BLM.

3.6.4.3 LOCATABLE MINERALS

3.6.4.3.1 Septarian Nodules

Septarian nodules are geode-like concretions containing angular cavities or cracks, or septaria. The nodules are often valued by collectors, and occur in the Tropic Shale near the tract. The nodules in the region are thought to be of high (gem) quality, and are considered a locatable resource.

According to the *Kanab Field Office RMP/EIS Final Analysis of the Management Situation,* active mining for septarian nodules is occurring on leases in the Mount Carmel area southwest of the tract (BLM 2005b). Development potential is rated moderate in areas where Tropic Shale is present, as in the Alton tract (BLM 2005b). However, because no surveys or studies have been done on the tract for septarian nodules, it is unknown how common these nodules are in the tract, or if they are present in sufficient density to be economically viable for development.

3.6.5 Underground Coal Fires

According to (Stracher 2007) spontaneous combustion is the most significant cause of fires in coal mines. An increase in the temperature of coal occurs when the coal is exposed to air. A reaction occurs between the coal and the air in a solid-gas process that involves the reaction of oxygen. Provided there is an adequate supply of oxygen, a process called *runaway ignition* can occur. Runaway ignition is when the heat raises the temperature of the coal, which changes the rate of oxidation. If unchecked, this process can grow exponentially and subsequently initiate a fire. If the generated heat is quickly dissipated, the risk of spontaneous combustion decreases.

Coals of lower BTU rank are more susceptible to spontaneous combustion than coals of higher rank. The coal in the Alton Coal Tract has an average of 10,019 BTUs per pound, which is lower than other coal fields in Utah (Jahanbani 1998). Even higher rank, eastern coals have ignited either by spontaneous combustion or other sources once exposed to atmospheric oxygen.

Coal ignitions due to spontaneous combustion in surface mines or surface coal stockpiles do occur but are readily accessible and manageable. Mine operators have financial and environmental incentives to quickly and effectively control any ignitions that may occur in surface mines or surface coal stockpiles. However, underground fires near surface coal mines have proven to be troublesome because the fires generally cannot be controlled or extinguished. This is a particular problem in the eastern United States where higher population density means towns and structures can be, and have been, directly affected because the towns are directly above the coal seams.

Underground coal fires can also be attributed to mine-related activities such as cutting and welding, electric work, use of explosives, smoking, or any activity that could provide ignition. Other activities that do not provide a spark but can increase the risk for spontaneous combustion include the movement of heavy machinery and vehicles that have the potential to create fractures in the coal seam, which leads to increased oxygen circulation. In addition, fires can be caused after abandonment of the mine when humans provide ignition of the coal through other means.

A historical review of the coal history prepared by Doelling and Graham (1972) and site visits have not shown any indication of past coal mine fires near the tract. Also, past mining of the Smirl Coal Zone in the tract and surrounding areas has occurred at very shallow depths, with more exposure of the coal to atmospheric oxygen.

3.7 Hazardous Materials and Hazardous and Solid Waste

3.7.1 Existing Sources of Hazardous Materials and Hazardous and Solid Waste On and Adjacent to the Tract

The analysis area for hazardous materials and hazardous and solid waste is the tract and the reasonably foreseeable coal haul transportation route. Hazardous materials are defined as any material that may pose a hazard to human health or the environment, because of its quantity, concentration, or physical or chemical characteristics. Hazardous materials include flammable or combustible material, toxic material, corrosive material, oxidizers, aerosols, and compressed gases. Solid waste includes garbage; construction debris; commercial refuse; sludge from water supply or waste treatment plants, or air pollution control facilities; and other discarded materials. Hazardous materials discussed in this section include hazardous chemicals, hazardous substances, and hazardous wastes, and are defined below according to the EPA (2010).

- Hazardous chemical: An EPA designation for any hazardous material requiring a Material Safety Data Sheet (MSDS) under OSHA's Hazard Communication Standard. Such substances are capable of producing fires and explosions or adverse health effects like cancer and dermatitis.
- Hazardous substance: Any material that poses a threat to human health and/or the environment. Any substance designated by EPA to be reported if a designated quantity of the substance is spilled in the waters of the United States or is otherwise released into the environment. Typical hazardous substances are toxic, corrosive, ignitable, explosive, or chemically reactive.
- Hazardous waste: Byproducts of society that can pose a substantial or potential hazard to human health or the environment when improperly managed. Possesses at least one of four characteristics (ignitability, corrosivity, reactivity, or toxicity), or appears on special EPA lists.

Coal mining and subsequent transportation activities would necessitate the presence of hazardous materials at the Alton Coal Tract. Primarily, these materials would include fuels, lubricants, and solvents. See Section 2.3.2.7 for a list of hazardous materials anticipated for the tract. Potential sources of hazardous or solid waste on the tract would include hazardous substances, petroleum products, and/or solid waste associated with coal mining and transportation activities. Currently there are no hazardous materials or solid wastes present on the tract.

3.8 Land Use and Access

3.8.1 Land Status and Ownership

The analysis area for land use and access is the tract. Primary land uses in and adjacent to the Alton Coal Tract include tourism, farming, livestock grazing, and dispersed recreation, including hunting. See Sections 3.9 Livestock Grazing and 3.11 Recreation for details on these specific land uses. The *Kane County, Utah General Plan* describes the area as, "some of the most remote and rugged lands in the continental United States" (FCAOG 2011). The plan has not allowed for significant development in the area. There are no commercial buildings, facilities, or private residences within the tract. However, the nearest residential community is the town of Alton, whose population is approximately 140 (UDWS 2010). Alton is immediately north of the northern tract boundary. There are no state lands in or immediately adjacent to the tract. The closest parcel of SITLA land is 1 mile northwest of the tract. Map 1.1 illustrates the location of the tract in relation to some of the private and federal land ownerships in the area.

Access to the tract is from US-89, approximately 2.9 miles west of the tract. This highway is the major thoroughfare for the area, serving as a route for tourist traffic to public lands, including Bryce Canyon National Park, Dixie National Forest, BLM-managed lands, and Grand Staircase-Escalante National Monument. For details regarding transportation along portions of US-89, refer to Section 3.14 Transportation and Appendix H.

3.8.1.1 PRIVATE LANDS AND EXISTING LAND USES ON AND ADJACENT TO THE TRACT

All coal reserves within the tract are federally owned, though surface ownership is mixed. Approximately 1,296 surface acres of the tract are in private ownership, including eight different private surface owners. Landowners have been notified of the tract and will be included throughout the EIS process. Private land uses in the tract and surrounding land include farming, livestock grazing, and dispersed recreation, including hunting. Land use specifically in Alton has traditionally been for homes, farming, and livestock grazing. There have not been any official classifications of land use or zoning ordinances to enforce the use of land; however, the land has been generally classified into four areas: residential, church, agriculture, and recreation (FCAOG 1981). Two-track roads also exist throughout the tract for recreational use and for private landowner access to private surface lands.

3.8.1.2 FEDERAL LANDS AND EXISTING LAND USES ON AND ADJACENT TO THE TRACT

The BLM-KFO consists of 2,847,200 acres, of which the BLM manages approximately 554,000 acres (approximately 20%). All coal reserves within the tract are federally owned. Approximately 2,280 surface acres of the tract are in federal (BLM) ownership, representing 0.4% of the total area managed by BLM-KFO. Dominant land uses in the tract include livestock grazing and recreation (primarily backcountry motorized travel and sightseeing, OHV use, and hunting).

3.8.2 Land Use Planning and Management

3.8.2.1 FEDERAL

Land use planning for public lands in the area allocates the land to many uses, including mining, grazing, and recreation (BLM 2008b). No coal production has occurred in Kane or Garfield counties since 1971, and there are presently no coal leases in the boundaries of the BLM-KFO (BLM 2008b).

Dixie National Forest lands near the tract are managed for the following recreation activities: OHV touring, hunting, fishing, photography, picnicking, hiking, backpacking, camping, and viewing nature, wildlife, and geologic features. Currently the forest is being managed under the forest plan that was signed in 1986. Revisions to the forest plan are currently on hold.

As discussed in Chapter 1, some of the coal reserves in the tract are not currently considered recoverable because KFO Route 116 traverses the tract. Under SMCRA, the approval of surface-mining operations on lands within 100 feet of the outside line of the ROW for a public road requires a process resulting in a final decision by DOGM or the public road authority. In the event of a lease sale, Kane County and the BLM would temporarily relocate KFO Route 116 during the life of the mine. Once mining operations are complete, the temporary road location would be reclaimed, and the original route would be reconstructed according to requirements specified in R645-103-234–R645-103-234.400 for relocation of public roads.

3.8.2.2 LOCAL

The entire tract lies within the northwest section of Kane County. Approximately 85% of Kane County lies in federal ownership (FCAOG 2011). Historically, Kane County lands have been used for agriculture (predominantly livestock grazing and some farming), and according to the *Kane County, Utah General Plan* (FCAOG 2011), much of the land within and adjacent to the tract is currently zoned for agricultural use.

Garfield and Iron counties are adjacent to Kane County to the north and west, respectively. These counties include areas for tourism and recreation. It is anticipated that coal mined from the tract would be transported through these counties for delivery to market (see Section 2.6.4 Reasonably Foreseeable Coal Loadout Location and Transportation Route). Further, public travel is frequent through these counties, specifically to access federal lands near the tract (Bryce Canyon National Park, Dixie National Forest, BLM-administered lands, and Grand Staircase-Escalante National Monument). Both the Kane County and Garfield County general plans identify transportation infrastructure as an important investment due to their contribution to tourism travel in the area. The Garfield County plan indicates that the roads in the area are in fair condition partly due to insufficient funds to properly maintain and renovate them. For a detailed description of travel and transportation in the area please see Section 3.14 Transportation and Appendix H.

The town of Alton is a rural/agricultural area. Agricultural uses (i.e., animals, gardening, and farming) are permitted on residential lots, with reasonable limitations provided. Future areas of growth will be planned to minimize impact on community resources and to be consistent with the best use of the land surrounding Alton (FCAOG 1981).

3.9 Livestock Grazing

3.9.1 Regional Overview

The analysis area for livestock grazing is the tract, reasonably foreseeable coal haul transportation route, and the area immediately adjacent to the tract and transportation route, because the potential impacts to the vegetation that livestock rely on are not expected to extend beyond this area. Grazing in the Alton Coal Tract is administered by the BLM in accordance with the *Standards for Rangeland Health and Guidelines for Grazing Management on BLM Lands in Utah* (BLM 1997). These standards and guidelines were instituted for all Utah rangelands and are based on ecological principles that underlie the sustainable production of rangeland resources. With regard to rangeland health, the following four conditions must be present on BLM-administered public lands:

- Watersheds are in, or are making significant progress toward, properly functioning physical condition, including their upland, riparian-wetland, and aquatic components; soil and plant conditions support infiltration, soil moisture storage, and the release of water that are in balance with climate and landform and maintain or improve water quality, and timing and duration of flow.
- Ecological processes, including the hydrologic cycle nutrient cycle, and energy flow, are maintained, or there is significant progress toward their attainment, in order to support healthy biotic populations and communities.
- Water quality complies with state water quality standards and achieves, or is making significant progress toward achieving established BLM management objectives such as meeting wildlife needs.
- Habitats are, or are making significant progress toward being, restored or maintained for federal threatened and endangered species, federal proposed, Category 1 and 2 federal candidate and other special status species. (BLM 2007)

Section 3 of the Taylor Grazing Act of 1934, as amended, authorizes livestock grazing on BLM-administered public lands.

3.9.2 Allotments on and Adjacent to the Tract

Seven grazing allotments encompass 2,143 acres of the tract (Table 3.9.1; Map 3.11); two occur completely within the tract and five occur partially within the tract. The Alton and Cove (Alton) allotments occur completely within the tract. The allotments that occur partially within the tract are the Isolated Tracts, Levanger Lakes, Robinson Creek, Syler Knoll, and Upper Sink Valley allotments. These allotments are used exclusively for cattle grazing; they are not used to graze horses or sheep (BLM 2008a).

Table 3.9.1. Grazing Allotment Acres and Animal Unit Months (AUMs) in the Alton Coal Tract

Allotment	Total Federal Acres	Acres Within the Tract*	Percentage of Allotment in the Tract†	Total AUMs Allocated to Livestock	Calculated AUMs in Tract‡
Alton	392	388.5	99%	5	5
Cove (Alton)	158	155.9	99%	10	10
Isolated Tracts	1,028	243.9	24%	65	15
Levanger Lakes	872	196.3	23%	33	7
Robinson Creek	524	208	40%	24	10
Syler Knoll	442	363.5	82%	6	5
Upper Sink Valley	4,806	586.7	12%	311	38
Total	**8,222**	**2,143**	**26%**	**454**	**118**

* Acres are approximations subject to up to 5 acres of error as a result of potential misalignment of datasets at different scales.
† Percentage of each allotment in the tract has been rounded to the nearest whole number.
‡ Calculated by multiplying the total AUMs allocated to livestock by the percentage of the allotment in the tract.

The carrying capacity of a livestock grazing allotment is defined in terms of AUMs. In general terms, an AUM is the amount of forage needed to sustain one cow and her calf for one month. In specific terms, an AUM is a standardized measurement of the amount of forage necessary to sustain one cow unit (or its equivalent) for one month (approximately 800 pounds of usable air-dried forage), or the amount of forage necessary to sustain one 1,000-pound animal for one month.

Table 3.9.1 shows the total acres and percentage for each allotment that occurs partially or completely within the tract. The table also includes the total AUMs that are allocated to livestock in each allotment, and the calculated number of AUMs within the tract. The number of AUMs in the tract was calculated by multiplying the total AUMs allocated to livestock within the allotment by the percentage of the allotment within the tract. Calculated AUMs in the tract may or may not be properly represented because the AUMs in these allotments are typically found in concentrated areas due to the pinyon-juniper encroachment. As pinyon-junipers encroach into shrub-steppe vegetation communities and outcompete forbs, grasses, and shrubs for resources, fewer acres of high quality forage are available for livestock consumption within allotments. However, because the rate and extent of juniper encroachment across allotments over the life of the tract cannot be determined, it is conservatively assumed that AUMs (forage) are evenly distributed throughout the allotments.

Livestock grazing also occurs at various locations along the reasonably foreseeable coal haul transportation route. Vegetation used as forage for livestock within a 100-foot buffer of the reasonably foreseeable coal haul transportation route is affected by current vehicle traffic along this route. Road dust and vehicle exhaust inhibit stomatal function and photosynthesis (Hirano et al. 1995), and therefore impact overall plant health.

3.10 Paleontology

The analysis area for potential impacts to paleontological resources is the tract. The Alton Amphitheatre is below the west rim of the Paunsaugunt Plateau, immediately east of the Sevier fault zone. In general, the geological column in this portion of the Colorado Plateau (Foster et al. 2001) is highly fossiliferous in the Upper Triassic (Chinle Formation), Lower and Middle Jurassic (Moenave, Kayenta, and Carmel formations), and Upper Cretaceous (Dakota, Tropic, Straight Cliffs, Wahweap, and Kaiparowits formations). The tract would be primarily in the Tropic Shale (53.5%), Dakota Formation (20.3%) and Alluvium (21.2%); the remaining 5% would be in landslide deposits or areas where no data are available. Uppermost Cretaceous and Paleogene units (Canaan Peak, Pine Hollow, Grand Castle and Claron formations) are only sparsely fossiliferous due to the high energy or highly destructive weathering conditions that pervaded for most of that time. The fossil record of these units, whether highly or sparsely fossiliferous, is highly significant, and several of the formations, including the Chinle, Moenave, Wahweap and Kaiparowits formations, are justifiably famous for their vertebrate fossil fauna. The geological column in the area records a succession of semiarid to arid terrestrial environments, with intertonguing, shallow marine units in the early and middle Mesozoic, tropical, humid coastal plain conditions in the Late Cretaceous (Eaton 1991; Titus et al. 2005), and low elevation, intermontane basins during the latest Cretaceous and Paleogene. The fossil faunas and floras reflect this succession, and the tropical humid coastal plain deposits contain the highest fossil biomass. Recent work in the Kaiparowits Basin immediately to the east has demonstrated that the Alton Amphitheater contains one of the most complete Late Cretaceous (73–100 million years ago) terrestrial fossil records known in the world (Eaton et al. 1999). Surveys in the sparsely vegetated badlands of the central and southern Kaiparowits Plateau have uncovered the remains of dozens of new species of marine reptiles, dinosaurs, mammals, crocodylians, turtles, lizards, fish, and other taxa (Eaton et al. 1999; Gates 2004; Nydam 1999; Titus et al. 2005) making this resource world class. Paleontological resources in the Dakota and Tropic Shale formations are highly fossiliferous, consisting mainly of well-known invertebrate fossils such as gastropods and cephalopods. Located only 35 miles to the west, the greater Alton area holds potential for similar, significant Late Cretaceous fossil resources.

3.10.1 Paleontological Resources

The Alton Amphitheatre is underlain entirely by Late Cretaceous-age through Eocene-age sedimentary bedrock (Tilton 2001). In ascending order, these are the Dakota (target formation for coal mining), Tropic, Straight Cliffs, Wahweap, and Claron formations. A review of the Proposed Action in Chapter 2 shows that only the Dakota Sandstone and the Tropic Shale would be significantly impacted by the installation, operation, and maintenance of the mine. Both of these units have produced significant fossils in the immediate area near the town of Alton. The Dakota Formation yields an abundant and diverse lower and middle, Cenomanian terrestrial vertebrate fauna, of which only the mammals have been described (Eaton 1993, 1995). Many of the specimens reported in these papers were recovered from the Alton Amphitheatre or immediately nearby, and clearly support the resource potential of the Dakota Formation. Fish, turtles, crocodylians, squamates, and dinosaurs are also known to occur in the Dakota Formation. The Tropic Shale similarly yields a robust, highly significant vertebrate fauna (Albright et al. 2002, 2007a, 2007b; Gillette et al. 2001). However, most of what is known about the formation has been gleaned from the Kaiparowits Plateau. Two partial plesiosaurs have been recovered near the town of Alton, one in the Ford Pasture area approximately 15 km southeast of Alton (Titus 2004, 2005) and one in the Muddy Creek septarian mine approximately 20 km southwest of Alton (Gillette et al. 1999). A third isolated paddle bone, probably a humerus, was observed west of Trail Canyon (Titus 2004, 2005); it was not collected. In addition to the marine fauna, the partial remains of an ornithischian dinosaur were collected from the Tropic Shale in the area of Muddy Creek, east and south of the tract.

Field inventories conducted in 2004 and 2005 by the BLM found the Tropic Shale in the area around the south margin of the tract to be highly fossiliferous (Titus 2004, 2005). Unusual features were noted and consist of rare, articulated fish remains and the existence of limestone mounds that may represent cold CH_4 seeps active in the Cretaceous (sourced from the Smirl Coal Zone). Upper Cenomanian ammonites and other invertebrates of the *Euomphaloceras septemseriatum*, *Eumophaloceras costatum*, *Burroceras irregulare*, and *Neocardioceras juddi* ammonoid biozones are locally common and exceptionally well preserved in three dimensions inside of limestone concretions that weather out of the shale. The ammonoid taxa found in the Alton area are considered significant because three-dimensional, well preserved specimens are rarely found in stratigraphically younger, ammonoid biozones of North America, such as the biozones present in the Alton area. In spite of the quality and abundance of fossil specimens that occur in the Tropic Shale in the Alton area, exposures of the formation are generally poor; soil and plant cover is extensive; and colluvium from the overlying Straight Cliffs and Grand Castle formations forms debris fans over much of the formation's areal extent. Therefore, the likelihood of discovering one of these limestone concretions before they have been damaged, altered or destroyed by natural processes is relatively low. Based on nearby areas where the Dakota Formation and the Tropic Shale are better exposed, the following resource occurrence patterns can be expected out of the Dakota Formation:

- The lower gravely member of the Dakota Formation is mostly barren of fossils except for reworked specimens of large, petrified conifer logs (probably sourced from the Morrison or Chinle formations) and Paleozoic invertebrate fossils in clasts derived from the Sevier Thrust Belt. These are not of any particular scientific significance and would not require mitigation, although local petrified wood collectors do value the wood as a hobby material.
- The middle member of the Dakota Formation contains common plant, invertebrate, and vertebrate fossils. The distribution of the vertebrate fossils, which are the most significant from a protection perspective, is random and uncommon in overbank pond mudstone and less random and more concentrated in the basal layers of sandstone channel deposits. Large sections of turtle shells, bivalve and gastropod concentrations, ganoid fish scales, and scattered crocodylian teeth and bones are the most obvious remains in such channel deposits. However, bulk sampling and careful study of the resulting concentrates show a much more diverse fauna that includes dinosaur, lizard, and mammalian remains.
- The upper member of the Dakota Formation is abundantly fossiliferous; however, the fauna is dominantly nearshore marine and aquatic in nature. The vertebrate fauna is dominated by isolated shark teeth and poorly preserved, boney fish remains. Plant fossils associated with the Smirl Coal Zone have been observed to be very well preserved in the Skutumpah Creek area, and potential for well-preserved vertebrates and soft bodied invertebrates in the coal zone is high even though no Konservat-Lagerstatte-type preservation has been previously observed in the Alton area.

The Tropic Shale is not formally divided into members, but it can informally be divided into three zones (intervals) in the Alton area, a lower siderite dominated interval, a middle highly fossiliferous carbonate concretionary interval, and an upper, poorly fossiliferous concretionary interval. They are as follows:

- The lower interval is approximately 7–8 m thick and immediately overlies the Smirl Coal Zone. Although fossiliferous, this lower interval has not yielded anything but poorly preserved ammonites and bivalves of the *Vascoceras diartianum* ammonoid biozone. Large specimens of the heavily ribbed ammonite *Calycoceras naviculare* are not uncommon, but they are nearly all crushed.

- The middle interval is characterized by calcite concretions 0.3–0.5 m in diameter and contain an abundant and well preserved benthic and nektic fauna. Ammonites and other mollusks are the dominant fauna, but crustaceans, corals, annelids, shark teeth, bony fish remains, and marine reptile skeletons also occur. Ammonites of the *Euomphaloceras septemseriatum* biozone (next zone above that of *V. diartianum*) are widespread and well preserved over much of North America. Although this zone's ammonites, including *Metoicoceras geslinianum, Sciponoceras gracile, Worthoceras vermiculum, Placenticeras cumminsi*, and *Eumophaloceras septemseriatum*, are common and very well preserved in the Alton area, they have no special scientific value outside of the local region. Hobby collectors do place great value on these fossils as objects of aesthetic beauty and wonder.
- The upper interval is characterized by three-dimensional ammonite fossils from the zones above the *E. septemseriatum* (middle) interval that are generally uncommon in North America, being well known from only a handful of places. Just south of the tract, on the east side of the Sink Valley, three-dimensional specimens of ammonites from the *Euomphaloceras costatum*, *Euomphaloceras* n. sp., *Burroceras irregulare*, and *Neocardioceras juddi* Ammonoid Biozones were collected in succession (Titus 2002). This is a very rare occurrence and is one of only three places in North America where this can be observed. It is thought that the presence of unusually high levels of coal-sourced CH_4 in the sediment during the fossilization process may have helped catalyze the excellent preservation of this succession (Titus 2002). Vertebrates are not particularly common in this interval. However, perfectly preserved three-dimensional fish fossils in this interval have been collected from the *Euomphaloceras costatum* zone in the Ford Pasture area of the BLM-KFO. The overlying Turonian sediments contain concretions, but these are generally poorly fossiliferous or contain poorly preserved fossils. To the east, this interval has the highest potential for marine reptiles. Unfortunately, there are not enough data to model their abundance in the Alton area even though their presence is certain given the finds at Muddy Creek and Ford Pasture. Higher levels in the Tropic Shale and Straight Cliffs Formation are fossiliferous but would not be impacted by activities outlined in the Proposed Action or alternatives and therefore are not reviewed.

Potential also exists for Late Pleistocene fossil resources in older alluvial and/or pluvial deposits; however, there are no good age constraints on alluvial fill in the Alton Sink and therefore no way to accurately assess potential. A similar setting near Skutumpah Creek, approximately 15 km to the southeast, yielded a partial proboscidean skeleton (cf. *Mammuthus columbi*) that was excavated by the Museum of Northern Arizona; therefore, it is likely that the floors on the alluvial fill are old enough to contain pre-Holocene vertebrate megafauna.

3.11 Recreation

Southwest Utah offers a variety of recreation opportunities in varying terrain, including mountains, desert, forests, canyons, rivers, and lakes. Major recreation attractions are Bryce Canyon National Park, Dixie National Forest, and Grand Staircase-Escalante National Monument, and several scenic highways and backways. A number of developed and semideveloped campgrounds, day-use areas, back country roads, and trails exist for recreational use in the area. The analysis area for recreation (defined below) is managed by the BLM, NPS, USFS, UDWR, counties, and local municipalities.

The recreation resources analysis area for the Alton Coal Tract consists of the tract, linear features such as roads and OHV trails affected by mine-related activities, the reasonably foreseeable coal haul route, and all adjacent lands within a 5-mile radius of the tract (Map 3.12). A 5-mile radius (encompassing approximately 92,573 acres) was chosen on the assumption that recreational users affected by mining activities would move to lands that provide similar recreation opportunities that are immediately adjacent to the tract. Outside the 5-mile radius, additional recreation activities, areas, and opportunities were identified to describe the indirect and cumulative impacts of the alternatives. These areas were identified from BLM and USFS land use plans, NPS general management plans, UDWR management areas, discussions with BLM, USFS, and UDWR resource specialists, and county and municipality plans.

3.11.1 Bureau of Land Management Recreation Opportunities, Management Objectives, and Experiences

BLM manages the tract and adjacent areas as part of an extensive recreation management area (ERMA) for undeveloped and dispersed recreation opportunities. ERMA objectives include providing for visitor health and safety, limiting user conflict, and protecting resource values, with no activity-level planning required. Therefore, actions within ERMAs would generally be implemented directly from land use planning decisions. Dispersed camping is allowed throughout the recreation analysis area, which is managed as VRM Class IV, allowing for landscape modifications (see Section 3.2 Aesthetic Resources). OHV use is permitted on designated routes on BLM-managed lands within the analysis area. There are approximately 92 miles of routes available for OHV use within the recreation analysis area. Of the 92 miles, approximately 13 miles of routes are in the tract: 11 miles on BLM-managed land and 2 miles on private land. The BLM manages lands within the analysis area for the following recreation activities: OHV touring, hunting, fishing, photography, picnicking, hiking, backpacking, camping, competitive events, and viewing nature, wildlife, and geologic features. No other recreational trails or facilities are on BLM-managed lands within the recreation analysis area.

BLM also manages the Grand Staircase-Escalante National Monument. The monument was established in 1996 and is approximately 10 miles southeast of the analysis area. No portion of the monument is within the analysis area. However, it is expected that some recreation users, such as hunters, if displaced, would relocate their activities to similar ecological systems on the monument. Approximately 600,000 users visit Grand Staircase-Escalante National Monument each year. Areas within the monument adjacent to the analysis area are managed as an Outback Zone (BLM 1999) for undeveloped and self-reliant visitor experiences. Visitor facilities would be provided only for locations needed for resource protection. Most of the monument adjacent to the analysis area is managed as a VRM Class II and III.

Within the KFO, the BLM manages approximately 25,579 acres within the analysis area. In the KFO RMP all 25,579 acres within the analysis area are managed as an ERMA (BLM 2008b). Under the RMP, ERMAs provide for a range of undeveloped and dispersed recreation opportunities. Very little recreational use occurs on BLM-managed lands within the analysis area, with hunting being the predominant recreation activity. BLM does not have visitor use numbers for recreational activities occurring within the analysis area.

3.11.2 U.S. Forest Service Recreation Opportunities, Management Objectives, and Experiences

The Dixie National Forest has 17,397 acres in the recreation analysis area. The existing Dixie National Forest Land and Resource Management Plan (Dixie National Forest Plan) manages USFS lands within the analysis area as semiprimitive, nonmotorized zones and semiprimitive, motorized zones on the Recreation Opportunity Spectrum (ROS) (USFS 1986). Semiprimitive, nonmotorized zones are settings that have primitive roads or trails that are not open to motorized use. These zones are generally at least 2,500 acres in size and are between 0.5 and 3.0 miles from all roads, railroads, or trails with motorized use. Access to these zones is by nonmotorized trails, nonmotorized primitive roads, or cross-country. The analysis area contains a natural-appearing environment and has a high probability of solitude.

Semiprimitive, motorized zones are managed in a similar manner as the semiprimitive, nonmotorized zones. The only difference is that the semiprimitive motorized zone allows the use of motorized access on trails and roads within the area.

Dixie National Forest lands within the analysis area are managed for the following recreation activities: OHV touring, hunting, fishing, photography, picnicking, hiking, backpacking, camping, and viewing nature, wildlife, and geologic features.

There is limited motorized access to Dixie National Forest lands within the analysis area. Few roads access these locations and therefore, little recreation use occurs in these areas. Existing recreational facilities on nearby Dixie National Forest lands include the nonmotorized, 78-mile-long, Grand View trail that runs from the Thunder Mountain trailhead to the Sheep Creek trailhead. The Paunsaugunt OHV trail system also runs through Dixie National Forest lands near the analysis area. Dixie National Forest does not maintain visitor use information for lands near the analysis area.

Portions of the Dixie National Forest within the analysis area are managed under several management prescriptions (recreation, wood production and utilization, and livestock grazing) developed in the Dixie National Forest Plan. Management prescriptions are distinct from ROS zones in that they are intended to provide management guidelines for many different types of uses on the Dixie National Forest, and not just recreational use.

Approximately 12,070 acres of the analysis area is in the recreation management prescription. This management prescription provides guidelines for a broad range of outdoor recreation activities that meet recreational demands, and allows for a broad range of low-cost, dispersed recreation opportunities.

Approximately 4,470 acres of the analysis area are in the wood production and utilization management prescription. This management prescription is designed to manage for wood and fiber production. However, along forest roads, the USFS manages the area for a semiprimitive, motorized experience and a semiprimitive, nonmotorized experience in nonroaded areas within the zone.

Finally, approximately 855 acres of the analysis area are in the livestock grazing management prescription. This management prescription is designed to manage for intensive livestock grazing. The prescription also allows for dispersed recreation, with opportunities ranging from semiprimitive, nonmotorized to roaded natural on the ROS.

3.11.3 Bryce Canyon National Park Recreation Opportunities, Management Objectives, and Experiences

The southwest boundary of Bryce Canyon National Park is approximately 10 miles east of the tract. The park is open year-round and over the past five years, annual park attendance has averaged roughly 1.5 million visitors. The NPS provides visitors with numerous opportunities to explore the landscape and experience a relaxing, peaceful encounter in the outstanding natural setting of Bryce Canyon National Park.

Although Bryce Canyon National Park is outside the recreation analysis area, roads to the park may be affected by mine-related actions if they overlap the reasonably foreseeable coal haul route, and some recreational settings may be affected by mine operations (see Section 3.2 Aesthetic Resources for more information on visual resources and nightscapes; see Section 3.3 Air Resources for more information on visibility).

Over 99% of the park is managed for recreational activities. The *Bryce Canyon National Park General Management Plan* (NPS 1987) provides approximately 37% (13,325 acres) of the park as the natural environmental subzone, where lands are managed for preservation of natural features and no development is allowed. Approximately 62% (22,325 acres) of the park is managed as the wilderness subzone, where lands are managed to retain eligibility for wilderness designation in accordance with criteria developed for wilderness designation under the Wilderness Act of 1964. The remainder of the park (185 acres) is managed for preservation of historic features and development of facilities for park management.

Recreation use in Bryce Canyon National Park includes hiking, backpacking, camping, cross-country skiing, photography, picnicking, and viewing nature, wildlife, and geologic features. Hunting is not allowed in Bryce Canyon National Park.

3.11.4 Utah Department of Wildlife Resources Recreation Opportunities, Management Objectives, and Experiences

The UDWR manages hunting and fishing in Utah. The tract is in UDWR's PPMA. This management area (approximately 957,122 total acres in size) is open to all small-game hunting; hunting for mule deer and elk is managed through a permit system. The UDWR manages big game hunting in the PPMA as a trophy hunting area, with high buck-to-doe ratios for mule deer. Combined with limited hunting permits, the area is also popular for wildlife viewing of trophy mule deer, particularly because the area is between high visitation sites, such as Bryce Canyon National Park and Grand Staircase-Escalante National Monument.

For the 2007 hunting season, approximately 180 mule deer permits were issued for the PPMA. The UDWR allocated approximately 34 permits for archery only, 50 permits for muzzleloader only, and 96 permits for any weapon. In 2007 success rates for mule deer ranged from 68% for archery to 78% for muzzleloader and any weapon permits, with 100% of all permits being used.

Also in 2007, approximately 33 elk permits were issued for the management area, with nine permits allocated to archery only, five permits for muzzleloader only, and 19 permits for any weapon. The 2007 success rates for elk ranged from 17% for archery only to 45% for any weapon. The muzzleloader-only success rate was 20%. Approximately 97% of all 2007 tags were used in the PPMA.

There are no data on the number of hunters using the PPMA for hunting other species (predominantly small game), but UDWR believes most small-game hunters are from nearby communities (Aoude 2008).

Finally, Upper Kanab Creek has a small rainbow trout fishery, but no fishing occurs on or near the tract (Hadley 2008).

The tract falls within a cooperative wildlife management unit (CWMU), the Alton CWMU. A CWMU is a hunting area consisting primarily of private lands. Its management involves cooperation with public agency land managers to manage healthy and diverse populations of big game animals. The Alton CWMU is 43,658 acres and ranges in elevation from 5,500 feet to 9,000 feet. Public hunting is permitted from June through December (CWMU 2008). Within the Alton CWMU, 21 deer permits and four elk permits are issued each year. According to the CWMU contact, the tract does not fall within prime CWMU deer or elk habitat, and over the past 20 years, there have been no deer or elk kills in the proposed tract (Heaton 2009).

3.11.5 Designated Highways Recreation Opportunities, Management Objectives, and Experiences

The National Scenic Byways Program was established under the Intermodal Surface Transportation Efficiency Act of 1991, and reauthorized in 1998 under the Transportation Equity Act for the 21st Century. Under the program, the U.S. Secretary of Transportation recognizes certain roads as National Scenic Byways or "All-American Roads" based on their archaeological, cultural, historic, natural, recreational, and scenic qualities. There are 126 such designated byways in 44 states. The Federal Highway Administration manages the National Scenic Byways system to maintain the defined qualities of a designated road segment as a scenic byway. Utah scenic byways are managed by the Utah Office of Tourism and are also managed to maintain the defined qualities of a designated road segment as a state scenic byway

Mine-related activities would result in the use of several transportation corridors along the reasonably foreseeable coal haul route that have been designated as scenic byways and that lead to recreation areas. US-89 is designated as a State of Utah scenic byway from the intersection with SR-12 south to the City of Kanab. It is also known as the Mount Carmel Scenic Byway and is designated as a National Heritage Highway. The road provides access to the Dixie National Forest and BLM-managed lands within the recreation analysis area.

SR-12 is another designated scenic byway. It has been designated as an All-American Road, a state scenic byway, and a national forest byway. The road accesses portions of Dixie National Forest, Bryce Canyon National Park, Grand Staircase-Escalante National Monument, and Kodachrome Basin State Park. The road is popular for sightseers and visitors to Bryce Canyon and Capitol Reef national parks and would not be utilized as part of the reasonably foreseeable coal haul transportation route. The East Fork of the Sevier Scenic Byway (SR-12) travels south from SR-12 through the Sevier River Valley with the Paunsaugunt Plateau west of the byway and the Pink Cliffs to the east. The byway follows the river the entire way, passing Tropic Reservoir about halfway. From US-89, 9 miles east of Kanab, the Johnson Canyon/Alton Amphitheatre Scenic Backway first passes through portions of the Grand Staircase-Escalante National Monument, including the vermillion cliffs, then climbs into the white cliffs. The Alton road spur of the byway travels north to Alton and provides better views of the pink cliffs, the Alton Amphitheater, and extinct volcanoes. The Alton road then loops northeast rejoining US-89 north of Glendale.

3.11.6 Transportation and Recreation

Recreationists currently use portions of the reasonably foreseeable coal haul transportation route (see Section 2.6.4) for sightseeing, travel, or both to and from other recreation destinations described here. A transportation study (Fehr & Peers Transportation Consultants 2013) evaluates the existing condition of traffic on this route. The results of this study detailing the affected environment for transportation are included in Section 3.14 Transportation.

3.11.7 Other Recreation Opportunities, Management Objectives, and Experiences

Garfield and Kane counties both have management plans that provide direction for management of various activities within both counties. The Garfield County management plan has not completed the section regarding recreation management at this time. In the management plan, the county states that the "management direction for the Resource/Resource Use (Recreation) will be completed, subject to public comment, and adopted at some point in the future" (FCAOG 2007a). However, the plan does establish land use management areas, including several recreation areas ranging from wilderness to developed recreation. According to the plan, areas around the tract are managed as Recreation II zones. Recreation II zones provide for the following:

> Motorized and nonmotorized recreation activities such as driving for pleasure, viewing scenery, picnicking, fishing, snowmobile riding, and cross country skiing are possible. Motorized travel may be restricted to designated routes to protect the physical and biological resources. Visual resources are managed so that management activities maintain or improve the quality of recreation opportunities. Management activities are not evident, remained visually subordinate, or may be dominant, but harmonize and blend with the natural setting. Landscape rehabilitation is used to restore landscapes to a desirable visual quality. Enhancement aimed at increasing positive elements of the landscape to improve visual variety is also used. Dispersed recreation is only lightly managed, and management prescriptions are generally limited to situations necessary to maintain ecological stability and visual objectives of the management area. These lands are generally managed for VRM Class III. (FCAOG 2007a)

The *Kane County, Utah General Plan* (FCAOG 2011) does not provide specific management direction for all recreation within the county. Much of the land within and adjacent to the tract is managed for agriculture. The agriculture zone does not provide any management prescriptions for recreation. However, the plan does provide for management direction relating to recreational use of federal public lands within the county. It contains a request for federal agencies to provide for multiple recreation uses in Kane County by maintaining existing amenities and providing new recreation sites for the public's enjoyment. It also contains a request for agencies to pursue motorized and nonmotorized public access opportunities and to collect, review, and analyze data on recreation use within the county.

3.12 Socioeconomics

3.12.1 Demographic Overview

In accordance with NEPA, this analysis of the local social and economic conditions addresses the relationships between the Alton Coal Tract and the communities and socioeconomic resources it may affect. The following characterization of current social and economic conditions describes the culture, demographics, employment, tourism, income, fiscal and budgetary information, community facilities, and EJ communities in the region that could be affected by coal mining activities related to the tract. Numerical data in this section have been updated since the DEIS whenever appropriate, based on more recent U.S. Census Bureau (census) numbers and current economic conditions.

The analysis area for social and economic resources (the tract's socioeconomic study area [SESA]) comprises Kane, Garfield, and Iron counties. Although the tract is in Kane County, 0.10 mile south of the town of Alton, impacts to the surrounding counties are analyzed given the potential number of employees that may commute from surrounding counties, the reasonably foreseeable coal haul route, and the reasonably foreseeable rail loadout location.

3.12.1.1 SOCIAL SETTING

Presently, the SESA comprises a collection of rural communities characterized by pastoral landscapes, open space, and small town qualities. Many of the area's residents are of the Church of Jesus Christ of Latter Day Saints pioneer heritage and are proud of the values, customs, and culture that have resulted from their historical connections and lifestyle (FCAOG 2011). Area residents are generally interested in maintaining a rural lifestyle and quality of life that have been important parts of their past. According to the *Garfield County General Plan*, the county is committed to protecting the "custom, culture, and welfare of Garfield County's visitors and residents while providing for the conservation, use and/or enjoyment of its resources" (FCAOG 1998). In Kane County, 90% of the land is under federal ownership, and an additional 3.8% of the land base is controlled by SITLA, managed for the purpose of generating revenues for public institutions and education. In Garfield County, 90.1% of the land is federal and 4.7% is SITLA land (Utah Office of Tourism 2013a).

Because federal and state governments control more than 95% of the land in Kane and Garfield counties, many residents believe that much of the county's potential wealth is tied to its public lands. Therefore, a large number of residents are particularly interested in public land use management decisions, and county leaders are interested in developing cooperative working relationships with government agency managers (FCAOG 2007a). In addition, most of the local government revenues in Kane County come from *ad valorem* property tax and sales tax receipt shares. However, because so much of the land in the county is not available for development, the amount of property tax revenues that the county can collect is limited. Therefore, from Kane County's perspective, multiple use activities on federal lands in the county are critical to the continued vitality of its tax base (Kane County 2012).

Although Iron County has a greater percentage of lands under private ownership (29%), the social values and attention paid to public land management issues are similar to that of Kane and Garfield counties. According to the *Iron County Local Planning Summary*, the first goal of the *Iron County General Plan* is to "retain control of the issues which effect [affect] the County's custom, culture and economic stability" (2003).

The SESA is also home to Bryce Canyon National Park, which straddles Garfield and Kane counties. Approximately 75% of the park and its entrance are in Garfield County, whereas the other 25% of the park is in Kane County. Therefore, most of the tourism access to Bryce Canyon occurs in Garfield County by US-12. Cedar Breaks National Monument is also in the SESA in Iron County, approximately 60 miles west of Bryce Canyon.

3.12.1.2 POPULATION AND DEMOGRAPHICS

Due to the aridity, ruggedness, and isolation of the Alton Coal Tract, the overall population of the SESA is sparse. Garfield County has a population density of approximately 1.0 person per square mile, Kane County has 1.8 people per square mile, and Iron County has approximately 14.0 people per square mile (higher than Garfield and Kane counties but approximately half the state average of 33.6 people per square mile) (U.S. Census Bureau 2013d, 2013e, 2013c).

Despite the small population relative to the geographic size of the counties, the population rates have steadily increased in recent years (Table 3.12.1). Since 1990, Kane County's population has increased 38.6% to 7,137 in 2010. The population increase over this time period can be attributed almost equally to in-migration (more people moving into the county than out, at approximately 880 people), as well as natural population increase (births minus deaths, at approximately 730 people). The annual population increase in Kane County averaged 1.2 % from 1990 to 2010. The Town of Alton reported 119 residents in 2010, a 28% increase from 1990. The largest city in Kane County is Kanab, with a population of 4,312 in 2010 (U.S. Census Bureau 2013l, 2013a; UDWS 2010). See Table 3.12.1 for county population growth figures.

Garfield County, located directly north of Kane County, has experienced similar growth patterns. The population has steadily increased (30.6%) since 1990 to 5,184 in 2010. The cities with the largest populations are also the areas experiencing the greatest amount of growth. These cities (populations in parentheses) are Panguitch (1,520), Escalante (797), and Tropic (530) (UDWS 2008a).

Iron County's population is nearly eight times higher than Kane and Garfield counties and has expanded rapidly in recent years. Overall, the county's population more than doubled, with a 121.3% increase from 20,910 in 1990 to 46,272 in 2010. Cedar City maintains the bulk of the county's residents with a 2010 population of 28,857. However, population growth slowed dramatically in 2009. The county's annual growth rate of 1.0% in 1990 ranked below the statewide average growth rate of 1.5% and well below the average annual growth rate of 4.0% that the county boasted from 1990 to 2008. From 2008 to 2010, the birth rate and natural population increase totaled 1,814, but persons leaving the county from 2008 to 2010 totaled 416, marking the first time since 1989 that net migration was negative (U.S. Census Bureau 2013l).

Table 3.12.1. Population Characteristics of the Alton Coal Tract Socioeconomic Study Area

	1990	2000	2010	Percentage Change Since 1990
Kane County	5,150	6,037	7,137	38.6%
Garfield County	3,970	4,763	5,184	30.6%
Iron County	20,910	34,079	46,272	121.3%
State of Utah	1,729,227	2,246,553	2,800,089	61.9%
Town of Alton	93	134	119	28.0%

Source: U.S. Census Bureau (2013l).

3.12.1.3 HOUSING AND PROPERTY VALUES

This section characterizes the existing conditions of housing and property values in the SESA as they relate to the potential mine impacts. With regard to housing, impacts to property values are often of particular interest to local residents when considering changes to existing land uses in their community. Some comments submitted during the original scoping period for the Alton Coal EIS expressed concern that the mine would cause a decrease in the area's property values. Other comments received at the Fair Market Value Hearing and other local scoping meetings expressed the opposite opinion and provided comments about the benefits of a mine. Comments received on the DEIS echoed these opinions. In sum, residents in the region and others expressed interest that development of a surface coal mine could do the following:

1. Impact property values a) positively in terms of value increases due to proximity to employment opportunities, and b) negatively in terms of value reductions due to proximity to a mine site
2. Impact economic activity a) positively in terms of increased employment and businesses activity, and b) negatively in terms of lost revenue for the local tourism industry (if tourists were to be deterred from visiting the area)
3. Change the area's quality of life a) positively in terms of providing employment for the rising generation, and b) negatively in terms of the potential to lose the sense of place currently derived by the rural culture and proximity of Bryce Canyon National Park along with other recreation opportunities on SESA public lands

The census estimates that from 2007 to 2011, Garfield County had 3,644 housing units, of which 1,500 (41.2%) were vacant. The median home value for the same time period was $149,500. Table 3.12.2 displays similar figures for Garfield County's largest towns (Panguitch, Escalante, and Tropic) and resort communities (Boulder, Bryce Canyon, Panguitch, and Tropic). Panguitch and Tropic fall into both categories. Each of Garfield County's towns listed below had median home values below the county median, except for the town of Boulder, which saw median home values estimated at $169,400, nearly 15% above the county median (U.S. Census Bureau 2007–2011a).

Table 3.12.2. Housing Statistics for Resort Communities in the Socioeconomic Study Area

Town	Driving Distance to the Tract (miles)	Total Housing Units	Occupied Housing Units	Vacant Housing Units	Vacancy Rate (%)	Median Home Value ($)
Boulder	118	128	97	31	24.2%	$169,400
Brian Head	48	1,268	25	1,243	98.0%	$1,000,000 or more
Bryce Canyon	48	77	35	42	54.5%	$143,800
Escalante	89	520	414	106	20.4%	$133,300
Kanab	39	2,165	1,967	198	9.1%	$177,800
Orderville	17	277	237	40	14.4%	$143,800
Panguitch	36	808	671	137	17.0%	$128,600
Tropic	51	319	271	48	15.0%	$140,200

Source: U.S. Census Bureau (2007–2011a).

Note: Resort communities are characterized by the Utah Office of Tourism and the Utah State Tax Commission.

From 2007 to 2011, Iron County had an estimated 19,330 housing units, of which 4,017 (20.8%) were vacant. The median home value for the same time period was $196,400. Cedar City, the largest town in Iron County, had nearly half (11,069) of these housing units, with a vacancy rate of only 10.4% (1,147 units) and a median home value above the county median at $201,000. Brian Head, Iron County's only resort community, had approximately 1,268 housing units with a median home value of $1,000,000 or more (well over the county median). A popular skiing resort destination, Brian Head, had only 25 occupied housing units according to the census, or a 2% occupancy rate (U.S. Census Bureau 2007–2011a). Lastly, Kane County had 5,686 housing units, of which 2,473 (43.5%) were vacant. The median home value for the same time period was $171,600. Kanab, the largest town in Kane County and also considered a resort community, had 2,165 of these housing units with a vacancy rate of only 9.1% and a median home value above the county median at $177,800. Orderville, a small resort community 17 miles from the tract by car, had 277 housing units with a median value below the county median of $143,800, of which 237 or 85.6% were occupied. Alton, with 63 housing units, had 10 vacant homes (15.9%) and a median home value of $195,000, 13.6% above the county median (U.S. Census Bureau 2007–2011a).

3.12.1.3.1 Property Taxes

Property tax revenue helps fund state and local governments' operating budgets as well as school and fire districts. Statewide, over 50% of property tax revenues are allocated to schools, followed by counties (20%), special districts (14%), and cities and towns (13%). Counties use property tax revenue to fund court systems, sheriffs' departments, transportation projects, emergency services, and tax relief to the indigent, blind, and veterans.

Property tax impacts could occur near the tract due the physical change in land use and the concentration of mining activities in and around the Alton Coal Tract; as such, existing property values within Kane County (the county in which the mine would be located) are evaluated here. State of Utah numbers are given for comparative purposes. In 2011, the average estimated residential sales price in Kane County was $160,569 and the primary residential tax rate was 0.006271. The effective tax rate equals the average of the total residential taxes charged divided by the average of the total residential market values. The average property tax paid in Kane County in 2011 was $1,007. Of the $1,007, on average, $420 went to the county, $473 to the school districts, $56 to cities and towns, and $58 to special districts. By comparison, the 2011 statewide average estimated residential sales price was $195,817, and the primary effective tax rate was 0.006535, making the average property tax payment for the state of Utah $1,248 (Utah State Tax Commission 2007).

In 2011, property taxes paid by all Utah Coal Mines in the state totaled $4.32 million dollars (Hogue 2012).

3.12.1.3.2 Second-home Ownership

Second-home ownership is an important trend occurring in southern Utah. Tracking second-home ownership accurately by disclosing the percentage and valuation of new second-home permits versus permits for new houses for full-time residents can be challenging. This challenge can be mitigated by looking at property taxes collected on primary residences (dwellings used as a person's primary residence) versus nonprimary residences (mainly second homes), because they are taxed at different rates. Property taxes in Utah are levied on primary residential properties at 55% of fair market value, whereas nonprimary residential properties are taxed at 100% of fair market value. Table 3.12.3 shows actual property taxes charged against primary and nonprimary residential properties as well as each type's share of the total taxable value of residential properties in the county for the year 2011.

Table 3.12.3. Tax Comparisons of Primary and Nonprimary Residential Property in the Socioeconomic Study Area in 2011

County	Property Taxes Charged Against Primary Residential Properties ($)	Property Taxes Charged Against Nonprimary Residential Properties ($)	Share of Total Taxable Value for Primary Residential Properties (%)	Share of Total Taxable Value for Nonprimary Residential Properties (%)
Garfield	$1,207,759	$1,701,719	40%	60%
Iron	$14,445,096	$7,215,357	65%	35%
Kane	$2,339,272	$4,534,107	35%	65%

Source: Utah State Tax Commission (2012).

In Garfield County in 2011, approximately 60% of the taxable value for residential property was in the nonprimary category, pointing to a high percentage of second versus primary homes. The same was the case for Kane County, with only 35% of residential taxable value coming from primary residences. Iron County, which is home to the largest city in the SESA (Cedar City with a 2010 population of 28,857), had the opposite balance, with only 35% of residential taxable value coming from nonprimary residences (Utah State Tax Commission 2012).

According to the *Kane County, Utah General Plan* (Kane County 2011), over 30% of total county housing units were considered seasonal or recreational (the highest percentage of the total units in the five southwestern Utah counties), with the largest concentration of these located near Bryce Canyon National Park in Cedar Mountain and Deer Springs. These data are consistent with the taxation figures listed in Table 3.12.3. The general plan also notes that new residential construction, although remaining steady from the 1970s through the mid-1990s, increased substantially from 1994 to 2006, with approximately 50% of the new construction attributable to seasonal or recreational housing.

Recent studies indicate that second homes are typically built based on scenic beauty and recreation potential. A Colorado-based study reports that 95% of second-home owners selected their homes based on scenery, and 91% cited recreation opportunities as being important amenities that influence their decision (Venturoni et al. 2005). Initially, the construction of new second homes may be beneficial because they increase the local property tax base. However, a high concentration of second homes may also be problematic for local residents because they can increase the cost of living for local residents by increasing property taxes. In Utah, this effect is partially mitigated by the previously discussed 45% exemption for primary residential property taxes (versus nonprimary residential properties, which are taxed at 100% of assessed value). There still remains potential for conflict within communities between second-home owners and full-time residents because full-time residents often desire to diversify their economic base, become less dependent on tourism, and meet the basic needs of the community with respect to affordable housing and education (Venturoni et al. 2005). Most of the second homes in Kane County are on Cedar Mountain (approximately 30 miles from the tract), whereas those in Iron and Garfield counties are even further away from the tract (see Table 3.12.2 for driving distances from resort communities to the tract).

3.12.1.4 EMPLOYMENT AND INCOME

The labor market in the SESA has been subject to the impacts of the slowing economy in recent years. The unemployment rates in the SESA and across the state have fluctuated since the year 2000. See Figure 3.12.1 for unemployment trends in the SESA.

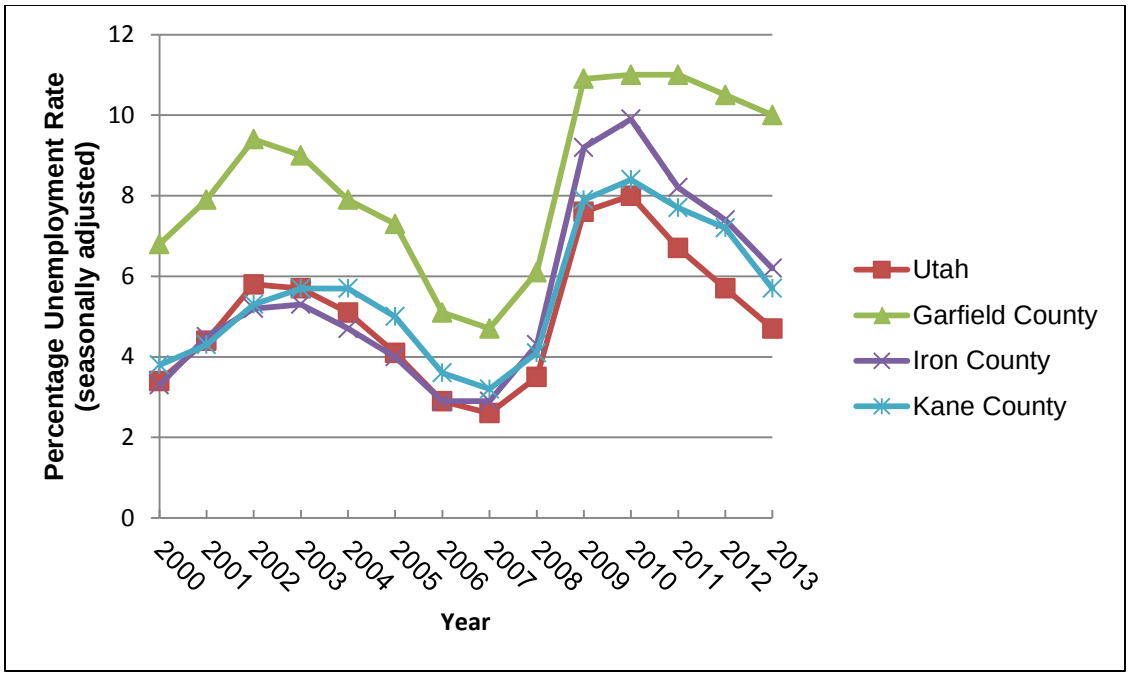

Figure 3.12.1. Unemployment rate in the socioeconomic study area in 2000–2013 (UDWS 2013a).[2]

Job losses have been prevalent across a range of industries, but they have been most heavily concentrated around the construction and manufacturing industries. See Table 3.12.4 for characteristics of the SESA's labor force.

Table 3.12.4. Labor Force Characteristics of the Alton Coal Tract Socioeconomic Study Area in 2012

	Labor Force	Employed	Unemployed	Percentage Unemployment Rate
Garfield County	2,741	2,454	287	10.5%
Kane County	3,339	3,098	241	7.2 %
Iron County	19,195	17,772	1,423	7.4%
State of Utah	1,353,597	1,276,249	77,348	5.7%

Source: UDWS (2013a).

According to UDWS, the average monthly income in each county in the SESA is substantially lower than the state average (Table 3.12.5). The low wages are attributed to the high percentage of lower-paying, seasonal, tourism-related jobs in Kane and Garfield counties, and to a large working student population in Iron County. The minimum wage in Utah has been $7.25 (same as the federal minimum wage) since July 2009.

[2] Unemployment figures are annual averages except 2013, which is the monthly figure from April 2013.

Table 3.12.5. Alton Coal Tract Socioeconomic Study Area Income and Wages in 2010

	Kane County	Garfield County	Iron County	State of Utah
Total personal income (millions)	$225.0	$142.3	$1,072.3	$90,250.2
Per capita income	$31,454	$27,439	$23,164	$32,517
Average monthly nonfarm wage	$2,238	$2,205	$2,288	$3,235

Sources: UDWS (2013b, 2013c).

Despite the lean job market and low wages, total personal income in the combined SESA rose 29% from approximately $1.1 billion in 2005 to approximately $1.4 billion in 2010. However, only 43% of the SESA's total population is considered part of the workforce (both employed and unemployed) (UDWS 2013d).

The distribution of employment by industry sector in the SESA appears in Table 3.12.6. Throughout the SESA, government is the predominant employer, with an average of 27% of the labor force in each county employed in this industry sector. The leisure and hospitality sector also accounts for numerous jobs in the SESA. Garfield County has the highest percentage (42%) of the labor force employed in the leisure and hospitality sector. One of the largest employers in Garfield County is Ruby's Inn. Other tourism-based employers in the county are Bryce Canyon Resort, Offshore Marina, Bryce Canyon Pines, and the New Western Motel. In Kane County, where 30% of the workforce is employed in the leisure and hospitality sector, Aramark (Lake Powell Resorts) is one of the largest employers. Best Friends Animal Society is also one of the largest employers and hosts nearly 30,000 visitors a year (Best Friends Animal Society 2011). Iron County maintains fewer jobs (13%) in the leisure and hospitality sector. However, the Utah Shakespeare Festival held at Southern Utah University in Cedar City draws thousands of tourists to Iron County annually and employs approximately 250 individuals in the summer and fall (Utah Shakespeare Festival 2013). Table 3.12.6 breaks down employment by sector in the SESA.

Table 3.12.6. Employment and Percentage Share by North American Industry Classification System Industry Sector in 2011

	Kane County	Garfield County	Iron County	Total per Sector (average percentage share over the SESA)
Natural resources and mining	5	9	99	113
	0.2%	0.4%	0.7%	0.4%
Construction	88	41	570	699
	2.9%	1.8%	3.8%	2.8%
Manufacturing	99	40	1,370	1,509
	3.3%	1.7%	9.1%	4.7%
Trade/transportation utilities	413	259	2,684	3,356
	13.8%	11.2%	17.7%	14.2%
Information	17	91	115	223
	0.6%	3.9%	0.8%	1.8%

Table 3.12.6. Employment and Percentage Share by North American Industry Classification System Industry Sector in 2011

	Kane County	Garfield County	Iron County	Total per Sector (average percentage share over the SESA)
Financial activities	109	27	707	843
	3.6%	1.2%	4.7%	3.2%
Professional/business services	52	18	1,158	1,228
	1.7%	0.8%	7.6%	3.4%
Education/health/ social services	113	231	1,707	2,051
	3.8%	10.0%	11.3%	8.4%
Leisure/hospitality (tourism)	906	964	1,910	3,780
	30.2%	41.6%	12.6%	28.1%
Other services	462	17	315	794
	15.4%	0.7%	2.1%	6.1%
Government	740	620	4,498	5,858
	24.6%	26.8%	29.7%	27.0%
Total	**3,004**	**2,317**	**15,132**	**20,453**

Source: UDWS (2013a).

Over time, nonfarm jobs and wages in Garfield County fluctuated between 2,260 jobs with an average monthly wage of $1,907 in 2006 and 2,317 jobs with an average monthly wage of $2,130 in 2011. The county lost 2.3% of these jobs from 2010 to 2011, and the average monthly wage dropped from $2,204 to $2,130. Iron County had 16,806 nonfarm jobs in 2006 (average monthly wage of $2,055) and 15,132 jobs in 2011 (average monthly wage of $2,319), losing 1,674 jobs over the time period. Lastly, Kane County lost 88 nonfarm jobs from 2006 to 2011, but saw an average monthly wage increase of $364 over the same time period. Most of the jobs in each county lost over this five-year period were in the construction sector, which lost on average 10% of its sector jobs in Garfield County, 21% in Iron County, and 11% in Kane County (UDWS 2013d).

The mining and natural resources development sector represents the lowest employment sector in the SESA, accounting for less than 1% (113) of SESA jobs. Data from the U.S. Department of Labor's Bureau of Labor Statistics Quarterly Census of Employment and Wages for the coal mining sector (North American Industry Classification System Code 2121) were not available for any county in the SESA. The report *The Utah Coal Industry: Economic and Fiscal Impacts* (Hogue 2012) estimates that in 2011, the Utah coal mining industry directly employed approximately 1,748 persons with associated wages averaging $77,520 and total compensation (wage plus benefits) averaging $90,000. Thus, the coal mining sector provided for $132.0 million in wages and $155.0 million in total compensation in 2011. These wages are substantially above the statewide wage average of $40,898/year. In addition, though the service sector employed higher numbers of individuals in 2011 (2,107), average wages were also much lower at $30,396 annually (Hogue 2012). In addition, Hogue (2012) estimates that Utah's coal mining industry provided an additional 2,952 indirect jobs in the state. Indirect jobs result from economic linkages between the coal industry and other industries, and by the economic activity stimulated by the expenditure of associated wage earnings. These 2,952 indirect jobs accounted for an estimated $123.0 million in employee compensation in 2011. Therefore, direct and indirect compensation from coal mine industry jobs totaled approximately $278 million in 2011 (Hogue 2012).

3.12.1.4.1 Economic Contribution of Utah-produced Coal for Export

In 2011, United States coal exports totaling 107 million short tons resulted in significant economic contributions, and accounted for approximately 10% of total United States coal production (Ernst & Young LLP 2013). According to the report *U.S. Coal Exports: National and State Economic Contributions* (Ernst & Young LLP 2013), Utah ranked 15th overall, accounting for a 2% share (19 million short tons) of total United States coal production in 2011. Of this, approximately 6% (1.1 million short tons) of Utah-produced coal was exported abroad. Using economic multipliers derived from the 2010 IMPLAN input-output model, the report estimates the additional direct, indirect, and induced economic contributions of Utah's exported coal in the form of employment, labor income, and gross value added within three distinct categories: export coal production, downstream transportation, and port operations and cargo handling. Economic contribution figure estimates attributable to the export of Utah's coal from the 2013 report are shown in Table 3.12.7.

Table 3.12.7. Economic Contribution of Utah-Produced Coal for Export in 2011

Estimated Economic Contribution	Category	Direct	Indirect and Induced	Total
Employment (number of full- and part-time employees)	Export coal production	200	610	810
	Downstream transportation	80	370	450
	Port operations and cargo handling	–	30	30
	Total	**280**	**1,010**	**1,290**
Labor income (millions of 2011 dollars)	Export coal production	$19	$28	$47
	Downstream transportation	$9	$14	$23
	Port operations and cargo handling	–	$1	$1
	Total	**$27**	**$43**	**$71**
Gross value added (millions of 2011 dollars)	Export coal production	$37	$52	$89
	Downstream transportation	$15	$25	$40
	Port operations and cargo handling	–	$2	$2
	Total	**$53**	**$79**	**$131**

3.12.1.5 TOURISM

As mentioned in Section 3.11 (Recreation), numerous recreation and tourism opportunities are near the tract and along the reasonably foreseeable coal haul route. Bryce Canyon National Park, Dixie National Forest, and Grand Staircase-Escalante National Monument are major tourist attractions in the area. In general, spending by travelers in the SESA has fluctuated in recent years. The fluctuations in traveler spending are attributed to the weakening in the United States economy since 2007. Over the five-year period from 2006 to 2011, traveler spending in Garfield County increased from $55.7 million to $82.3 million, a 33% increase when adjusted for inflation. Spending by travelers in Kane County increased from $70.5 million in 2006 to $100.8 million, a 28% increase; and in Iron County, travelers spent $100.3 million in 2011, 7% less than the $96.7 million spent 2006 (when adjusted for inflation) (Utah Office of Tourism 2009). Table 3.12.8 reflects various travel and tourism contributions to the SESA in 2011.

Table 3.12.8. Alton Coal Tract Socioeconomic Study Area Tourism Profile 2011

	Kane County	Garfield County	Iron County	SESA Totals
Spending by travelers (millions)	-$100.8	-$82.3	$100.3	$283.4
Travel and tourism-related employment	1,820	1,486	1,812	5,118
Local tax revenue from traveler spending (000s)	$5,314.4	$4,339.1	$5,292.3	$14,945.8
State ranking (spending by travelers per county)*	12th	14th	9th	–

Source: Utah Office of Tourism (2013a).

* Data for 2009 state rankings are for 2009 because updated information was not available.

Individuals who participated in the scoping process reported that tourists to the area contribute significantly to the local economy. In the SESA, there are numerous tourism-based businesses (bed and breakfasts, resorts, hotels, etc.) for visitors who visit the national parks and other tourist destinations in the area. According to local residents, tourism and recreation are the primary industries currently using the reasonably foreseeable coal haul transportation route. Locals have also reported a growing number of bicycling and motorcycling tours along US-89.

Visitors to the area contribute to the local economy by direct spending, tourism-related employment, and tourism-based tax revenues. Tourism tax revenues are derived from transient room tax, restaurant tax, car rental tax, and gross taxable retail sales. Tables 3.12.9, 3.12.10, and 3.12.11 and Figures 3.12.2 and 3.12.3 further break down tourism tax revenues in the SESA over time (figures for car rental tax were not available).

Table 3.12.9. Transient Room Tax Revenues 2008–2012

County	2008	2009	2010	2011	2012	Total Over Five Years
Garfield	$1,069,707	$1,106,964	$1,152,762	$1,152,728	$1,161,530	$5,643,691
Iron	$838,162	$732,181	$839,377	$843,708	$908,439	$4,161,867
Kane	$695,688	$688,404	$1,050,038	$1,100,587	$1,336,608	$4,871,325

Source: Utah Office of Tourism (2013b).

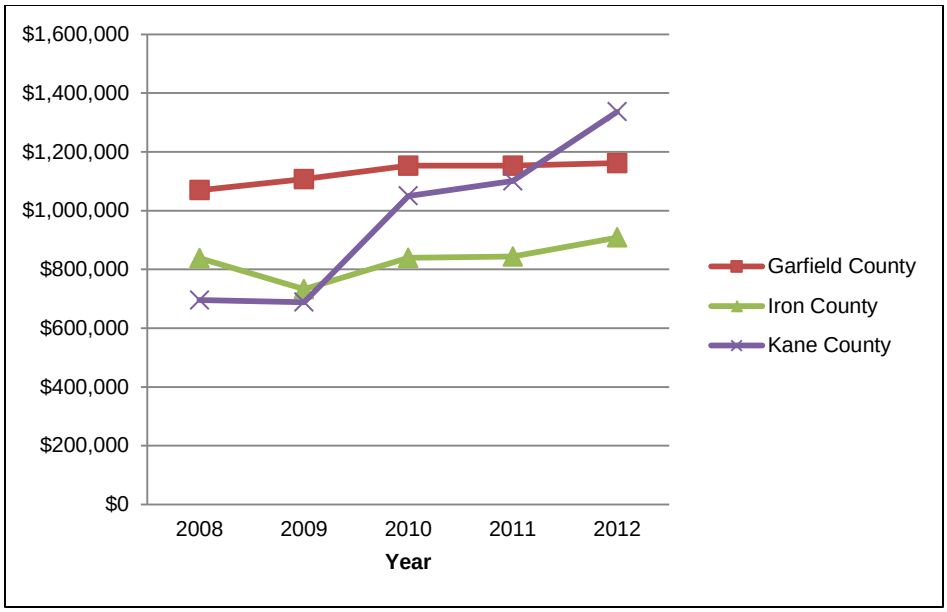

Figure 3.12.2. Transient room tax revenues 2008–2012 (Utah Office of Tourism 2013b).

Table 3.12.10. Restaurant Tax Revenues 2008–2012

County	2008	2009	2010	2011	2012	Total Over Five Years
Garfield	$160,684	$168,137	$176,301	$188,040	$181,652	$874,814
Iron	$473,622	$458,375	$468,710	$500,612	$521,469	$2,422,788
Kane	$118,087	$122,813	$134,638	$142,271	$153,411	$671,220

Source: Utah Office of Tourism (2013b).

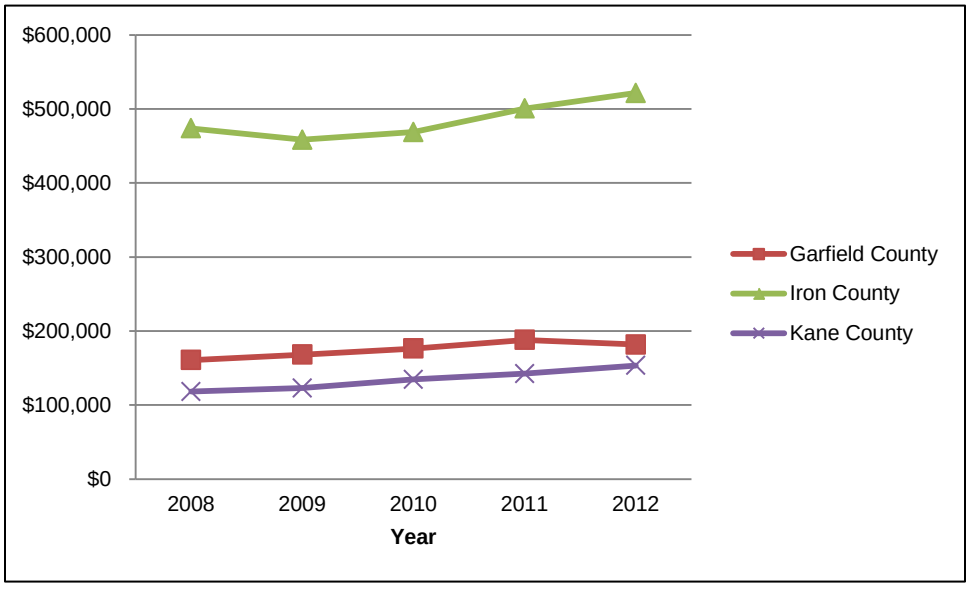

Figure 3.12.3. Restaurant tax revenues 2008–2012 (Utah Office of Tourism 2013b).

The figures and tables above show that both transient room tax and restaurant tax revenues have generally increased year over year from 2008 to 2012 for each county in the SESA. However, Garfield County experienced a 3.4% decrease in restaurant tax revenues from 2011 to 2012. Table 3.12.11 shows resort communities sales tax revenues from 2008 to 2012, most of which declined over the five-year period. Bryce Canyon City in Garfield County saw the greatest five-year sales tax revenue increase of 5.4%, but experienced a drop of $35,556 (a 10.7% decrease) in revenues from 2011 to 2012.

Table 3.12.11. Socioeconomic Study Area Resort Communities Sales Tax Revenues 2008–2012

County	Community	2008	2009	2010	2011	2012	Total Over Five Years	Percentage Change over Five Years
Garfield	Boulder	$36,196	$42,515	$33,264	$31,106	$32,936	$176,017	-9.01%
Garfield	Bryce Canyon	$281,803	$305,935	$325,202	$332,566	$297,010	$1,542,516	5.40%
Garfield	Panguitch	$201,937	$151,315	$158,011	$164,088	$178,606	$853,957	-11.55%
Garfield	Tropic	$75,533	$47,921	$51,881	$54,290	$53,243	$282,868	-29.51%
Iron	Brian Head	$245,675	$211,179	$224,636	$218,152	$221,255	$1,120,897	-9.94%
Kane	Kanab	$585,612	$510,851	$505,924	$571,874	$543,142	$2,717,403	-7.25%
Kane	Orderville	$76,539	$63,890	$64,437	$77,480	$73,366	$355,712	-4.15%

Source: Utah Office of Tourism (2013b).

In addition to traveler spending and tax revenues, travel- and tourism-related employment plays an important economic role in the SESA. Travel- and tourism-related jobs in the SESA were estimated at 5,118 in 2011 by the Utah Office of Tourism (2007–2010), a 72% increase over 2006 levels. Table 3.12.12 and Figure 3.12.4 show travel- and tourism-related employment numbers over time for the SESA, which have increased dramatically (in some cases more than doubling) since 2009 in all three counties.

Table 3.12.12. Travel- and Tourism-related Employment in the Socioeconomic Study Area 2006–2011

	2006	2007	2008	2009	2010	2011
Garfield	814	658	708	577	1,367	1,486
Iron	1,537	1,419	1,412	1,178	1,775	1,812
Kane	608	645	705	536	1,590	1,820
Combined SESA	2,959	2,722	2,825	2,291	4,732	5,118

Source: Utah Office of Tourism (2007-2010).

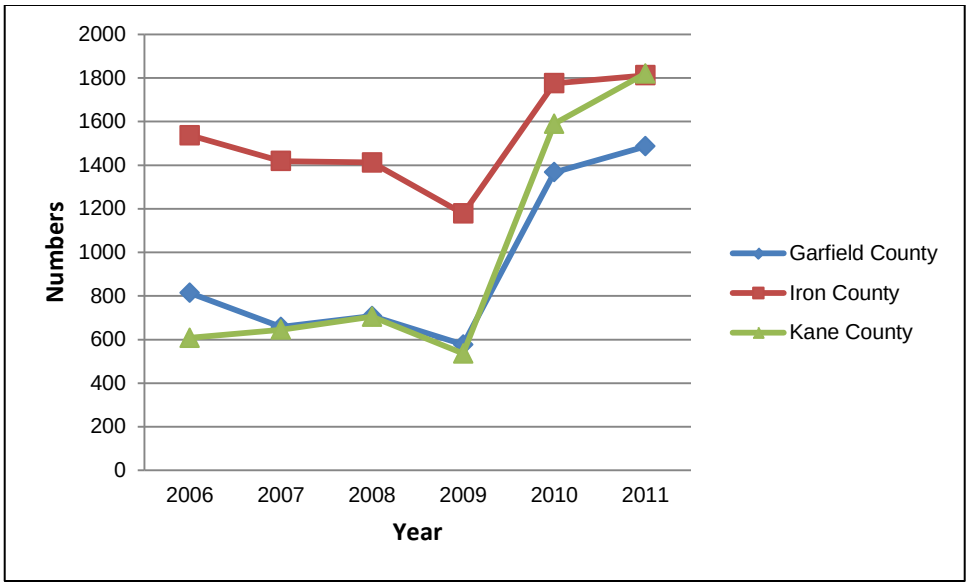

Figure 3.12.4. Travel- and tourism-related employment in the socioeconomic study area 2006–2011 (Utah Office of Tourism 2007-2010).

Although it is difficult to predict exactly how much tourists spend in an area on a given day, previous researchers have developed some estimates. A 1994 survey by Utah State University economists estimated visitor spending for southern Utah in general, for three wilderness areas, and for one WSA in southern Utah (Keith et al. 1995). Table 3.12.13 summarizes this study (visitors include general leisure visitors, business visitors, and recreationists to these four areas).

Table 3.12.13. Spending Estimates for Visitors to Southern Utah and Visitors to Southern Utah Wilderness Areas and Wilderness Study Areas

Area Visited	Expenditures Per Person Per Day (2011 dollars)
All visitors to southern Utah	$94
Visitors to three southern Utah wilderness areas and one WSA	$25–$34

Source: Keith and Fawson (1995).

Notes: Original data in 2001 dollars for southern Utah visitors and 1994 dollars for Utah wilderness area visitors. Adjusted to 2011 dollars using Consumer Price Index inflation values.

Southern Utah visitors are divided into those visiting for leisure purposes (74%) and those visiting for business purposes (26%).

The three Utah wilderness areas surveyed are Box-Death Hollow (Garfield County), Dark Canyon (San Juan County), and Paria Canyon (Kane County). Grand Gulch (San Juan County) is a WSA. These four areas in southern Utah are considered multi-day backpacking venues; therefore, the expenditures estimate may not be representative of day-use spending. Day-use spending can be higher because recreation day-use visitors may, for example, stay in motels, eat in restaurants, and purchase from local retailers. Also, these four areas are a mix of designated wilderness and WSAs.

Although the public lands in the SESA are not marketed, they do provide an economic and social value to local residents and tourists. Even if no money changes hands, visitors to the area and local residents find value and benefit by the presence of public lands because they provide satisfaction and unique opportunities. With specific regard to the SESA, the public lands that surround the town of Alton and other small communities contribute to the area's rural, small-town feel. The local residents enjoy the area because of the pristine beauty and opportunities for solitude that the public lands provide. According to newer residents in towns in the SESA, the area's peaceful lifestyle and slow pace was an attraction (SWCA 2007a). Thus, the public lands are of value to local residents and the tourists who enjoy the area.

Where relevant and feasible, the BLM directs to use estimates of nonmarket environmental values in NEPA analysis supporting planning and other decision making (BLM 2013b). Typically, nonmarket valuations have been used to estimate the monetary value individuals place on public lands. Nonmarket valuations view public lands in terms of their on-site value and their "passive" use or their off-site value. Economists have used data collected from actions or survey responses of visitors, homebuyers, and the public to simulate market conditions and elicit measures of value (Loomis 2005). The nonmarket value is the value received by the users and is above and beyond what they received for their direct expenditures. Table 3.12.14 presents average on-site use values for selected recreation activities that resemble public use activities near the Alton Coal Tract.

Table 3.12.14. Average Nonmarket Use Values of Recreation on Public Land from Existing Studies of Activities in the Intermountain Area

Recreation Type	Value Per Person Per Activity Day (2011 dollars)
Mountain Biking	$219.68
Float boating/rafting/canoeing	$80.62
Fishing	$59.03
Hunting	$57.81
General recreation	$57.71
Hiking	$45.88
Camping	$41.34
Picnicking	$33.66
Sightseeing	$28.08
Offroad vehicle driving	$27.16
Wildlife viewing	$44.34

Source: Loomis (2005).

Notes: Original data are in 2004 dollars and have been adjusted here to 2011 dollars using the Consumer Price Index inflation rate. All values are rounded to the nearest dollar. Data are median values from existing studies. The Inter-mountain area is considered USFS Regions 1–4. General recreation is a composite of recreation opportunities at a site with a measure for the site, not a specific activity.

In contrast to the on-site valuation of public lands, it is important to understand the passive-use valuation of public lands. Passive-use studies measure the satisfaction of knowing that undeveloped, primitive public land is simply "there" and will be preserved. A passive-use valuation study of Utah wilderness, completed more than 15 years ago, found that Utah residents placed an economic value of $82.46 per household (in 2011 dollars) on the preservation of the 2.7 million acres of designated wilderness in Utah (Loomis 2000). Although the lands within the proposed tract and surrounding areas are not designated wilderness areas, the example has been given to demonstrate the economic value of undeveloped, primitive landscapes. Although the economic value for passive use on public lands not containing a high level of wilderness characteristics would almost certainly be less than $82.46 per 2.7 million acres, the exact value households are willing to pay is unknown.

3.12.2 Government and Public Finance

3.12.2.1 REGIONAL COAL PRODUCTION

In 2011, Utah was ranked as the 14th highest coal-producing state, with 20.1 million tons of coal being produced in mines throughout Utah (Utah Geological Survey 2012), and 15th overall with 19 million tons according to the Ernst & Young 2013 report. Most Utah coal production occurs in Carbon, Emery, and Sevier counties. No coal production on BLM-administered land has occurred in Kane and Garfield

counties since 1971 (2008d). However, 54% of the state's estimated remaining recoverable coal can be found in Kane County with 20.8% in Garfield County. Iron County has 1.7% of the state's coal reserves, with no coal mining currently occurring in the county (Utah Geological Survey 2013b).

3.12.2.1.1 Coal Royalty Revenues

Coal production on federal lands is subject to royalty payments and disbursements under the MLA. The royalty rate for surface mined coal is 12.5% of sales value and is paid to the Department of the Interior Office of Natural Resources Revenue (ONRR). These royalties are paid by mining companies to the federal government, which in turn dispenses approximately 50% to the State of Utah. Royalties received by Utah are distributed to several entities according to state law, most of which are allocated to UDOT (40%) and the Permanent Community Impact Fund (32.5%). The rest is allocated as follows: Department of Community and Culture (5.0%), State Board of Education (2.25%), Utah Geological Survey (2.25%), Water Research Laboratory (2.25%), and Payments in Lieu of Taxes (52¢ per acre).

In fiscal year 2012, over 13 million tons of coal were mined in Utah at a reported sales value of $521.3 million dollars. Of the total sales value, more than $65 million were reported in royalty revenues. Of this, approximately $36 million were disbursed to Utah. Bonus payment totaled $530.3 million in fiscal year 2012 (ONRR 2013).

3.12.2.1.2 Permanent Community Impact Fund Board

The Permanent Community Impact Fund Board (CIB) provides loans and/or grants to state agencies and subdivisions of the state that are or may be socially or economically impacted, directly or indirectly, by mineral resource development on federal lands. Projects eligible for funding include planning, construction, and maintenance of public facilities as well as provision of public services. Between fiscal years 2008 and 2012, Kane County received a total of $22,630,654 CIB funding ($4,107,654 in grants and $18,523,000 in loans). Of the 16 total projects funded by the CIB, one was in the town of Alton and two were in Kanab. Garfield County received a total of $13,652,000 in funds ($4,126,000 in grants and $9,526,000 in loans). Iron County received at total of $14,879,500 in CIB funding ($766,500 in grants and $14,113,000 in loans) (UDWS 2012).

3.12.3 Public Health and Safety

3.12.3.1 TRANSPORTATION

Principal transportation routes in the SESA are US-89, SR-14, SR-20, and I-15. US-89 runs from north to south through the towns of Panguitch, Hatch, and Kanab, and serves as the main access road to south-central Utah, including access between Bryce Canyon and Zion national parks.

UDOT has five roadway improvement projects along US-89 scheduled for completion in the next five years according to the *Statewide Transportation Improvement Plan 2008–2013*. The projects include construction of a passing lane from Milepost 88.3 to 89.1 (estimated cost: $1.4 million) and partial realignment and pavement rehabilitation from 300 North in Kanab to Kanab Creek Bridge (estimated cost: $10 million). In Garfield County, intersection improvements at US-89 and SR-14 (Long Valley Junction) are underway (estimated cost: $16 million) and road widening along US-89 is projected (estimated cost: $9 million) (2008).

In Kane, Garfield, and Iron counties, the county governments are responsible for ongoing road maintenance and repair. Special service districts undertake capital construction projects financed primarily by CIB funds. Local government assistance for road improvements includes Class B and Class C Road Funds programs as well as federal and state aid for specified projects.

3.12.3.2 LAW ENFORCEMENT

The Kane County Sheriff's Office employs 12 full-time law enforcement officers. They provide law enforcement services to the unincorporated areas of Kane County and several contract communities, including Alton. Kanab and Big Water have their own police departments.

Garfield County has one county sheriff, three deputy sheriffs, two Panguitch City police officers, two Utah Highway Patrol troopers, and one Escalante police officer. The sheriff's office has 21 volunteers from Panguitch, eight from Bryce Valley, and 19 from Escalante (FCAOG 1998).

The Iron County Sheriff's Department has 33 full-time officers, 18 of which are patrol officers. The department provides law enforcement to the unincorporated areas of the county and small cities including Summit, Paragonah, Kanarraville, and Newcastle. The jail is operated by the Iron County Sheriff's Department and employs 45 officers, one full-time bailiff, and five officers are part-time bailiffs. Several cities in Iron County have their own police departments, including Cedar City, Enoch, Parowan, and Brian Head. Southern Utah University in Cedar City also has its own police department (Evans 2008).

Crime in Kane County is considerably lower than the average for the State of Utah. In 2005, the crime rate per 1,000 people in Kane County was 11.77 (73 total index crimes) and Utah's crime rate per 1,000 was 40.35 (99,650 total index crimes). Index crimes are crimes against persons or property. There were 316 arrests made in Kane County in 2005. Larceny was the most reported crime with 44 reports, and aggravated assault was the second most reported crime with 17 reports. There were zero homicides and two reported rapes in the county in 2005 (UDPS 2005).

Garfield County's crime rate per 1,000 was 34.23. The index crime rate in 2005 was 153. The county had 116 reports of larceny. There were zero homicides and two reported rapes in 2005 (UDPS 2005).

The crime rate per 1,000 in Iron County was 28.24. The index crime rate in 2005 was 1,082. Larceny was also the most reported crime in Iron County with 753 reports. Approximately 1,656 arrests were made in the county. There was one homicide and 14 reported rapes in 2005 (UDPS 2005).

3.12.3.3 FIRE PROTECTION

Kane County has nine fire departments, including one located in the town of Alton. The Alton fire department has two fire trucks, zero paid fire fighters, and two volunteers (FCAOG 2007b).

Garfield County has 11 fire departments. Most fire departments are staffed by volunteers and have no paid firefighters; with the exception of Boulder Fire Department which has 14 paid firefighters and zero volunteers. The number of fire trucks per department range from one to four and the types of trucks range from structure and brush trucks, wildland trucks, Type 1 through 3 engines, and water tender trucks.

Iron County has nine fire departments operated primarily by volunteers. The Cedar City Fire Department has four paid employees and 35 active volunteers. The range and types of fire trucks available in Iron County are similar to those in Garfield County.

3.12.3.4 HEALTHCARE

Within the SESA, there are three hospitals that provide 24-hour emergency care and physician staffing. Kane County Hospital in Kanab is a 38-bed facility with two full-time physicians. Garfield Memorial Hospital in Panguitch is a 20-bed facility with three full-time physicians. Valley View Medical Center in Cedar City (Iron County) is a 48-bed facility (Hospital-Data.com 2009). Garfield Memorial and Valley View are operated by Intermountain Health Care. All three hospitals accept Medicaid and Medicare patients. There are also hospitals with 24-hour emergency services in St. George (approximately 100 miles south of Alton) and Richfield (approximately 115 miles north of Alton). These hospitals are equipped to handle acute medical and trauma conditions, and air transport via Air-Med (University of Utah) or Life Flight (Intermountain Health Care) can provide emergency service to hospitals further away.

Numerous Intermountain Health Care healthcare clinics are available in the SESA, including Panguitch, Cedar City, Circleville, Escalante, Cannonville, and Orderville. The clinics provide family and internal medicine, pediatrics, lab, x-ray services, etc.

3.12.3.5 AMBULANCE

Ambulance services are provided via local counties. Kane County Ambulance is operated out of Kanab. Garfield County Ambulance is in Panguitch. Iron County Ambulance is in Parowan.

3.12.4 Environmental Justice

3.12.4.1 EXECUTIVE ORDER BACKGROUND AND REGULATORY GUIDANCE

EJ refers to the fair and equitable treatment of individuals regardless of race, ethnicity, or income level, in the development and implementation of environmental management policies and actions. In February 1994, President Clinton issued EO 12898, *Federal Actions to Address Environmental Justice in Minority and Low Income Populations*. The objective of this EO is to require each federal agency to "make achieving EJ part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low income populations" (EO 12898). The EPA has an agency mandate to steward EJ and has an EJ goal for all citizens of the United States. The EPA states that its EJ goal will be achieved when "everyone enjoys the same degree of protection from environmental and health hazards and equal access to the decision-making process to have a healthy environment in which to live, learn, and work" (EPA 2013b).

Convened under the auspices of the EO, the Interagency Working Group defines Black/African American, Hispanic, Asian and Pacific Islander, American Indian, Eskimo, Aleut and other nonwhite persons as minority populations. Low-income populations are defined as persons living below the poverty level based on their total income.

The EPA defines a community with potential EJ populations as one that has a greater percentage of minority or low-income populations than an identified reference community. The standard for identifying minority populations is either 1) the minority population of the affected area exceeds 50% or 2) the minority population percentage of the affected area is "meaningfully greater" than the minority population percentage in the general population or other appropriate unit of geographic analysis, such as a reference community (CEQ 1997). The EPA has not specified what percentage of the population can be characterized as "meaningfully greater" in order to define an EJ population. To address this and other questions, a small working group comprising the EPA and the BLM was convened to discuss the

question and to respond to comments from the EPA on the DEIS. As a result of these discussions, the BLM and the EPA agreed that for the purposes of this analysis, an EJ population of concern would be identified if the community's minority and/or poverty status was greater than that of the reference community.

The area of analysis used to identify the potential EJ populations included census tracts and communities along the reasonably foreseeable coal haul transportation route. Towns and census tracts along the reasonably foreseeable coal haul route (segments of I-89, SR-14, SR-20, I-15, and SR-56) were identified as units of measurement for potential EJ communities, and the reference community chosen for these units was the county within which the town or census tract lies (Iron, Garfield, and Kane counties). These communities' poverty and minority rates were analyzed against those of their respective counties. This analysis uses Census Bureau American Community Survey (ACS) five-year estimates for the 2007–2011 period for poverty levels and 2010 Census Demographic Profile Data for minority status. These data were chosen to cover both poverty and minority topics over the three different geographic areas (counties in the SESA, census tracts along the reasonably foreseeable coal haul route, and towns along the coal haul route). Communities along the reasonably foreseeable coal haul transportation route that were identified as EJ populations are shown in Tables 3.12.15, 3.12.16, 3.12.18 and 3.12.19 and are discussed below.

3.12.4.2 POVERTY RATES

The first element of concern in the study of EJ is the potential for actions (taken or not taken) to cause disproportionate impacts to low income populations. Low income populations are characterized as those living below the poverty level. In 2010, the poverty level established by the census for a family of four (with two related children under age 18) was $22,113 (U.S. Census Bureau 2013f). In 2012, the poverty level for the same household increased to $23,283. The tables below identify EJ populations in counties in the SESA, census tracts along the reasonably foreseeable coal haul route, and towns along the reasonably foreseeable coal haul route living below the poverty level as compared to their respective reference communities. The reference community used for each census tract and town was the county within which each unit resides. The State of Utah poverty level is included for reference.

Tables 3.12.15 and 3.12.16 show identified impoverished EJ communities in the census tracts and towns along the reasonably foreseeable coal haul transportation route and near the tract. Census tracts and towns with percentages of individuals living below the poverty level of their respective reference community (counties) have shaded cells (reference community values are underlined). Towns within each census tract are listed in Table 3.12.15 for reference.

Table 3.12.15. Percentage Living Below the Poverty Level in Census Tracts along the Reasonably Foreseeable Coal Haul Route and near the Tract

	State of Utah	Iron County									Garfield County		Kane County	
Reference community/ census tract number	–	Iron County Proper (reference community)	1101	1102	1103	1104	1105	1106	1107.01	1107.02	Garfield County Proper (reference community)	3	Kane County Proper (reference community)	1301
Towns in census tract	–	–	Paragonah, Parowan, Summit	Cedar City, Enoch	Cedar City	Cedar City	Cedar City	Cedar City	Cedar City	Cedar City	–	Panguitch, Hatch	–	Alton
Percentage living below poverty level	11.4%	20.7%	7.5%	18.4%	31.5%	22.0%	28.6%	21.2%	11.6%	24.7%	14.2%	15.6%	8.3%	15.2%

Source: U.S. Census Bureau (2007–2011b).

Table 3.12.16. Percentage Living Below the Poverty Level in Towns along the Reasonably Foreseeable Coal Haul Route and near the Tract

County	State of Utah	Iron County						Garfield County			Kane County	
Town		Iron County Proper (reference community)	Cedar City	Paragonah	Parowan	Summit	Enoch	Garfield County Proper (reference community)	Panguitch	Hatch	Kane County Proper (reference community)	Alton
Percentage living below poverty level	11.4%	20.7%	22.6%	10.1%	7.8%	0.0%	16.3%	14.2%	20.0%	1.8%	8.3%	35.6%

Source: US Census Bureau (2007–2011b).

Note: No data available for Iron Spring or Long Valley Junction.

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Tables 3.12.15 and 3.12.16 show EJ communities in census tracts as follows: census tract 3 in Garfield County; census tracts 1103, 1004, 1005, 1106, and 1107.02 in Iron County; and census tract 1301 in Kane County. Towns identified as EJ communities are Panguitch, Cedar City, and Alton. Because EJ communities were identified, an analysis to address resource impacts to these communities is carried forward in Chapter 4.

3.12.4.3 RACE AND ETHNICITY

Overall, the SESA has a greater percentage of whites and a lower percentage of other races than the State of Utah as a whole. Also, the state population as a whole has more than double the Hispanic population of Kane, Garfield, and Iron counties. Information regarding racial and ethnic composition in the SESA is provided in Table 3.12.17.

Table 3.12.17. Race Percentages in the Socioeconomic Study Area

Location	White	Hispanic or Latino	Black or African American	American Indian and Alaska Native	Asian or Pacific Islander	Other/Two or More Races
Garfield County	94.1%	4.5%	0.4%	1.6%	1.4%	2.5%
Iron County	90.7%	7.7%	0.5%	2.2%	1.1%	5.6%
Kane County	95.7%	3.7%	0.2%	1.5%	0.4 %	2.2%
SESA average	93.5%	5.3%	0.4%	1.8%	1.0%	3.4%
State of Utah	**86.1%**	**13.0%**	**1.1%**	**1.2 %**	**2.9%**	**8.7%**

Source: U.S. Census Bureau (2013b).

As stated earlier, a community or census tract is considered as having a potential EJ population if the population that falls within the category exceeds the percentage in the reference community, which is the county within which a town or census tract is located. As indicated in Table 3.12.17, the American Indian and Alaska Native population in each county in the SESA is greater than the reference population (State of Utah).

Tables 3.12.18 and 3.12.19 below show identified minority EJ communities in the census tracts and towns along the reasonably foreseeable coal haul transportation routes and near the tract. Census tracts and towns with higher percentages of minority populations than their respective reference communities are underlined. State of Utah minority population levels are included for reference. Reference community values are shown in shaded cells. Towns within each census tract are listed in Table 3.12.18 for reference.

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Table 3.12.18. Minority Percentages in Census Tracts along the Reasonably Foreseeable Coal Haul Route and near the Tract

	State of Utah	**Iron County**									**Garfield County**		**Kane County**	
Census tract number	–	Iron County Proper (reference community)	1101	1102	1103	1104	1105	1106	1107. 01	1107. 02	Garfield County Proper (reference community)	3	Kane County Proper (reference community)	1301
Towns in census tract	–	–	Paragonah, Parowan, Summit	Cedar City, Enoch	Cedar City	Cedar City	Cedar City	Cedar City	Cedar City	Cedar City	–	Panguitch, Hatch	–	Alton
Hispanic or Latino	13.0%	7.7%	5.5%	7.2%	10.5%	4.8%	11.9%	6.5%	6.2%	6.2%	4.5%	3.3%	3.7%	2.9%
Black or African American	1.1%	0.5%	0.2%	0.1%	0.3%	1.1%	0.5%	0.7%	0.8%	0.3%	0.4%	0.5%	0.2%	0.2%
American Indian and Alaska Native	1.2%	2.2%	0.6%	1.6%	1.6%	1.5%	4.6%	2.6%	1.3%	1.5%	1.6%	1.5%	1.5%	2.7%
Asian or Pacific Islander	2.9%	1.1%	0.4%	0.8%	0.7%	1.2%	0.9%	1.3%	1.5%	1.5%	1.4%	0.6%	0.4%	0.7%
Other/Two or More Races	8.7%	5.6%	3.5%	5.2%	7.1%	4.1%	9.1%	2.7%	3.9%	3.4%	2.5%	1.7%	2.2%	2.0%

Source: U.S. Census Bureau (2013b).

Table 3.12.19. Minority Percentages in Towns along the Reasonably Foreseeable Coal Haul Route and near the Tract

Minority Percentages	**State of Utah**	**Iron County**						**Garfield County**			**Kane County**	
	–	Iron County Proper (reference community)	Cedar City	Paragonah	Parowan	Summit	Enoch	Garfield County Proper (reference community)	Panguitch	Hatch	Kane County Proper (reference community)	Alton
Hispanic or Latino	13.0%	7.7%	7.9%	2.9%	4.8%	8.1%	6.7%	4.5%	3.0%	0.8%	3.7%	5.0%
Black or African American	1.1%	0.5%	0.7%	0.0%	0.2%	0.0%	0.1%	0.4%	0.7%	0.0%	0.2%	0.0%
American Indian and Alaska Native	1.2%	2.2%	2.7%	0.2%	0.6%	3.1%	1.6%	1.6%	2.0%	0.0%	1.5%	2.5%
Asian or Pacific Islander	2.9%	1.1%	1.2%	0.2%	0.2%	0.0%	0.9%	1.4%	0.5%	0.8%	0.4%	2.5%
Other/Two or More Races	8.7%	5.6%	6.0%	3.0%	2.3%	4.4%	4.7%	2.5%	1.6%	0.8%	2.2%	5.9%

Source: U.S. Census Bureau (2013b).

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Tables 3.12.18 and 3.12.19 show several minority populations at the census tract or town scale that exceed that of their respective counties, and were therefore identified as EJ communities. In Garfield County, EJ communities were identified in census tract 3 and Panguitch due to minority population percentages of African American, American Indian and Alaska Native, and Asian/Pacific Islander groups that exceed the county levels. Iron County has multiple minority populations exceeding county levels in both Cedar City and Summit, in addition to the following census tracts: 1103, 1004, 1005, 1106, 1107.01, and 1107.02 (see Tables 3.12.18 and 3.12.19). In the Town of Alton, all minority group population percentages except African Americans exceed Kane County levels. Impacts analyses are carried forward in Chapter 4 to address resource impacts to identified EJ communities.

3.12.4.4 NATIVE AMERICAN BASELINE HEALTH DATA

According to Utah Office of Public Health Assessment (2005), Utah's American Indian/Alaska Natives population suffers disproportionally from the prevalence of chronic diseases or conditions such as arthritis, asthma, coronary heart disease, diabetes, and poor mental health, as outlined for specific conditions in Table 3.12.20.

Table 3.12.20. Native American Baseline Health Statistics for Utah

Chronic Disease or Condition*	Utah American Indian/Alaska Natives	All Utahns	Disparity
Arthritis	32.2%	23.8%	+ 8.4%
Asthma	11.4%	5.5%	+ 5.9%
Coronary heart disease	8.7%	4.5%	+ 3.3%
Diabetes	8.0%	4.5%	+ 3.5%
Poor mental health	22.9%	15%	+ 7.9%

Source: Utah Department of Health (2005, 2009).

* Prevalence, not deaths from, which is a different statistic available only for diabetes and coronary heart disease.

Table 3.12.20 shows that Utah American Indian/Alaska Natives suffer disparities in incidence of chronic diseases and conditions within their population as compared to the greater population of Utah; this disparity ranges from over 3% for coronary heart disease and diabetes, to nearly 6% higher rates of asthma, and finally an approximately 8% and 8.5% increase in poor mental health and arthritis, respectively (Utah Department of Health 2005).

3.13 Soils

The analysis area for soils is the tract and the reasonably foreseeable coal haul transportation route. Soils are the medium for plant growth and provide nourishment for nearly all terrestrial organisms. They support a number of vegetation and animal communities in the Alton Coal Tract. The following section describes the soils that occur in the tract, as categorized by the soil survey conducted as part of the 1987 UII PAP (UII 1987b). The soil conditions described below are shown on Maps 3.13 and 3.14. Soils in the tract are derived primarily from sedimentary geologic deposits that occur throughout the region, including the Tropic Shale (61% of the tract) and Dakota Sandstone (16% of the tract) deposits (UII 1987b). A variety of soil types exists in the tract, including highly saline and highly erodible soils (UII 1987b). Soils that are highly saline, highly erodible, and have low water-holding capacity (drought intolerant) may be especially vulnerable to impacts and may be harder to reclaim or restore after disturbance. Biological soil crusts are unambiguously effective in reducing wind and water erosion of the soil surface (BLM 2011b). Disturbance of biological soil crusts affects most soils, but depending on the type of soil and biotic community, some are affected more than others.

Soils along the reasonably foreseeable coal haul transportation route are similar to the soils found in the tract, derived primarily from sedimentary geologic deposits such as Tropic Shale and Dakota Sandstone. Soils within a 100-foot buffer of the reasonably foreseeable coal haul transportation route are affected by current vehicle traffic along this route. The deposition of road dust and vehicle exhaust can affect the chemical composition of soils over time, affecting soil productivity.

3.13.1 Sensitive Soils

Sensitive soils have characteristics that make them more susceptible to impacts or more difficult to restore or reclaim after disturbance. These characteristics consist of moderate to high salinity, low nutrient levels, high runoff potential, and limitations to grazing, susceptibility to high wind or water erosion; or occurring on very steep slopes that are more susceptible to erosion. In this EIS, a sensitive soils designation refers to highly erodible soils, saline soils, drought intolerant soils, sodic soils, shallow soils (limited rooting depth), alkaline soils, and biological soil crusts. Sensitive soils are difficult to reclaim or restore, and once disturbed, the impact is usually long term. Table 3.13.1 shows the risk factors used to determine the sensitivity of soil units mapped for the UII PAP in 1987 (UII 1987b). The table shows the specific factors used to determine the risk of rehabilitation restrictions for soils in the tract. Table 3.13.2 shows the number of acres in the tract that are at risk for restricted soil rehabilitation due to a number of restrictive soil features.

Table 3.13.1. Soil Rehabilitation Restrictions and Reclamation Risks

Factors	High Risk	Moderate Risk	Low Risk	Restrictive Feature
Erodibility				
Water erosion hazard (from 1987 survey)*	High	Moderate	Slight to Moderate	Water erosion hazard
Limits on Reclamation				
Available water capacity (inches)†	< 4	4–6	> 6	Droughty soils
Salinity‡ (mmhos/cm; surface layer)¥	> 16	8–16	< 8	Excess salt
Sodium adsorption ratio§ (surface layer)¥	> 13	4–13	< 4	Excess sodium
Depth to C horizon (inches)¥	< 10	10–20	> 20	Rooting depth
Alkalinity (pH of surface layer)¥	> 9.0	7.8–8.9	< 7.8	Excess alkalinity

* Water erosion hazard was rated for bare soil areas based on inherent soil characteristics, such as texture, permeability, soil aggregate stability, and strength of soil structure.

† Maximum value for the range of available water capacity for the soil layer given as inches of water per 36 inches of soil.

‡ Maximum value for the range in soil salinity; mmhos/cm is the units of millimhos per centimeter and is a measure of electrical conductivity that is used to describe soil salinity.

¥ Draft parameters developed by the BLM's National Science and Technology Center, Soil Survey Geographic database (SSURGO) soils mapping.

§ Maximum value for the range in sodium adsorption ratio; sodium adsorption ratio is a measure of the ratio of the sodium to the calcium and magnesium in a soil.

Table 3.13.2. Acres (and percentage) of the Alton Coal Tract At Risk of Restricted Soil Rehabilitation

Restrictive Feature	High Risk	Moderate Risk	Low Risk
Erodibility			
Water erosion hazard	843 (23.6%)	2,515 (70.3%)	218 (6.1%)
Limits on Reclamation			
Droughty soils	627 (17.5%)	182 (5.1%)	2,768 (77.4%)
Excess salt	0 (0.0%)	0 (0.0%)	3,577 (100.0%)
Excess sodium	4 (0.1%)	0 (0.0%)	3,498 (97.8%)
Rooting depth (shallow soils)	2,872 (80.3%)	693 (19.4%)	12 (0.3%)
Excess alkalinity	0 (0.0%)	416 (11.6%)	3,161 (88.4%)

Notes: Because some soil units had missing data, risk factors may not total to 100% of the tract acreage.

3.13.1.1 WATER-EROSIVE SOILS

Water-erosive soils have naturally high rates of erosion; however, the erosion rates are easily accelerated by surface-disturbing activities. In all, 843 acres of soils with a high risk of erodibility occur on the tract (23.6% of the tract). Soils with a moderate risk of erodibility occur on 2,515 acres or 70.3% of the tract. Soils with a low risk of erodibility occur on 218 acres or 6.1% of the tract. A soil's potential for water erosion was estimated based on inherent soil characteristics such as soil texture, permeability, aggregate stability, and the strength of the soil structure (UII 1987b). Observations of erosion in mapped soil units were also used to determine their risk for erosion. Accelerated erosion forms rills and gullies, and can

contribute to excess sedimentation in streams and reservoirs. In addition, erosion reduces natural revegetation and the effectiveness of vegetation restoration efforts by removing topsoil, washing away plant seeds and propagules, and burying or damaging existing plants.

3.13.1.2 DROUGHT-INTOLERANT SOILS

Certain soil types are more sensitive to negative impacts during drought conditions. A number of soil units on the tract have a low available water capacity due to soil structure and composition (UII 1987b); thus, these high risk soils and their associated vegetation may be severely affected by drought. Severe drought may adversely affect the production of perennial vegetation. Soils at high risk for poor reclamation occur over 627 acres, or 17.5%, of the tract. Areas at moderate risk occur over an additional 182 acres, or 5.1% of the tract. Areas with a low risk occur over 2,768 acres, or 77.4% of the tract.

3.13.1.3 SALINE SOILS

Soil salinity can influence the downstream effects of erosion and the reclamation potential of an area's soils. Highly saline soils limit the diversity of vegetation species that can be established on a site, and at very high levels, they may inhibit the establishment of even halophytic (salt-loving) plants. Erosion of saline soils impacts the water quality of downstream watersheds. Highly saline soils are soils with electrical conductivity levels of greater than 16 millimhos per centimeter (mmhos/cm). Moderately saline soils fall between 8 and 16 mmhos/cm. The tract contains only soils with electrical conductivity levels of less than 8 mmhos/cm, or low salinity.

3.13.1.4 SODIC SOILS

High sodium levels can affect the reclamation potential of disturbed soils by inhibiting the establishment of vegetation. Four acres (or 0.1%) of the Alton Coal Tract are highly sodic, or have a sodium adsorption ratio of greater than 13 mmhos/cm. The rest of the tract has a low risk of sodic soils, or a sodium adsorption ratio of less than 4 mmhos/cm.

3.13.1.5 SHALLOW SOILS

A shallow topsoil layer (or A horizon) limits a plant’s ability to root deeply. It may inhibit an area's restoration potential because of its limited depth, water holding capacity, and nutrients available for plant establishment. Rooting depth, or depth to the C horizon of the soil, affects restoration potential because plant root growth does not occur below the upper (A and B) soil horizons. The C horizon of the soil is characterized by unweathered parent material and generally does not support the biological activity necessary for soil development. It is assumed for this analysis that soils with an A horizon of less than 10 inches are at high risk for poor reclamation (based on draft parameters developed by the BLM's National Science and Technology Center). These soils occur over 2,872 acres, or 80.3%, of the tract. Areas at moderate risk (or with a rooting depth of 10–20 inches) occur over an additional 693 acres, or 19.4% of the tract. Areas with a low risk (a rooting depth greater than 20 inches) occur over 12 acres, or 0.3% of the tract.

3.13.1.6 ALKALINE SOILS

Alkalinity refers to soil pH. High pH, or an alkaline condition, generally limits a plant’s ability to establish itself. A number of soil units on the tract are moderately alkaline (UII 1987b). Approximately 416 acres of the tract have moderately alkaline conditions (11.6%), and 3,161 acres (88.4%) have a low risk of reclamation restriction due to alkalinity.

3.13.1.7 BIOLOGICAL SOIL CRUSTS

Some of the dominant vegetative communities in the tract, such as pinyon-juniper and sagebrush communities, have evolved with the presence of biological soil crusts. Biological soil crusts are made up of mats or filaments of cyanobacteria, lichens, and mosses. Development of biological soil crust is strongly influenced by soil texture, soil chemistry, and soil depth. Crusts are more developed in shallow, sandy, nonsaline soils. Biological soil crusts play a major role in reducing water and wind erosion and in preventing the establishment of invasive annual grasses (BLM 2011b). They fix atmospheric nitrogen and carbon, retain soil moisture, and provide surface cover. Crust composition and level of abundance can be used to determine the ecological history and condition of a site (BLM 2011b).

Loss of biological soil crust leads to reduced soil productivity, decreased plant cover and vigor, and increased wind and water erosion. Severity, size, frequency, and timing of a surface-disturbing activity affect the degree of impacts to biological soil crusts, as well as vascular plant community structure, adjoining substrate condition, inoculation material availability, and climate during and after a disturbance. Fine-textured soils have faster crust recovery rates than coarse-textured soils (BLM 2011b). In the scientific literature, recovery rates have ranged widely (two to more than 3,800 years) and either appear to show no pattern or often appear contradictory. However, general recovery times can be predicted for soil crusts in different environments. During studies on the Colorado Plateau, cyanobacterial cover has recovered within 14–34 years (BLM 2011b). Assuming adjoining soils are stable and rainfall is average, recovery rates for lichen cover in southern Utah have been estimated at a minimum of 45 years, whereas recovery of moss cover was estimated at 250 years (Belnap et al. 1997). The distribution of soil crusts in the tract is unknown. Approximately 1,430 acres (40.2%) of the tract have soils associated with pinyon-juniper vegetation, which is often associated with biological soil crusts. An additional 1,609 acres (45.0%) of the tract have soils associated with sagebrush, which is also associated with soil crusts.

The inoculation of biological soil crusts is used to speed up the recovery of biological soil crusts and soil reclamation. Recent scientific research has involved field testing of the inoculation of reclaimed soils with biological soil crusts (improved with sand barriers) over a three-year time period. Results show that cyanobacterial and algal cover climbed up to 48.5%, and 14 cyanobacterial and algal species were identified at the end of the inoculation experiment (W. Wang et al. 2009). In addition, biological crusts' thickness, compressive strength, and chlorophyll *a* content increased with inoculation time over three years; moss species appeared in the second year; cyanobacterial inoculation increased organic carbon and total nitrogen of the soil; and total salt, calcium carbonate, and electrical conductivity in the soil also increased after inoculation (W. Wang et al. 2009). The study concludes that cyanobacterial inoculation would be a suitable and effective technique to recover biological soil crusts, and may further restore the ecological system.

3.14 Transportation

3.14.1 Regional Overview

The transportation analysis area is the tract and reasonably foreseeable coal haul transportation route. Existing vehicle traffic in and near the tract and reasonably foreseeable coal haul transportation route consists of local residents; tourists to Bryce Canyon National Park, the Dixie National Forest, and public lands; and commercial truck traffic. Transportation infrastructure associated with the tract and reasonably foreseeable coal haul transportation route would include numerous unimproved, dirt access roads and two-track trails, KFO Route 116, US-89, SR-20, I-15, and SR-56. The Union Pacific Railroad 21-mile branch to the Salt Lake City-Los Angeles line is west of Cedar City, Utah. It is the nearest railroad facility to the tract. Current transportation facilities along the coal truck haul route can be found in Appendix H.

3.14.2 Existing Traffic Conditions on the Reasonably Foreseeable Coal Haul Transportation Route

Existing traffic conditions for both roadways and intersections along the reasonably foreseeable coal haul transportation route are quantified using a level of service (LOS) measurement. LOS is a measure of the quality of service on transportation infrastructure and generally indicates the level of traffic congestion. LOS on two-lane highways is a reflection of traffic flow conditions, average speed, and average time spent following other vehicles. LOS at intersections reflects the amount of congestion and delay experienced by motorists at intersections. LOS is rated on a scale of A (the best) to F (the worst). LOS-A on roadways occurs where traffic flows are at or above posted speed limits and where drivers have complete mobility between lanes. LOS-A at intersections occurs when drivers take less than 10 seconds to pass through an intersection. LOS-F occurs when the vehicle traffic flow exceeds the road segment capacity (Fehr & Peers Transportation Consultants 2013). Table 3.14.1 includes a description of LOS-A through LOS-F (Fehr & Peers Transportation Consultants 2013).

Table 3.14.1. Intersection Level of Service Descriptions

LOS	Description of Traffic Conditions
A	Free Flow/Insignificant Delay Extremely favorable progression. Individual users are virtually unaffected by others in the traffic stream.
B	Stable Operations/Minimum Delays Good progression. The presence of other users in the traffic stream becomes noticeable.
C	Stable Operations/Acceptable Delays Fair progression. The operation of individual users is affected by interactions with others in the traffic stream.
D	Approaching Unstable Flows/Tolerable Delays Marginal progression. Operating conditions are noticeably more constrained.
E	Unstable Operations/Significant Delays Can Occur Poor progression. Operating conditions are at or near capacity.
F	Forced Flows/Unpredictable Flows/Excessive Delays Unacceptable progression with forced or breakdown of operating conditions.

Source: Fehr & Peers Transportation Consultants (2013).

KFO Route 116 is the main graded dirt road that travels north–south through the tract. It becomes a paved, two-lane road from the town of Alton west to US-89. LOS data are not available for KFO Route 116. US-89 is a north–south highway that passes through the towns of Hatch and Panguitch. Most of US-89 is a two-lane highway, with passing lanes on steep climbs and a four-lane section in Panguitch. The speed limit is posted at 65 miles per hour (mph) in the area of analysis, except in Hatch and Panguitch where it is reduced to 40 mph, and 35 mph, respectively. Four of the intersections in the transportation area of analysis occur on US-89 at SR-14, SR-12, south of SR-20, and SR-20. SR-12 is the main access road from US-89 east to Red Canyon (in the Dixie National Forest) and to Bryce Canyon National Park. None of these intersections have traffic signals.

SR-20 is an east–west state road that connects US-89 and I-15. SR-20 is a paved, two-lane road with a climbing lane on steep sections approaching the summit. The speed limit is posted at 60 mph from the junction with US-89 to the steep upgrade, 35 mph climbing the upgrade to the summit, and back to 65 mph from the summit to I-15.

I-15 is a four-lane, divided, interstate freeway that runs north–south through Utah. Along the reasonably foreseeable coal haul transportation route, I-15 has posted speed limits of 75 mph from SR-20 to Cedar City.

SR-56 is an east–west state road from Cedar City to the Nevada state line. SR-56 varies from four lanes through Cedar City to two lanes outside the city. The only intersection with a traffic signal along the reasonably foreseeable coal haul transportation route occurs at I-15 and SR-56. SR-56 has a posted speed limit of 45 mph on the reasonably foreseeable coal haul transportation route.

Existing conditions along the reasonably foreseeable coal haul transportation route consist of low volumes of traffic generally moving at free-flow speeds. Haul route segments along US-89 and SR-20 operate at LOS-C or better during weekday and weekend traffic in both directions. LOS-C occurs on roadways at or below capacity where posted speed limits are easily maintained, but the ability to pass or change lanes is not always assured. The existing LOS along the directional segments of I-15 and SR-56 was not measured as part of the Fehr and Peers study (Fehr & Peers Transportation Consultants 2013).

Existing conditions at intersections along the reasonably foreseeable coal haul transportation route include low delays per vehicle and little to no congestion. The four unsignalized intersections along US-89 operate at LOS-A during peak morning and peak evening hours. Although LOS was not measured on directional segments of I-15 and SR-56, the signalized intersection at SR-56 and I-15 operates at LOS-C or better during peak morning and peak evening hours (Fehr & Peers Transportation Consultants 2013).

A 2003–2005 study of vehicle accidents across the reasonably foreseeable coal haul transportation route was prepared by UDOT (Fehr & Peers Transportation Consultants 2013). The study generated a three-year crash history for US-89, SR-20, I-15, and SR-56. The study shows that the predominant crash type across all four segments is the single vehicle, accounting for 81.2% of accidents along US-89, 86.1% of all accidents along US-20, 77.6% of all accidents along I-15, and 48.3% of all accidents along SR-56. Single-vehicle accidents along the haul route were wildlife or domestic animal related, or involved drivers running off the road because of excessive speed, weather, falling asleep, and driving under the influence. Most multi-vehicle accidents involved rear-end crashes from following too closely, and sideswipe crashes from attempting to pass under unsafe conditions (Fehr & Peers Transportation Consultants 2013).

3.15 Vegetation

3.15.1 Regional Overview

The analysis area for vegetation is the tract, reasonably foreseeable coal haul transportation route, and the area immediately adjacent to the tract and transportation route, because the potential impacts to vegetation from the proposed pit disturbance, facilities construction, coal hauling, and road relocation are not expected to extend beyond this area. Kane County is in the Colorado Plateau Semidesert Province (USFWS 1996) of south-central Utah. The Alton Coal Tract occurs in the semiarid foothills of this ecoregion (Woods et al. 2001b). Vegetation communities on the tract are typical of what is found in the surrounding Colorado Plateau region, namely pinyon-juniper woodlands, sagebrush shrublands, and mountain brush communities. Details of vegetation communities in the tract are presented in the sections below. Sources followed for identifying the scientific nomenclature in this section include the U.S Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) PLANTS Database (NRCS 2013) and Welsh et al. (2003).

Mean annual precipitation in the town of Alton was approximately 16.7 inches from 1915 to 2013, and mean annual maximum temperature for this same period was 60.0°F (WRCC 2013). The Colorado Plateau province receives precipitation in a bimodal pattern; precipitation occurs in the form of snow during the winter months and in the form of monsoonal storms in late summer (West et al. 2000). The Alton area also receives its annual precipitation in a bimodal pattern (WRCC 2006). The climate of the Colorado Plateau supports plant species that are physiologically adapted to withstand drought and heat, such as through leaf texture, surface-area, and specialized photosynthetic processes (Willson et al. 2008).

Vegetation on public lands in the tract is managed by the BLM in accordance with the KFO RMP (BLM 2008b). Vegetation treatment and management on public lands would provide measures to maintain or improve the overall health of vegetation communities (BLM 2008b). Specific management for vegetation would target forests and woodlands, uplands, and riparian and wetland communities through implementation of controls on noxious and invasive weed species and application of *Standards for Rangeland Health and Guidelines for Grazing Management on BLM Lands in Utah* (BLM 1997). Vegetation treatments would consist of prescribed fire, mechanical, chemical and biological treatments, woodland product removal, and wildland fire.

Vegetation communities along the reasonably foreseeable coal haul transportation route are similar to the vegetation communities found in the tract. Vegetation within a 100-foot buffer of the reasonably foreseeable coal haul transportation route is affected by current vehicle traffic along this route. Road dust and vehicle exhaust inhibit stomatal function and photosynthesis (Hirano et al. 1995), and therefore impact overall plant health.

3.15.2 Vegetation Communities in the Tract

The analysis area for vegetation is the tract, because the potential impacts from proposed mining activities, including surface disturbance from pit disturbance, facilities construction, and road relocation, would be limited to the tract. The analysis area also includes the reasonably foreseeable coal haul transportation route, because road dust, coal dust, and vehicle dust have the potential to affect vegetation near the route. Vegetation communities in the tract are pinyon-juniper woodland, mountain brush, meadow, rabbitbrush, riparian, sagebrush/grassland, and sagebrush/grassland (treated) (USFWS 1996). Pinyon-juniper woodlands include transition zones between this and other communities; pinyon-juniper/mountain brush, pinyon-juniper/sagebrush, and pinyon-juniper/sagebrush/mountain brush combinations also occur under this heading. Agricultural meadows and pastures on private surface lands

are also found in the tract. Ecologists surveyed the tract in fall of 2007 to determine the specific locations and acreages of these communities (Table 3.15.1; Map 3.15). The tract had also been previously surveyed by Mt. Nebo Scientific in 2007. Descriptions of these vegetation communities and lists of dominant species are presented in the sections below.

Table 3.15.1. Vegetation Community Acreages in the Alton Coal Tract

Vegetation Community	Acres	Percentage of the Tract*
Pinyon-juniper woodland	1,430.0	40.2%
Pinyon-juniper/mountain brush	438.8	–
Pinyon-juniper/sagebrush	506.0	–
Pinyon-juniper/sagebrush/mountain brush	485.2	–
Sagebrush/grassland	860.2	24.1%
Sagebrush/grassland (treated) †	749.1	20.9%
Annual and perennial grasses (pasturelands)	324.1	9.1%
Mountain brush	62.8	1.8%
Meadow	62.8	1.8%
Irrigated wet meadow wetland	31.6	–
Riparian	55.3	1.5%
Riparian wet meadow wetland	18.5	–
Mixed riparian scrub-shrub/wet meadow wetland	3.8	–
Rabbitbrush	10.7	0.3%
Total	**3,555.0**	**99.4%**

* Unvegetated areas consist of 4.1 acres of open water and 17.4 acres of roads, or approximately 0.6% of 3,576.6 acres in the tract.

† Mechanically treated to remove encroaching pinyon pine and Utah juniper and seeded to restore forb and grass cover.

3.15.2.1 PINYON-JUNIPER WOODLAND

Pinyon-juniper woodland (1,430 acres) accounts for the greatest percentage of land in the tract (40%). For the purposes of the reconnaissance surveys, all vegetation communities with pinyon pine (*Pinus edulis*) or Utah juniper (*Juniperus osteosperma*) trees as a dominant component of the overstory are considered to belong to the pinyon-juniper woodland community or one of its combinations (i.e., pinyon-juniper/mountain brush, pinyon-juniper/sagebrush, or pinyon-juniper/sagebrush/mountain brush). The pinyon-juniper woodland community discussed here is also identified as the Colorado Plateau Pinyon-Juniper Woodland cover class in the SWReGAP land cover database (Lowry et al. 2007).

Understory species in pinyon-juniper woodlands include shrubs, grasses, and forbs that are also commonly found in other vegetation communities in the tract. Shrub species include black sagebrush (*Artemisia nova*), Gambel oak (*Quercus gambelii*), Utah serviceberry (*Amelanchier utahensis*), alder-leaf mountain mahogany (*Cercocarpus montanus*), wild crab apple (*Peraphyllum ramosissimum*), antelope bitterbrush (*Purshia tridentata*), broom snakeweed (*Gutierrezia sarothrae*), and snowberry (*Symphoricarpos oreophilus*). Grass and forb species include slender wheatgrass (*Elymus trachycaulus*), daisy (*Erigeron* spp.), buckwheat (*Eriogonum* spp.), and fescue (*Festuca* spp.). Cacti species include prickly pear (*Opuntia* spp.) and echinocactus (*Echinocereus* spp.).

3.15.2.2 MOUNTAIN BRUSH

Mountain brush accounts for 62.8 acres (1.8%) of land in the tract and occurs mainly in ravines and hillsides. Gambel oak is the dominant overstory species in this community. The mountain brush community discussed here is also identified as the Rocky Mountain Gambel Oak-Mixed Montane Shrubland cover class in the SWReGAP land cover database (Lowry et al. 2007). Understory shrubs identified in this community are black sagebrush, big sagebrush (*Artemisia tridentata*), basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*), mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), rubber rabbitbrush (*Ericameria nauseosa*), Utah juniper, Rocky Mountain juniper (*Juniperus scopulorum*), pinyon pine, antelope bitterbrush, Woods' rose (*Rosa woodsii*), and snowberry. Grass and forb species in this community are crested wheatgrass (*Agropyron cristatum*), smooth brome (*Bromus inermis*), Kentucky bluegrass (*Poa pratensis*), and prickly pear cactus (*Opuntia* spp.).

3.15.2.3 ANNUAL AND PERENNIAL GRASSES

Agriculture is practiced, or has historically been practiced, on 324 acres (9.1%) of private surface land in the north half of the tract. This portion of the tract is classified as Agriculture by SWReGAP (Lowry et al. 2007), but it is a mixture of agricultural grasses and native grasses, forbs, and shrubs. Plant species identified in the annual and perennial grasses community are crested wheatgrass, black sagebrush, California brome (*Bromus carinatus*), smooth brome, thistle (*Cirsium* spp.), rubber rabbitbrush, orchardgrass (*Dactylis glomerata*), intermediate wheatgrass (*Thinopyrum intermedium*), slender wheatgrass, Russian wheatgrass (*Thinopyrum junceiforme*), curlycup gumweed (*Grindelia squarrosa*), broom snakeweed, and Indian ricegrass (*Achnatherum hymenoides*). Wheatgrasses (*Elymus* spp.) and crested wheatgrass were the dominant plants encountered during reconnaissance surveys.

3.15.2.4 MEADOW

The meadow vegetation community accounts for 62.8 acres (1.8%) of land near the north end of the tract. This portion of the tract is also classified as Agriculture by SWReGAP (Lowry et al. 2007), because the land was historically or is currently used for agricultural purposes. Vegetation in the meadow community consists of hydrophytic (water-loving) plants such as wiregrass (*Juncus arcticus*), small-wing sedge (*Carex microptera*), Missouri iris (*Iris missouriensis*), foxtail barley (*Hordeum jubatum*), and seaside arrowgrass (*Triglochin maritima*). Canada thistle (*Cirsium arvense*), a Utah state-listed noxious weed, is also in this vegetation community.

Runoff from irrigated agricultural fields in the northwest part of the tract has produced wet meadow conditions in large portions of the meadow vegetation community. A preliminary JD was issued in November 2012, identifying the potential limits of existing wetlands, streams, and other water bodies in the tract that may be subject to the USACE's regulatory jurisdiction under the CWA. The preliminary JD identified approximately 54 acres of wetlands (USACE 2012a). These wetlands were classified into three habitat types. Approximately 31.6 acres were classified as irrigated wet meadow wetlands; 18.5 acres were classified as riparian wet meadow wetlands; and the remaining 3.8 acres were classified as mixed riparian scrub-shrub/wet meadow wetlands (Frontier Corporation USA 2012).

3.15.2.5 RABBITBRUSH

The rabbitbrush vegetation community occurs on 10.7 acres (0.3%) of the tract. This community is similar in structure and vegetative composition to the sagebrush/grassland vegetation community but also includes four-wing saltbush (*Atriplex canescens*) and a greater concentration of rubber rabbitbrush. This community occurs adjacent to riparian communities in the tract, and is classified as Rocky Mountain Lower Montane Riparian Woodland and Shrubland by SWReGAP (Lowry et al. 2007).

3.15.2.6 RIPARIAN

This vegetation community accounts for 55.3 acres of land along streams in the tract, and is classified as Rocky Mountain Lower Montane Riparian Woodland and Shrubland by SWReGAP (Lowry et al. 2007). The riparian community represents 1.5% of the total land in the tract. It includes approximately 18.5 acres of riparian wet meadow wetlands and 3.8 acres of mixed riparian scrub-shrub/wet meadow wetlands (Frontier Corporation USA 2012). Species such as willows (*Salix* spp.), cottonwoods (*Populus* spp.), Russian olive (*Elaeagnus angustifolia*), and tamarisk (*Tamarix* spp.) occur in the overstory of the tract's riparian communities. Understory species include wiregrass and saltgrass (*Distichlis spicata*) and weedy species such as curlycup gumweed and broom snakeweed (SWCA 2007a). A portion of the understory is disturbed (SWCA 2007a).

3.15.2.7 SAGEBRUSH/GRASSLAND

The sagebrush/grassland vegetation community accounts for 860.2 acres (24.1%) of land in the tract. This vegetation community includes areas classified by SWReGAP as Colorado Plateau Mixed Low Sagebrush Shrubland, Inter-Mountain Basins Big Sagebrush Shrubland, and Inter-Mountain Basins Montane Sagebrush Steppe (Lowry et al. 2007). Black sagebrush is the dominant shrub species in this community, with some big sagebrush and rabbitbrush plants also in the shrub layer. A few small Utah junipers and pinyon pines are occasional components of this community. Understory species include crested wheatgrass, California brome, cheatgrass, foxtail barley, thistle, slender wheatgrass, western wheatgrass (*Pascopyrum smithii*), Sandberg bluegrass (*Poa secunda*), broom snakeweed, Palmer's penstemon (*Penstemon palmeri*), and tall tumblemustard (*Sisymbrium altissimum*).

3.15.2.8 SAGEBRUSH/GRASSLAND (TREATED)

This vegetation community accounts for 749.1 acres (20.9%) in the tract. Dominant species are similar to those identified in the sagebrush/grassland vegetation community and include black sagebrush, big sagebrush, and rubber rabbitbrush in the shrub stratum. SWReGAP identifies this community as Recently Chained Pinyon-Juniper Areas (Lowry et al. 2007). Utah juniper, pinyon pine, and Gambel oak are also present in this community, although these species are not dominant. Understory species in this community are broom snakeweed, Russian wildrye (*Psathyrostachys juncea*), slender wheatgrass, thistles, cheatgrass, California brome, Palmer's penstemon, crested wheatgrass, and yarrow (*Achillea millefolium*).

The ground in this community is covered partially with chipped remnants of Utah juniper and pinyon pine trees. Because the quality of sagebrush habitats has been reduced due to pinyon-juniper encroachment and loss of understory forbs and grasses, the BLM removed these trees during prescription fuels treatments in fall 2005, chipped them on-site, and broadcasted them over the immediate area (Frey et al. 2008; Gubler 2008). Ninety-nine percent of pinyon-juniper trees on 1,700 acres in the Alton–Sink Valley area were removed, and the treated area was seeded with forbs and grasses to restore sagebrush steppe habitat (Frey et al. 2008).

3.15.3 At-Risk Habitat Types

The UDWR has identified at-risk habitat types and identified priority wildlife habitats based on factors such as abundance, degree of threat, and trends in abundance. The UDWR at-risk habitat types include several habitat types present in the tract: montane riparian (riparian), montane shrub (mountain shrub), and sagebrush steppe (the sagebrush steppe component of sagebrush/grassland). According to the UDWR, montane riparian habitat is very rare in the state (0.2% of total land cover), with approximately 60%–79% of remaining habitat currently impacted, and a definite decreasing trend (UDWR 2005). There may be portions of riparian habitat of high value in the tract, but the presence of invasive riparian species such as tamarisk and Russian olive suggests that this cover type is not pristine. Montane shrub habitat is also rare (1.3% of total land cover), with approximately 40%–59% of remaining habitat currently impacted, and a possible decreasing trend. Montane shrub (mountain brush) cover in the tract consists of small parcels

dominated by Gambel oak. Although sagebrush steppe habitat is common (13.4% of total land cover), approximately 60%–79% of remaining habitat is currently impacted, and there is a definite decreasing trend. Several wet meadow and grassland cover types are also identified by UDWR (2005)as rare, priority habitat types, but these habitat types are not present in the tract. The meadow and annual and perennial grass cover types in the tract are both agricultural cover types that are not the rare habitats identified by UDWR (2005), even though they have value for local wildlife.

3.15.4 Invasive and Noxious Weeds

All non-native plant species identified during 2007 field reconnaissance surveys are listed in Table 3.15.2. This list includes invasive, noxious, and introduced weed species. Most of these species occur in disturbed sites such as private annual and perennial grasses communities and where vegetation treatments have occurred.

Table 3.15.2. Introduced, Invasive, and Noxious Weed Species Identified in the Alton Coal Tract

Common Name	Scientific Name	Status*	Location
Canada thistle	*Cirsium arvense*	Noxious	Meadow
Cheatgrass	*Bromus tectorum*	Invasive	Sagebrush
Russian olive	*Elaeagnus angustifolia*	Invasive	Riparian
Common mullein	*Verbascum thapsus*	Invasive	Sagebrush/grassland (treated)
Crested wheatgrass	*Agropyron cristatum*	Introduced	Sagebrush and annual and perennial grasses
Intermediate wheatgrass	*Thinopyrum intermedium*	Introduced	Annual and perennial grasses
Kentucky bluegrass	*Poa pratensis*	Native and introduced infra-taxa	Sagebrush and mountain brush
Orchardgrass	*Dactylis glomerata*	Introduced	Annual and perennial grasses
Small burnet	*Sanguisorba minor*	Introduced	Sagebrush/grassland (treated)
Tall tumblemustard	*Sisymbrium altissimum*	Invasive	Sagebrush/grassland (treated)
Tamarisk	*Tamarix* spp.	Noxious	Riparian

* Data from USDA (2008); Whitson (1996).

Introduced species are those that are not native to the lower 48 states. Many of the introduced species on this list, such as crested wheatgrass and intermediate wheatgrass, are forage plants brought intentionally to the United States for use as livestock feed. The USDA plants database (USDA 2008) was used to determine introduced statuses.

Invasive weeds are mostly introduced plant species that are able to spread faster than neighboring native species by being better equipped to take advantage of available water, sunlight, and nutrients. There are no federal or state lists of invasive weeds; the text *Weeds of the West* (Whitson 1996) was used to determine invasiveness statuses. Cheatgrass, tall tumblemustard, and common mullein are invasive weeds that occur in various communities in the tract.

Noxious weeds are plant species that have been formally recognized by federal, state, or county governments to pose serious risks to the economy of an area. The State of Utah has 19 listed noxious weed species. One of the Utah noxious weed species, Canada thistle, has been identified in the tract. A few individuals of this species are in the meadow vegetation community in the northwest section of the tract.

3.15.5 Special Status Species

Five federally listed plant species and 16 BLM-listed sensitive plant species are known to occur in Kane County, Utah (see Tables 1 and 2 in Appendix I's plant clearance report). Of these species, only a few are known to occur at the elevational range in the tract, and potential habitats are limited. Surveys for suitable habitat for special status plant species were conducted in November 2007, August 2008, and September 2008, and no potential habitats or occurrences of special status plant species have been identified in the tract. Because species conservation status and knowledge of distributions have been revised since the 2008 clearance surveys, an additional special status plant clearance analysis was conducted in 2012 (see Appendix I). Only Cronquist's phacelia (*Phacelia cronquistiana*; BLM sensitive) was identified as having potential to occur in the tract. Surveys of potential habitats for this species were conducted in June 2012, and no individuals were found (see Appendix I). Because there are no special status plant species in the tract, they are not discussed in Chapter 4.

3.16 Water Resources

The analysis area for water resources is the Kanab Creek watershed/shallow aquifer boundary. The Alton Coal Tract is in the upper reaches of the Kanab Creek watershed, a subdrainage to the Colorado River. The Kanab Creek watershed drains approximately 1,512,091 acres that include the tract as well as the towns of Alton and Kanab, Utah, and Fredonia, Arizona (Map 3.16). The watershed covers an elevation range from approximately 2,100 feet at the confluence with the Colorado River to 9,345 feet at the headwaters of Kanab Creek, which originates upstream of the tract on the Paunsaugunt Plateau. The tract is in an arid region where the average annual precipitation is approximately 12 inches in the lower elevations. Precipitation in the Kanab Creek watershed increases with elevation and can exceed 40 inches per year in the upper elevations. Most precipitation occurs as snow.

Groundwater systems in and adjacent to the tract are present in alluvial sediments, the Tropic Shale, and the Dakota Formation. Other water-related features that occur in the tract are riparian areas, probable wetlands, floodplains, and potential AVFs.

The reasonably foreseeable transportation route and coal loadout occur primarily in the Upper Virgin watershed (adjacent to the East Fork of the Virgin River), the Upper Sevier watershed (Sevier River, intersecting drainages, and along Bear Creek), and the Escalante Desert watershed in Iron County. West and south of the tract, the Virgin River watershed drains into the Colorado River. North of the tract, the Sevier River watershed drains north/northwest into Sevier Lake within the Great Basin.

3.16.1 Surface-water Resources

Around the tract, most of the annual runoff volume in streams draining the mountainous areas occurs during spring and early summer as a result of snowmelt and precipitation. The highest peak discharge commonly occurs during summer monsoonal storm events, which produce short bursts of intense precipitation. The total mean annual runoff from the Upper Kanab Creek basin into Arizona is approximately 50,000 acre-feet (Cordova 1981). Stream flows generally peak during March, but may vary from year to year depending on local weather conditions and yearly snowpack. Summer and early fall baseflow is typically much lower than spring conditions, except when infrequent storm-produced flows occur. Flows in the lower elevation streams are generally more variable than are flows originating in the mountainous region. The flows are influenced by spring lowland snowmelt, as well as rainstorms during the remainder of the summer and fall. In areas where stream waters are used for irrigation, water diversion from the streams for irrigation also substantially influences stream discharge rates.

Kanab Creek and two of its tributaries—Lower Robinson Creek and Simpson Hollow Creek—are the dominant surface-water features in the tract (Map 3.17). Kanab Creek flows in a south/southwesterly direction through the tract and downstream into Arizona. Within the Kanab Creek watershed, the tract is in the lower portions of the following three subwatersheds: Lower Robinson Creek, Kanab Creek below Reservoir Canyon, and Sink Valley Wash. These three subwatersheds have a combined area of 47,040 acres. The tract makes up 8% of these three subwatersheds and 0.25% of the entire Kanab Creek watershed. Also present is a network of ephemeral washes through which runoff from torrential precipitation events and seasonal snowmelt is drained from the land area in the tract. All the ephemeral washes in the tract and adjacent area are tributary to Kanab Creek. Although most of the ephemeral washes terminate directly into Kanab Creek, the ephemeral washes in the south portion of Block S drain into Sink Valley Wash, which flows into Kanab Creek approximately 5.5 miles south of the tract (see Map 3.17).

The quality of surface waters in and around the tract is variable. The State of Utah has designated the following three beneficial uses to the surface waters found in the tract (Kanab Creek downstream from the confluence with Reservoir Canyon and Lower Robinson Creek): 1) secondary contact recreation (2B), 2) nongame fish and associated food chains (3C), and 3) agricultural water supply (4). Secondary contact recreation (2B) refers to uses where full immersion does not occur, such as boating and wading. Waters designated for secondary contact recreation are required to maintain low bacteria counts to maintain healthy conditions for recreational users. Waters designated for nongame fish and associated food chains (3C) are required to exhibit appropriate levels of dissolved oxygen, temperature, pH, and other parameters needed to support aquatic life. Waters designated as agricultural water supply (4) (including irrigation and livestock watering) are required to be suitable for the irrigation of crops or as water for livestock. As such, they are required to meet general surface-water quality criteria for total dissolved solids (TDS), a common measure of salinity, and for various metals such as lead and cadmium.

Water-quality criteria are specific to designated beneficial uses; they include both numeric limits for individual pollutants or conditions and narrative descriptions of desired conditions. Section 303(d) of the CWA requires each state to submit a list to the EPA every two years identifying waters that fail state water-quality standards. The waters identified on the 303(d) list are known as impaired waters. Kanab Creek and its tributaries from the state line to the irrigation diversion at the confluence with Reservoir Canyon have recently been included on the 303(d) list of impaired waters based on exceedances of the 1,200 milligrams per liter (mg/L) TDS standard for irrigation water use. Previously, the lower portion of Kanab Creek (17.6 miles), from the Utah-Arizona state line north to Four-mile Hollow (13 miles north of Kanab) had been included on the 2008 list of impaired waters for exceedances of the TDS standard (1,200 mg/L for irrigation water use). Table 3.16.1 presents the applicable state water-quality standards for each constituent.

Table 3.16.1. Summary of State of Utah Water Quality Standards

	State Standard	Associated Beneficial Use
Temperature (degrees Celsius)	27	3C
pH	6.5–9.0	2B, 3C, 4
Dissolved oxygen (mg/L)	3.0*	3C
Total suspended solids (mg/L)	None	–
Nitrate and nitrite as N (mg/L)	4.0	2B
Total phosphorus (mg/L)	0.05†	2B
TDS (mg/L)	1,200.0	4

* One-day minimum standard.
† Threshold value.

During the initial mine startup construction for the Coal Hollow Mine in December 2010, discharges of both surface runoff from the mine area and groundwater intercepted in the mine pit areas to Kanab Creek occurred in response to unusually intense precipitation events. At that time, the region experienced the 10-year, 24-hour precipitation event, followed immediately by the 100-year, 24-hour precipitation event the following day (ACD, permit files at DOGM, 2013) (DOGM 2013a). In response to these anomalous precipitation events, discharges of surface-water runoff occurred. In response to continued wetness in early 2011, water was discharged from the mine's sedimentation ponds through the permitted UPDES discharge points. In the six UPDES discharge events that were monitored in 2011, the TDS concentrations of the mine discharge water ranged from 704 to 1,820 mg/L, averaging 1,037 mg/L. The discharge rates at the UPDES discharge points during these events ranged from 1.3 gallons per minute (gpm) to 15 gpm, averaging 5.4 gpm. The discharges that occurred in 2011 were both surface waters and

groundwaters intercepted in the mine pit areas. Under more normal climatic conditions, discharges from the Coal Hollow Mine have been infrequent. The Coal Hollow Mine was designed to contain mine waters (and to use the water for mine operational uses such as dust suppression) such that discharge to the receiving waters would not usually be necessary. There have been no UPDES discharges from the mine operation since November 2011.

3.16.1.1 KANAB CREEK

3.16.1.1.1 Surface-water Quantity and Use

Through most of the tract, the main stem of Kanab Creek is categorized in the National Hydrography Dataset as a perennial stream that has flow throughout the year. However, observed flow in Kanab Creek is highly dependent on climate and upstream water use and has been observed to run very low (less than 0.1 cubic feet per second [cfs]) through the tract during the summer (Petersen Hydrologic 2007). Monitoring of surface-water discharge rates and water quality parameters has occurred at monitoring sites SW-1A, SW-1, Kanab at C.R., SW-3, SW-2, and Kanab-L (Petersen Hydrologic 2013).

Discharge in the upper reaches of Kanab Creek, including tributaries that flow through the tract, is generally seasonal. Most of the water in Kanab Creek upstream of the town of Alton is diverted for irrigation during much of the year, leaving low flows in Kanab Creek downstream of the town and through the tract (see Appendix F). Discharge rates in Kanab Creek in and adjacent to the tract are substantially influenced by irrigation diversions of surface water from the creek. Kanab Creek irrigation diversions are present in and north of the tract. It is common for Kanab Creek to have little or no discharge south of the tract during much of the year. No irrigation diversions on Kanab Creek have been identified for a distance of at least 23 miles downstream from the lowermost irrigation diversion in the tract, which is just above the confluence of Lower Robinson Creek (Utah Division of Water Rights 2014).

The closest USGS gaging station to the tract is downstream north of Kanab (Station No. 09403600; see Map 3.17). The closest National Climatic Data Center (NCDC) weather station to the tract is south of the town of Alton (NCDC Alton Station No. 420086; see Map 3.17). Figure 3.16.1 shows Kanab Creek discharge from the USGS gaging station and precipitation recorded at the NCDC Alton Station from July 2000 to July 2010. Although the precipitation and stream discharge measurements were not taken in the tract, they are approximately representative of the relationship between rainfall and stream flow in the tract.

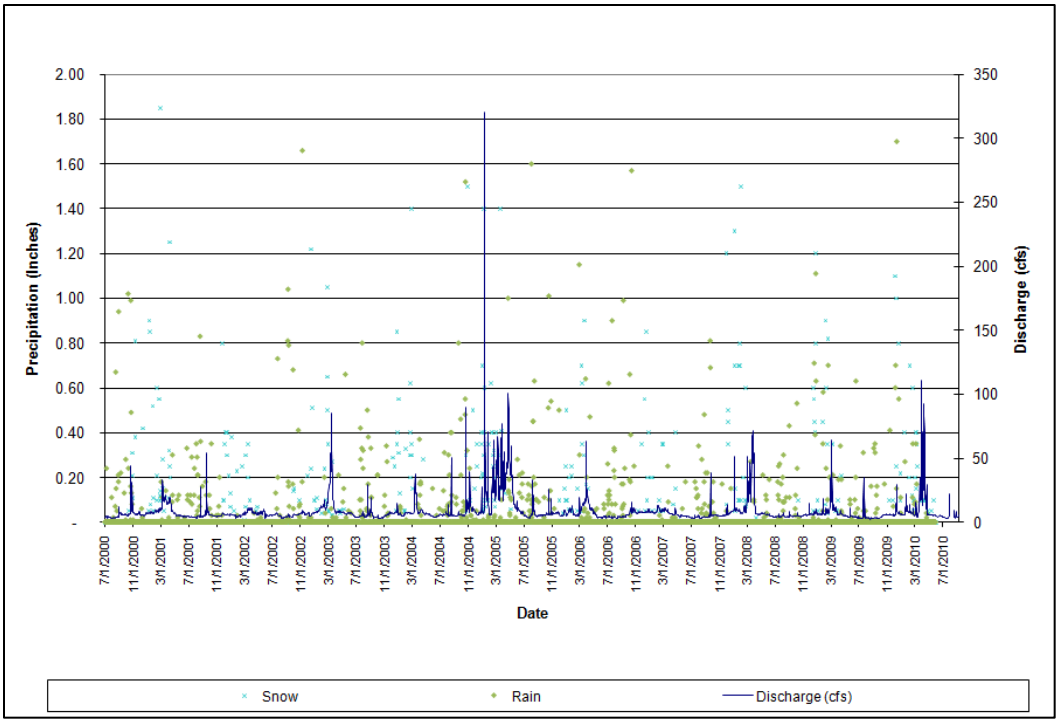

Figure 3.16.1. Precipitation at NCDC Alton Station No. 420086 and Kanab Creek discharge at USGS Station No. 09403600 from July 2000 to July 2010.

Flow data have been collected by Petersen Hydrologic on a quarterly basis since 2005 at three monitoring sites on Kanab Creek. These monitoring sites are, from upstream to downstream, SW-1, SW-3, and SW-2. Flows have also been collected at a fourth monitoring site (SW-5) on Lower Robinson Creek before it enters Kanab Creek (see Map 3.17). Figure 3.16.2 shows the flows measured at each site along Kanab Creek between 2005 and 2009; flows entering Kanab Creek from Lower Robinson Creek ranged from 0 to 0.9 cfs during this period.

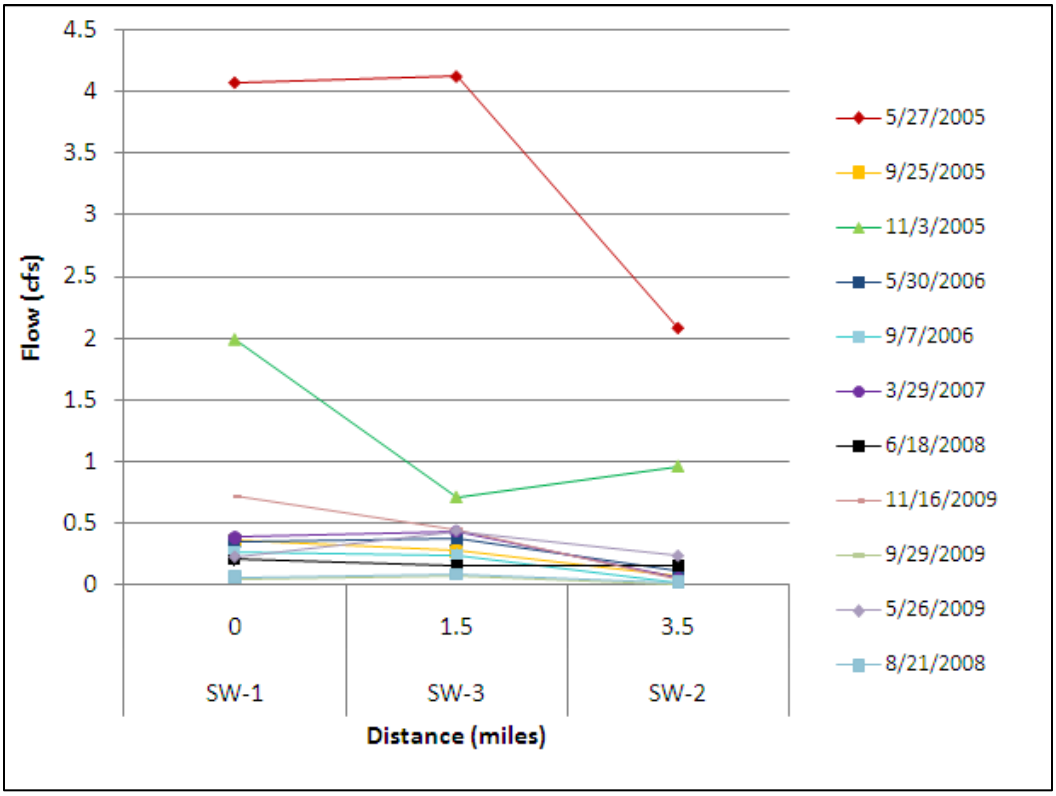

Figure 3.16.2. Discharge (flow) at Kanab Creek surface-water monitoring sites in the Alton Coal Tract, 2005–2009 (DOGM 2014). Distance starts at the first upstream monitoring site (SW-1) (Petersen Hydrologic 2007). See Map 3.17 for location of monitoring sites.

Beginning in 2011 and 2012, Petersen Hydrologic (2013) started collecting flow data from several additional monitoring sites on Kanab Creek and its tributaries. Sites where flow data were collected include (in upstream to downstream sequence) SW-1A, SW-1, Kanab at C.R., SW-3, Kanab-Mid, SW-2, and Kanab-L (see Map 3.17). In Figure 3.16.3, the flows measured in Kanab Creek during high-flow conditions (March 2013) are plotted. Flows measured during baseflow conditions (September 2012) are plotted in Figure 3.16.4. A discharge hydrograph for Kanab Creek as monitored at SW-3 is presented in Figure 3.16.5.

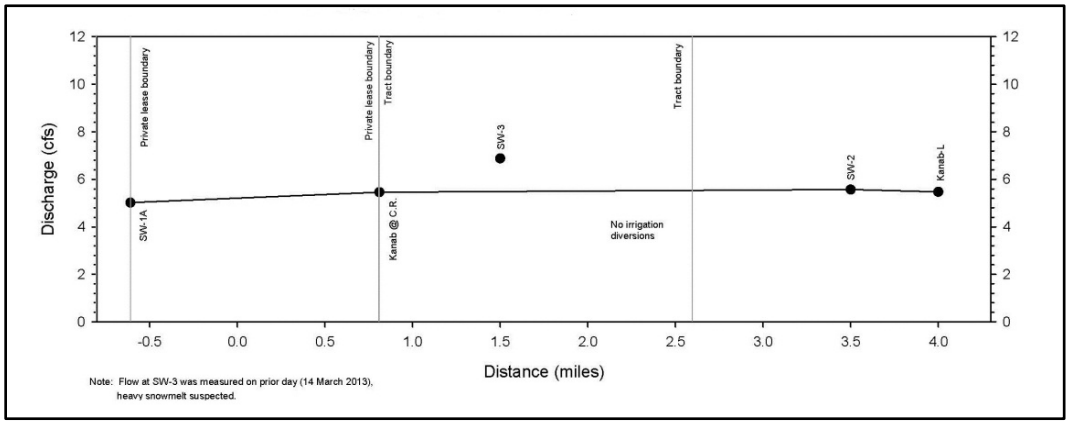

Figure 3.16.3. March 2013 Kanab Creek measurements (high-flow conditions).

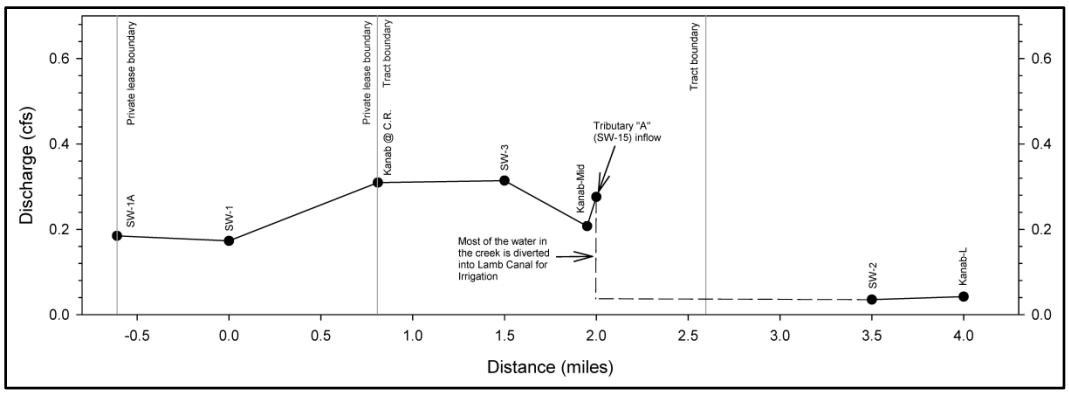

Figure 3.16.4. September 2012 Kanab Creek measurements (low-flow conditions).

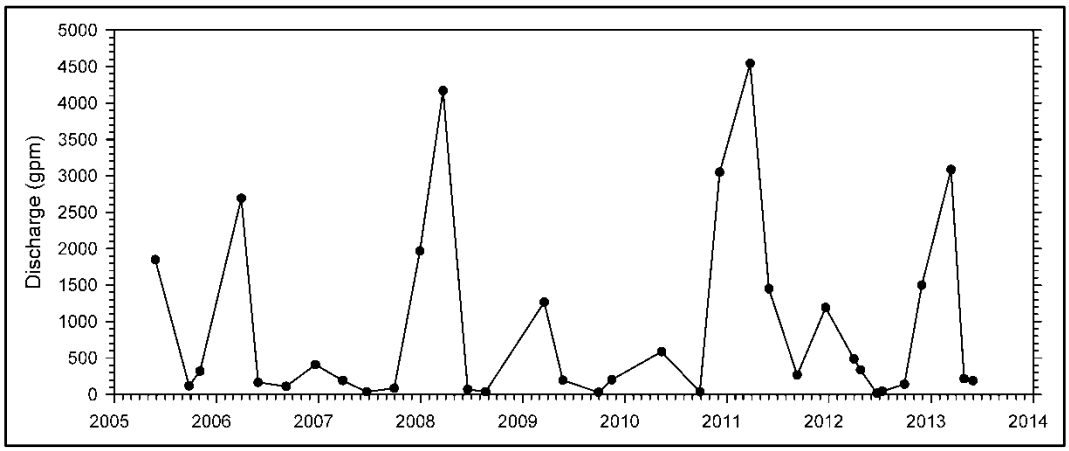

Figure 3.16.5. Kanab Creek discharge hydrograph.

When the creek was measured during high-flow conditions in March 2013, the stream gained by approximately 9%, or 0.44 cfs, between SW-1A (discharging at 5.02 cfs) and Kanab at C.R. (discharging at 5.46 cfs) (see Figure 3.16.3). Hydrological studies indicate that the modest gain between these two sites may be attributable to discharge into the stream channel from saturated alluvial sediments beneath the irrigated farming areas that are present between these two sites. Discharges measured at the lower three sites (Kanab at C.R., SW-2, and Kanab-L) are very similar (within the flow measurement accuracy) at approximately 5.5 cfs. The absence of appreciable variability in the discharge rates measured during high-flow conditions at the lower three monitoring sites suggests that there is no appreciable interaction between surface waters and groundwaters during the high-flow conditions (i.e., the stream neither loses water to the groundwater system nor gains water from groundwater discharge to the stream). This information also indicates that, during high-flow periods, Kanab Creek derives most of its flow from upgradient areas (north and east of the tract).

When Kanab Creek stream flows were measured during low-flow conditions in late September 2012, the flow measured at the upstream location SW-1A (82.8 gpm) was similar to that measured at SW-1 (77.6 gpm). However, the flow measured at Kanab at C.R. (139 gpm) was greater than that measured at SW-1 by approximately 61 gpm, representing a 79% increase in the flow. This increase in flow may also be attributable to discharge from saturated alluvial sediments beneath the farming areas that are present between these two sites. The flow measured at SW-3 (141 gpm) was essentially the same as that measured at Kanab at C.R. However, the discharge measured at Kanab-Mid (93 gpm) represents a loss of 48 gpm. Discharge from Simpson Hollow Creek to Kanab Creek was measured at 30.5 gpm. The

discharges measured at the two downstream monitoring sites (SW-2 and Kanab-L) were substantially lower, at approximately 16 gpm and 19 gpm, respectively. The decreases in flow between SW-3 and SW-2 are due to a combination of factors, including 1) irrigation diversions approximately 0.5 mile downstream from SW-3, 2) lack of local or regional recharge to the shallow aquifer sufficient to sustain baseflow (a losing stream), and 3) loss of water to evapotranspiration. It is common for Kanab Creek to have little or no discharge south of the tract during much of the year. Therefore, flows in Kanab Creek at the tract's south boundary are minimal or nonexistent for most of the year.

The primary uses of surface water in Kanab Creek are irrigation and stock watering. Irrigation around the town of Alton makes up the greatest portion of use (see Appendix F). Irrigation in the area is predominantly conducted with sprinklers, although some flood irrigation is also used. Flood-irrigated lands are found in the Kanab Creek valley near the confluence with Lower Robinson Creek and just south of the town of Alton (see Appendix F). During times when irrigation water is not being diverted at upstream locations (typically during the winter and early spring months), more substantial surface-water flows are present in the drainage (Petersen Hydrologic 2013).

3.16.1.1.2 Surface-water Quality

Water quality has been monitored in Kanab Creek at locations upstream, within, and downstream of the tract (see Map 3.17). The quality of the water in the creek varies appreciably by season and also by location within the area. The TDS concentrations measured in Kanab Creek in and near the tract (2005–2013) have ranged from 384 to 2,058 mg/L (Petersen Hydrologic 2013). The TDS concentrations in Kanab Creek measured approximately 6 miles south of the tract at USGS Station No. 04951830 (1999–2008) have ranged from 372 to 2,262 mg/L. There are several tributaries to Kanab Creek in and adjacent to the tract that discharge water that usually exceeds 2,000 mg/L TDS (Petersen Hydrologic 2013).

The lowest TDS concentrations measured in Kanab Creek near the tract have usually occurred during periods of high flow (Figure 3.16.6). During periods of low flow, higher TDS concentrations are commonly observed (Petersen Hydrologic 2013). The TDS concentrations of most groundwaters in and adjacent to the tract as well as surface waters that are tributary to Kanab Creek in the area commonly have TDS concentrations that are appreciably higher than are waters in Kanab Creek (Petersen Hydrologic 2013). Consequently, when the amount of discharge in Kanab Creek is large relative to the magnitude of local groundwater or surface-water inflow to the creek, the TDS concentrations are lower than when the discharge rates in Kanab Creek are low.

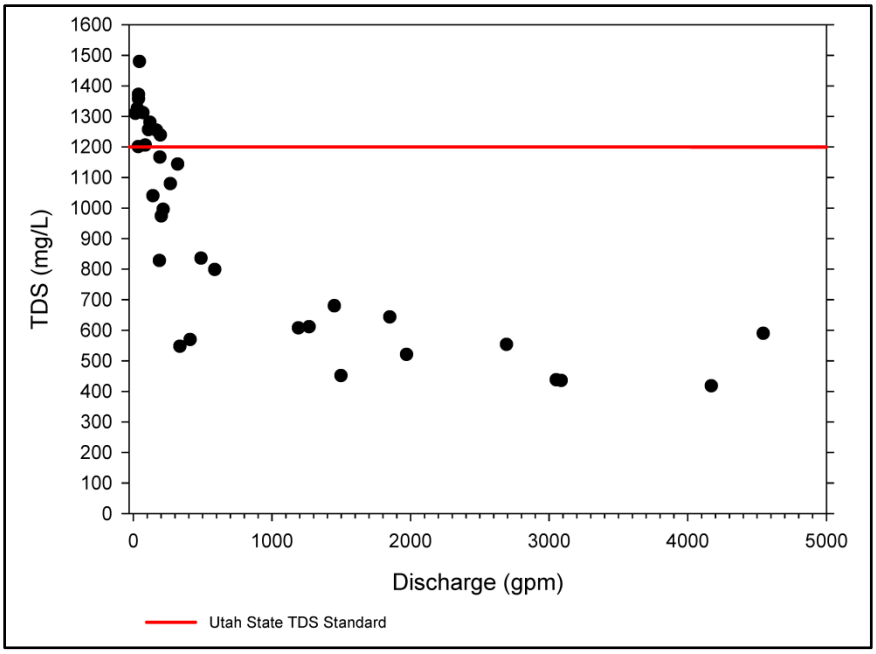

Figure 3.16.6. TDS concentrations at Kanab Creek.

Monitoring data indicate that the TDS of surface water in Kanab Creek increases as it flows through the tract during both high-flow and low-flow conditions (Petersen Hydrologic 2013). Plots of TDS concentrations in Kanab Creek water are presented in Figures 3.16.7 and 3.16.8. During high-flow conditions (March 2013), TDS concentrations increased by 156 mg/L (about 40%) from the upstream monitoring site SW-1A (384 mg/L) to the downstream monitoring site Kanab-L (540 mg/L). During low-flow conditions (September 2012), the TDS in the creek increased by 746 mg/L (about 76%) from SW-1A to Kanab-L. There had been no discharges of mine water from the Coal Hollow Mine in the year prior to these monitoring events.

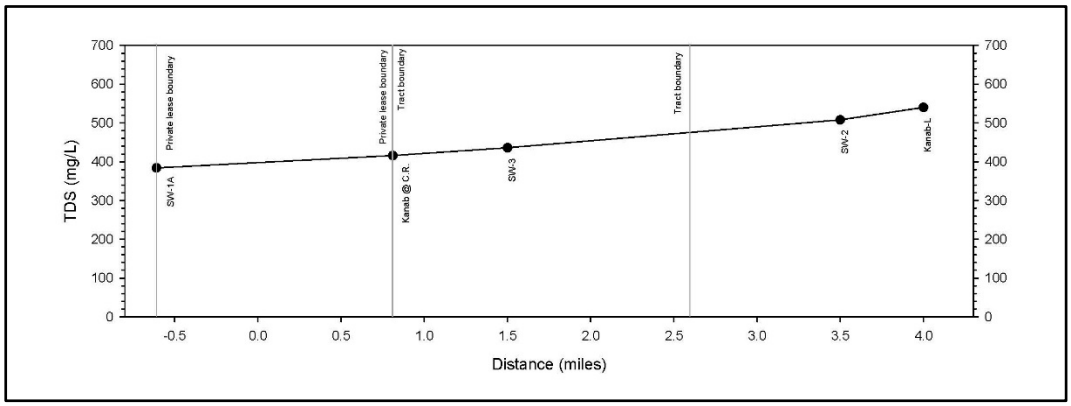

Figure 3.16.7. March 2013 Kanab Creek TDS measurements (high-flow conditions).

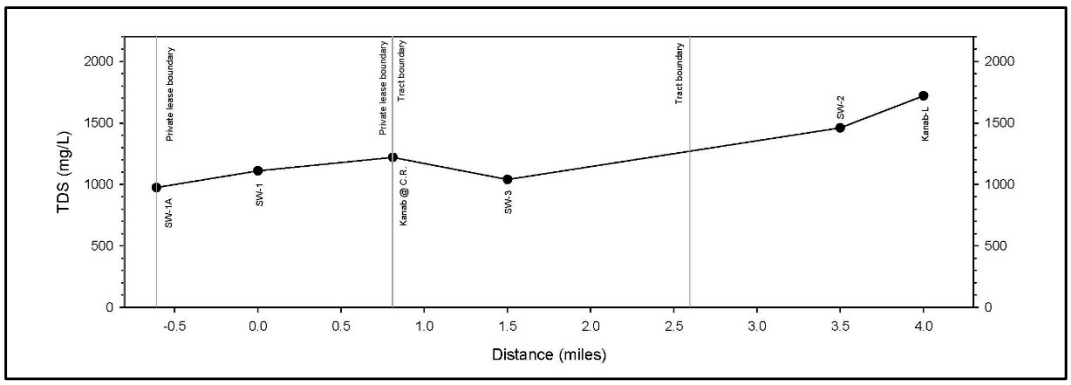

Figure 3.16.8. September 2012 Kanab Creek TDS measurements (low-flow conditions).

As Kanab Creek waters flow over the tract, the TDS concentrations in the creek increase, likely in response to 1) the inflow of locally derived groundwaters and surface waters with high TDS; 2) the dissolution of soluble evaporite minerals present in the rocks and sediments of the streambed and streambanks; and 3) evapoconcentration of creek waters, particularly during the warm summertime months when the evaporation potential is greatest. In areas where unstable bed and bank conditions result in appreciable erosion potential and associated transport of eroded sediment particles into the stream flow, the potential for increases in both TDS and suspended solids concentrations in the stream is exacerbated.

Temperatures measured in Kanab Creek (2005–2013) vary considerably with season. Temperatures near 0 degrees Celsius (°C) are common during the wintertime months, whereas temperatures as high as 26.9°C have been measured during the warm summertime months (Petersen Hydrologic 2013). The measured pH of water in Kanab Creek has ranged from 7.60 to 8.94. Dissolved oxygen levels measured in the creek have ranged from 6.1 to 12.1 mg/L, with the lower values typically occurring during the warm summertime months. Total suspended solids (TSS) concentrations have ranged from less than detectable levels to a maximum of 3,616 mg/L. The highest measured TSS concentrations generally correlate with periods of high discharge rates in the creek (Petersen Hydrologic 2013). Concentrations of nitrate and nitrite (as N) are usually low in the creek, with a maximum measured concentration of 2.17 mg/L. Concentrations of total phosphorous in Kanab Creek are also usually low (near the lower laboratory detection limit), although periodically total phosphorous concentrations exceeding 0.05 mg/L (ranging up to 0.18 mg/L) have been measured in Kanab Creek. The State of Utah has established a threshold indicator value of 0.05 mg/L total phosphorus concentration in streams and rivers as a trigger for further, in-depth assessment of water body condition and needs. This indicator value applies to recreation use in the watershed. Total phosphorus exceedances of the designated beneficial use threshold (0.05 mg/L) occur routinely in surface waters in and around the tract.

3.16.1.2 SIMPSON HOLLOW CREEK

3.16.1.2.1 Surface-water Quantity and Use

Simpson Hollow Creek is an intermittent tributary to Kanab Creek that flows from source areas near and below the town of Alton into Kanab Creek. Portions of the water source area for Simpson Hollow Creek are in Block NW. Monitoring for flow is also performed at sites Creek 1 and Creek 2, which are in the East Fork of Simpson Hollow Creek in upstream areas (Petersen Hydrologic 2013; see Map 3.17).The flows in Simpson Hollow Creek have been monitored at SW-15, which is at the confluence of the tributary with Kanab Creek (Petersen Hydrologic 2013; see Map 3.17). Discharge from Simpson Hollow Creek monitored during 2012 at SW-15 ranged from no flow in May 2012 to 481 gpm (1.07 cfs) in

February 2012 (Figure 3.16.9). Similarly, during 2013, discharge measured in the drainage ranged from no flow in May 2013 to 299 gpm (0.67 cfs) in April 2013. Throughout nine monitoring events in 2012 and 2013, the average discharge rate measured in the tributary was 108 gpm (0.241 cfs).

A water-storage reservoir with a surface area of approximately 4 acres is present in the west fork of Simpson Hollow Creek drainage (Frontier Corporation 2012; Map 3.18). Controlled releases of water from the reservoir can occur in response to agricultural needs. The timing of these releases likely influences the magnitudes of flows monitored at SW-15. The principal sources of water to Simpson Hollow Creek include 1) runoff of snowmelt and precipitation waters from the land surface within the tributary, 2) irrigation return flows (including surface runoff and shallow subsurface interflow runoff) from several large irrigated fields in the drainage area, and 3) groundwater discharge from a series of springs.

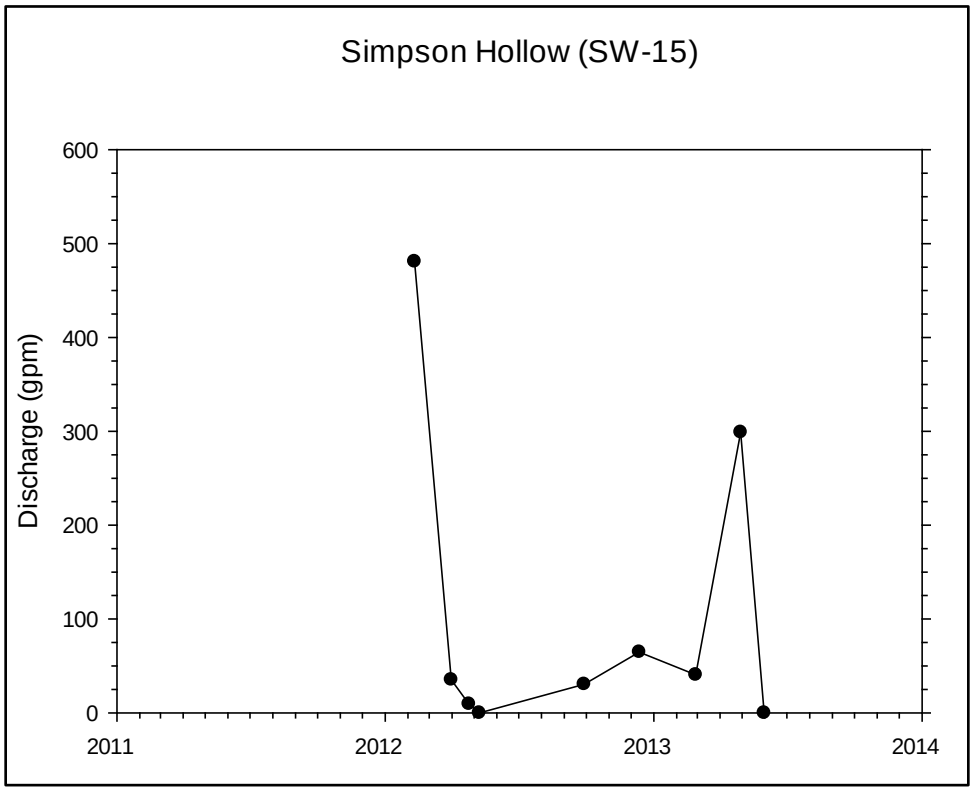

Figure 3.16.9. Simpson Hollow Creek discharge.

The uses of surface water in Simpson Hollow Creek include stock watering directly on the stream. Flow from Simpson Hollow Creek into Kanab Creek may also contribute to the quantity of surface water available for irrigation use in downstream locations.

3.16.1.2.2 Surface-water Quality

TDS concentrations measured in Simpson Hollow Creek at SW-15 in 2012 and 2013 ranged from 1,620 to 3,880 mg/L, averaging 3,033 mg/L (Petersen Hydrologic 2013). The surface waters are generally of the magnesium sulfate geochemical type. Surface waters in the east fork of Simpson Hollow Creek are also of the magnesium sulfate geochemical type. TDS concentrations measured in this tributary at monitoring site Creek 1 ranged from 656 to 4,250 mg/L. TDS concentrations measured higher in this same tributary at Creek 2 in the northeast portion of Block NW ranged from 10,000 to 10,700 mg/L. Discharge rates

measured at Creek 2, which is a headwater area for Simpson Hollow Creek that is sourced largely from nearby diffuse groundwater seepage areas, were less than 1 gpm (0.002 cfs) during each of the three monitoring events at that location (Petersen Hydrologic 2013).

Temperatures measured at the mouth of Simpson Hollow Creek (SW-15) ranged from 0.2°C to 17.3°C. The pH of the water varied from 8.34 to 8.67. Dissolved oxygen values ranged from 7.41 to 11.8 mg/L. TSS concentrations ranged from 4 to 14 mg/L. Nitrate and nitrite (as N) were below laboratory detection limits. Total phosphorous concentrations ranged from 0.02 to 0.07 mg/L. As indicated, the TDS concentrations measured at the three monitoring sites on Simpson Hollow Creek all exceed the 1,200-mg/L state standard for irrigation use.

3.16.1.3 LOWER ROBINSON CREEK

3.16.1.3.1 Surface-water Quantity and Use

Lower Robinson Creek is a tributary to Kanab Creek that originates from small canyons in the foothills of the Paunsaugunt Plateau east of the tract and flows east to west through the middle of the tract. Flows in Lower Robinson Creek are usually minimal. In its upper and middle reaches, Robinson Creek is an ephemeral wash with discharge occurring rarely (see monitoring site data for SW-4 and SW-101; Petersen Hydrologic 2013). In the lower reach of Lower Robinson Creek, small quantities of alluvial groundwater (typically approximately 5 gpm) seep into the deeply incised stream channel near monitoring site BLM-1 (Petersen Hydrologic 2013). Alluvial seepage water in Lower Robinson Creek (which is monitored at BLM-1 and SW-5) commonly persists in the stream channel to the confluence with Kanab Creek.

In its upper and middle reaches, Lower Robinson Creek is an ephemeral wash that rarely discharges. During the 29 monitoring events that have occurred at SW-4 since 2005, discharge has been only observed on one occasion. On that occasion in May 2005, a discharge of 539 gpm was measured. At that time, the region was experiencing a springtime snowmelt event during a very wet year. Appreciable discharge has infrequently been observed at SW-101 in the middle reach of Lower Robinson Creek (see Map 3.17). Discharge at SW-101 has only been observed during periods of appreciable snowmelt or during torrential precipitation events. The maximum discharge measured at SW-101 was 18.0 cfs (8,080 gpm), which occurred during a two-year, 24-hour event in October 2010.

In the lower reach of Lower Robinson Creek, small quantities of alluvial groundwater (typically approximately 7 gpm or less) seep into the deeply incised stream channel near monitoring site BLM-1 (Petersen Hydrologic 2013). Petersen Hydrologic (2007) reports that the discharge derives from the seepage of alluvial groundwater into the Lower Robinson Creek stream channel, which discharges where the stream channel intersects the relatively impermeable Dakota Formation. This alluvial seepage water in Lower Robinson Creek (which is monitored at BLM-1 and SW-5) commonly persists in the stream channel to the confluence with Kanab Creek. At other times, the water is lost to evapotranspiration or infiltrates completely into the gravelly Lower Robinson Creek channel substrate near the confluence with Kanab Creek.

In addition to the arid climate, the low-flow conditions of Lower Robinson Creek are also attributable to the fact that it is a losing stream in its lower reach, which loses flow to alluvial deposits under its channel and to evapotranspiration. In addition, the creek crosses a north-south-trending ridge of Tropic Shale along the Sink Valley Fault (see Map 3.10) that tends to divert water flowing through this alluvium along the fault and into shallow aquifers in Sink Valley rather than diverting it downstream.

There is only very limited use of stream waters in the middle and upper reaches because the watercourse is usually dry. In the lower reach of Lower Robinson Creek, the small alluvial seepage flows are used by wildlife and are also used for stock watering directly along the stream. There are no irrigation diversions

in the lower reach of Lower Robinson Creek. Non-extractive coal mining–related activities associated with the Coal Hollow Mine are currently occurring on lands in the tract that have private surface ownership in the Lower Robinson Creek drainage. These activities, which are regulated under a mining permit administered by DOGM, include coal haulage, stockpiling, and loadout operations; soil stockpiling operations; equipment maintenance operations; surface-water treatment in on-site sediment ponds and activities associated with the mine office facilities and associated roadways and parking lots. Although infrequent, periodic discharges of mine water from the Coal Hollow Mine to Lower Robinson Creek occur.

3.16.1.3.2 Surface-water Quality

The water quality of surface waters monitored in the ephemeral upper and middle reaches of Lower Robinson Creek has been variable. The TDS concentrations measured in the drainage (at SW-101) have ranged from 309 to 3,751 mg/L. Generally, the lower TDS values are associated with the highest discharge rates in the creek. The higher TDS measurements have occurred during periods of moderate to low discharge in the stream (Petersen Hydrologic 2013). Temperatures measured in the ephemeral reaches of Lower Robinson Creek ranged from 0.9°C to 17.7 °C. The pH of the stream water ranged from 7.39 to 8.62. Dissolved oxygen concentrations ranged from 5.64 to 11.7 mg/L. TSS concentrations ranged from 6 to 171,968 mg/L, with the highest values measured during high-discharge events. Although there is no longer a state standard for TSS, the maximum values recorded in and around the tract are very high. The maximum recorded TSS value measured on or near the tract is 171,968 mg/L, which occurred on October 5, 2010, at SW-101. At that time, the discharge measured in the ephemeral creek was 8,080 gpm (18.0 cfs). Other high values were recorded at the same location, including a TSS of 22,752 mg/L on March 18, 2009; 13,404 mg/L on March 21, 2008; and 9,020 on March 30, 2010. Total phosphorous concentrations ranged from nondetectable to 2.94 mg/L. Nitrate and nitrite (as N) concentrations ranged from nondetectable to 1.32 mg/L. In the lower reaches of Lower Robinson Creek, small quantities of discharge (less than approximately 5 gpm) sourced from alluvial groundwater seepage are usually present. The measured TDS concentrations of the seepage waters in the drainage have ranged from 751 to 1,680 mg/L.

3.16.1.4 EPHEMERAL WASHES

3.16.1.4.1 Surface-water Quantity and Use

Surface runoff on much of the land surface in the tract is drained through a network of ephemeral washes that flow only in response to periods of snowmelt or torrential rainfall. Because surface water is usually not present in these drainages, the potential for use of the infrequent surface flows is minimal. Additionally, because many of the ephemeral washes in the tract are currently in an unstable condition, the streambanks and streambed often undergo significant erosion during appreciable stream discharge events. As a result, when appreciable flows are present in the ephemeral washes, the water often contains high suspended solids concentrations, which limit their potential for use (Petersen Hydrologic 2013). Within the tract, Frontier Corporation (2012) has delineated 16 ephemeral stream channels with a combined channel length of nearly 30,000 feet. During the Frontier Corporation field survey in 2012, no surface water was observed in any of these ephemeral channels.

Sink Valley Wash is among the most substantial of the ephemeral drainages near the tract. Monitoring data indicate that Sink Valley Wash (east and south of the tract) flows only during periods of appreciable snowmelt or in response to torrential rainfall events (Petersen Hydrologic 2007). There is no measurable groundwater-derived baseflow discharge component in Sink Valley Wash. Surface-water runoff from the land area in the south portion of Blocks S and Sa drains into Sink Valley Wash. In this area, groundwater discharge from springs and seeps (which could contribute to surface-water flows in Sink Valley Wash) is

less than 1 gpm, and the quality of the quantities of water that does discharge from the springs is poor, with TDS concentrations ranging from 3,780 to 14,900 mg/L (see Section 3.16.2.4.1). For these reasons, surface waters originating from the tract that contribute to Sink Valley Wash flows are of limited use. It is noted that additional springs and seeps are in Sink Valley outside (east) of the tract. Groundwater discharges from these springs and seeps do not support baseflow discharge in the ephemeral Sink Valley Wash (Petersen Hydrologic 2007).

Surface-water flows exiting Sink Valley Wash near the tract's southeast edge in the southeast portion of Block S are also ephemeral, with flow occurring only during the spring snowmelt event or in response to large precipitation events (Table 3.16.2). During 40 discharge monitoring events on Sink Valley Wash at monitoring site SW-6 since 2005, the measured discharge has ranged from 0 to a maximum of 3.05 cfs (1,370 gpm), which occurred on March 22, 2008. During that time, appreciable discharge at SW-6 had been observed in response to the springtime snowmelt event in Sink Valley. At monitoring site SW-9, which is on Sink Valley Wash downstream from the tract, measured discharge has ranged from 0 to 1.1 cfs (492 gpm). It is noteworthy that when SW-9 was visited on March 22, 2008 (the date of the greatest measured discharge at SW-6), there was no discharge in Sink Valley Wash at SW-9.

Table 3.16.2. Flows Measured at SW-9 in Sink Valley Wash

Date	Flow (cfs)
01/13/1988	0.00
02/16/1988	1.70
03/24/1988	0.00
06/17/2005	0.00
09/24/2005	0.00
11/03/2005	0.00
03/30/2006	0.02
05/29/2006	0.00
06/18/2006	0.00
12/20/2006	0.00
03/29/2007	0.00
06/20/2007	0.00
09/30/2007	0.00
12/29/2007	0.00
03/21/2008	0.41
03/22/2008	0.00
6/17/2008	0.00
8/20/2008	0.00
12/30/2008	0.00
3/18/2009	0.00
5/24/2009	0.00
9/29/2009	0.00
11/18/2009	0.00
3/30/2010	0.02
4/23/2010	0.07
5/6/2010	0.00
5/13/2010	0.00
9/28/2010	0.01
12/7/2010	0.00

Table 3.16.2. Flows Measured at SW-9 in Sink Valley Wash

Date	Flow (cfs)
3/26/2011	0.00
5/31/2011	1.10
9/6/2011	0.00
12/19/2011	0.00
3/29/2012	0.00
5/8/2012	0.00
9/29/2012	0.00
12/13/2012	0.00
5/31/2012	0.00

Source: *Reconnaissance Alluvial Valley Floor Investigation in the Alton Coal Tract LBA and Adjacent Areas* (included as Appendix F), and Petersen Hydrologic 2013.

During monitoring of ephemeral stream channels performed by Petersen Hydrologic (2013) (at EW-1, EW-2, EW-2a, EW-3, and RG-L), the measured discharge rates have ranged from 0 to 24.5 gpm. As discussed in Section 3.16.1.3.2, discharges in the ephemeral reaches of Lower Robinson Creek in the tract of up to 18 cfs have been measured. Appreciable discharges have also been observed in other ephemeral washes in the tract (Petersen Hydrologic 2013).

3.16.1.4.2 Surface-Water Quality

The quality of waters present in ephemeral drainages in and around the tract is variable (Petersen Hydrologic 2013). TDS concentrations measured in the ephemeral drainages range from a minimum of 112 mg/L to a maximum of 4,980 mg/L (Table 3.16.3). The wide range of observed TDS concentrations is likely related to 1) the degree to which runoff waters physically interact with soluble minerals in the ephemeral drainage, and 2) the mineralogical composition of the sediments that come into contact with the runoff waters. Because many of the ephemeral washes are currently in an unstable condition, TSS concentrations in discharges in ephemeral washes, particularly during high-flow conditions, are often elevated (Petersen Hydrologic 2013).

Table 3.16.3. Water Quality Data from Ephemeral Washes (2005–2013)

Wash	Minimum TDS (mg/L)	Maximum TDS (mg/L)
Unnamed wash (EW-1)	112	2,740
Unnamed wash (EW-2)	986	4,840
Unnamed wash (EW-3)	246	432
Unnamed wash (RSD-1)	400	400
Unnamed wash (RG-L)	3,720	4,980
Sink Valley Wash (SW-6)	127	2,220
Sink Valley Wash (SW-9)	360	3,400
Lower Robinson Creek, ephemeral reach (SW-101)	309	3,751

3.16.1.5 DRAINAGE CONDITIONS

On private lands in the tract, the natural drainage channels associated with Kanab Creek and Lower Robinson Creek are susceptible to downcutting and mass wasting (Petersen Hydrologic 2007). Petersen Hydrologic (2007) reports that in some areas these channels have been downcut by several tens of feet below the surrounding topography. Petersen Hydrologic also reports that there is headcutting in the Sink Valley Wash and active erosion and collapse of the steep arroyo walls along Robinson Creek. Kanab Creek is a deeply incised arroyo channel with steep walls lining the creek bed where the stream has downcut into nearby sediment (Cordova 1981). As recently as 2005, landslides along the arroyo faces of Kanab Creek have been reported as a natural slope-failure slide (Lund 2005). The deteriorated condition of stream channels is largely attributed to historic land-management practices and the natural erosive properties of the soil and geology in this area (Petersen Hydrologic 2007). Various reaches of the stream channels in the tract and surrounding areas exhibit these conditions to varying degrees (e.g., in some stream reaches, more stable configurations are present).

Kanab Creek, Lower Robinson Creek, and Sink Valley Wash all experience downcutting during large precipitation events, creating near-vertical streambanks. These streambanks are unstable and result in mass wasting of sediment into the channel. The movement of large quantities of sediment during spring melt and large precipitation events modifies the stream channel on a regular basis. Along the creek margin, where lower slopes make it possible, cottonwood and willow trees along with sagebrush and grasses grow in a limited riparian area, stabilizing the streambank in these areas.

As defined by the BLM's Proper Functioning Condition Assessment protocol (BLM 2008c) and based on a field assessment conducted in November 2010, the functional rating for public land portions of Upper Kanab Creek is "Proper Function Condition," whereas the functional rating of public lands portions of Lower Robinson Creek is "Functional – At Risk" (BLM 2010b). The segments of Upper Kanab Creek and Lower Robinson Creek that were assessed by the BLM in 2010 are shown on Map 3.19. Proper function condition assessments have not been conducted for private lands in the tract.

3.16.2 Groundwater

The tract is at the base of a valley along the north-south axis of Kanab Creek. The complex geology and structure (faults and folds) of the Alton Coal Field forms a complex hydrogeologic setting vertically and laterally across and adjacent to the tract. In general, the vertical hydrogeologic units consist of unconsolidated clay, silt, sand, and gravel alluvial sediments that have been deposited near drainages and overlay the relatively impermeable Tropic Shale. The hydrogeology below the Tropic Shale consists predominantly of low-permeability shaley strata interbedded with lenticular (lens-like), fine- to medium-grained sandstones of the Dakota Formation. The Smirl Coal Zone, which is at the top of the Dakota Formation near the contact with the Tropic Shale, is reported to have a moisture content of approximately 13% (2004). However, most or all of this moisture is physically or chemically bound to the coal itself, and as such, it does not constitute a usable groundwater resource.

Groundwater systems in and adjacent to the tract are present in alluvial sediments, the Tropic Shale, and the Dakota Formation. Aquifer properties and groundwater resources beneath the Alton Coal Field have been investigated through extensive drilling, hydrogeologic characterization, and surface and groundwater monitoring (Doelling et al. 1972; Petersen Hydrologic 2007, 2013; UII 1987a). Detailed investigations of groundwater systems in Sink Valley (where substantial alluvial groundwater systems are present) have been performed in conjunction with permitting activities for the existing Coal Hollow Mine. In conjunction with these activities, many monitoring wells have been constructed in the tract and adjacent area (Table 3.16.4).

Table 3.16.4. Information for Wells in and Adjacent to the Alton Coal Tract

Well ID*	Year Completed	Location	Screened Formation	Well Elevation (feet)	Well Depth (feet)	Typical Depth to Water (feet)†
CO-18	2007	SW¼ of SE¼, Section 19, Township 39 South, Range 5 West	Alluvium	6,864	22	15
CO-54	2007	SW¼ of SE¼, Section19, Township 39 South, Range 5 West	Tropic Shale	6,860	54	27
C1-24	2007	NW¼ of SW¼, Section 20, Township 39 South, Range 5 West	Alluvium	6,949	27	13
C2-15	2007	NW¼ of NW¼, Section 29, Township 39 South, Range 5 West	Alluvium	6,920	15	11
C2-28	2007	NW¼ of NW¼, Section 29, Township 39 South, Range 5 West	Alluvium	6,920	28	10
C2-40	2007	NW¼ of NW¼, Section 29, Township 39 South, Range 5 West	Alluvium	6,920	40	10
C3-15	2007	SW¼ of NW¼, Section 29, Township 39 South, Range 5 West	Alluvium	6,920	15	5
C3-30	2007	SW¼ of NW¼, Section 29, Township 39 South, Range 5 West	Alluvium	6,920	28	5
C3-40	2007	SW¼ of NW¼, Section 29, Township 39 South, Range 5 West	Alluvium	6,920	40	5
C4-15	2007	NW¼ of SW¼, Section 29, Township 39 South, Range 5 West	Alluvium	6,874	15	5
C4-30	2007	NW¼ of SW¼, Section 29, Township 39 South, Range 5 West	Alluvium	6,874	30	5
C4-50	2007	NW¼ of SW¼, Section 29, Township 39 South, Range 5 West	Alluvium	6,874	50	4
C5-130	2007	SE¼ of NW¼, Section 29, Township 39 South, Range 5 West	Alluvium	6,939	130	-23
C6-15	2007	NE¼ of NE¼, Section 30, Township 39 South, Range 5 West	Alluvium/Tropic Shale	6,898	15	Dry
C7-20	2007	SE¼ of NE¼, Section 30, Township 39 South, Range 5 West	Alluvium	6,873	20	10
C8-25	2007	NE¼ of SE¼, Section 30, Township 39 South, Range 5 West	Alluvium	6,860	27	7
C9-15	2007	SE¼ of SE¼, Section 30, Township 39 South, Range 5 West	Alluvium	6,847	15	9
C9-25	2007	SE¼ of SE¼, Section 30, Township 39 South, Range 5 West	Alluvium	6,846	26	9
C9-40	2007	SE¼ of SE¼, Section 30, Township 39 South, Range 5 West	Alluvium	6,847	42	10
LR-45	2007	NW¼ of NW¼, Section 30, Township 39 South, Range 5 West	Alluvium	6,798	42	28
LS-15	2007	NW¼ of NW¼, Section 32, Township 39 South, Range 5 West	Alluvium	6,810	15	8
LS-28	2007	NW¼ of NW¼, Section 32, Township 39 South, Range 5 West	Alluvium	6,810	28	7
LS-60	2007	NW¼ of NW¼, Section 32, Township 39 South, Range 5 West	Alluvium	6,810	60	5

Table 3.16.4. Information for Wells in and Adjacent to the Alton Coal Tract

Well ID*	Year Completed	Location	Screened Formation	Well Elevation (feet)	Well Depth (feet)	Typical Depth to Water (feet)†
LS-85	2007	NW¼ of NW¼, Section 32, Township 39 South, Range 5 West	Alluvium	6,811	87	-3
SS-15	2007	SE¼ of SE¼, Section 30, Township 39 South, Range 5 West	Alluvium	6,832	15	5
SS-30	2007	SE¼ of SE¼, Section 30, Township 39 South, Range 5 West	Alluvium	6,830	29	4
SS-75	2007	SE¼ of SE¼, Section 30, Township 39 South, Range 5 West	Alluvium/burned coal	6,832	75	15
UR-70	2007	NW¼ of SW¼, Section 20, Township 39 South, Range 5 West	Alluvium	7,005	70	23
Y-36	1979	NE¼ of NW¼, Section 29, Township 39 South, Range 5 West	Smirl Coal Zone	6,957	214	84
Y-38	1979	NE¼ of SE¼, Section 30, Township 39 South, Range 5 West	Smirl Coal Zone	6,862	86	55
Y-39	1979	SE¼ of SW¼, Section 30, Township 39 South, Range 5 West	Smirl Coal Zone	6,850	12	Dry
Y-40	1979	NW¼ of NE¼, Section 31, Township 39 South, Range 5 West	Smirl Coal Zone	6,881	70	71
Y-41	1979	SE¼ of NE¼, Section 31, Township 39 South, Range 5 West	Smirl Coal Zone	6,844	64	49
Y-43	1979	SE¼ of NW¼, Section 30, Township 39 South, Range 5 West	Smirl Coal Zone	6,868	42	42
Y-45	1980	NE¼ of NE¼, Section 29, Township 39 South, Range 5 West	Smirl Coal Zone	7,045	330	250
Y-47	1980	NW ¼ of SW ¼, Section 29, Township 39 South, Range 5 West	Alluvium	6,867	46	14
Y-48	1980	NW¼ of SW¼, Section 29, Township 39 South, Range 5 West	Smirl Coal Zone	6,867	128	30
Y-49	1980	NE¼ of NE¼, Section 30, Township 39 South, Range 5 West	Smirl Coal Zone	6,872	102	41
Y-50	1980	NE¼ of NE¼, Section 30, Township 39 South, Range 5 West	Alluvium	6,872	31	11
Y-53	1980	SE¼ of NE¼, Section 19, Township 39 South, Range 5 West	Smirl Coal Zone	7,002	210	179
Y-55	1980	SW¼ of SW¼, Section 12, Township 39 South, Range 6 West	Smirl Coal Zone	6,949	69	68
Y-56	1980	SW¼ of SW¼, Section 12, Township 39 South, Range 6 West	Alluvium	6,892	40	4
Y-57	1980	NE¼ of NW¼, Section 29, Township 39 South, Range 5 West	Alluvium	6,964	70	-10
Y-58	1980	NW¼ of NW¼, Section 29, Township 39 South, Range 5 West	Alluvium	6,950	90	-10
Y-59	1980	SE¼ of NW¼, Section 29, Township 39 South, Range 5 West	Alluvium	6,962	110	-18
Y-61	1980	NE¼ of NW¼, Section 29, Township 39 South, Range 5 West	Alluvium	6,962	150	-10

Table 3.16.4. Information for Wells in and Adjacent to the Alton Coal Tract

Well ID*	Year Completed	Location	Screened Formation	Well Elevation (feet)	Well Depth (feet)	Typical Depth to Water (feet)†
Y-62	1980	NW¼ of NW¼, Section 32, Township 39 South, Range 5 West	Alluvium	6,817	110	-10
Y-63	1980	SW¼ of NW¼, Section 32, Township 39 South, Range 5 West	Alluvium	6,789	51	13
Y-69	1985	NE¼ of SE¼, Section 11, Township 39 South, Range 6 West	Smirl Coal Zone	6,950	53	10
Y-70	1985	NE¼ of NE¼, Section 13, Township 39 South, Range 6 West	Smirl Coal Zone	6,900	87	38
Y-98 (A1)	1986	NW¼ of NW¼, Section 21, Township 39 South, Range 5 West	Alluvium	7,174	86	84
Y-99 (A2)	1986	NE¼ of SW¼, Section 20, Township 39 South, Range 5 West	Alluvium	7,056	22	Dry
Y-100 (A3)	1986	NW¼ of SE¼, Section 20, Township 39 South, Range 5 West	Alluvium	7,083	131	75
Y-101 (A4)	1986	NE¼ of SW¼, Section 20, Township 39 South, Range 5 W.	Alluvium	7,017	77	22
Y-102 (A5)	1986	NW¼ of NW¼, Section 29, Township 39 South, Range 5 West	Alluvium	6,950	86	-6
Y-103 (A6)	1986	NW¼ of NW¼, Section 18, Township 39 South, Range 5 West	Alluvium	6,920	78	31
Nevada Power No. 1	1961	SW¼ of NW¼, Section 18, Township 39 South, Range 5 West	Navajo Sandstone	6,900	1,600	Not available
Nevada Power No. 2	1961	SE¼ of NW¼, Section 30, Township 39 South, Range 5 West	Navajo Sandstone	6,850	1,140	432
CHM Water Supply Well	2010	NW¼ of NW¼, Section 29, Township 39 South, Range 5 West	Alluvium	6,961	51	-16

*Some wells are no longer operative.

† Negative values indicate artesian pressure.

Sources: ACD (2013), DOGM (2013a), Petersen Hydrologic (2013), UII (1987a), Doelling et al. (1972), and UDNR (1981).

Alluvial deposits in the tract exist primarily within the narrow stream valleys, which are surrounded by and underlain by low-permeability bedrock units (see Map 3.10). The presence of the surrounding low-permeability bedrock impedes the potential for outflow of alluvial groundwater into surrounding bedrock units. Consequently, the directions of groundwater flow in shallow, unconfined alluvial groundwater systems in the narrow valleys follow the directions of the associated stream valleys that contain the alluvial deposits. Similarly, the hydraulic gradients in the shallow, unconfined alluvial groundwater systems within the narrow valleys also likely mirror the hydraulic gradients of the stream valleys that contain them. Laterally within the tract, the alluvium deposits range from a thin covering to a thicker covering of 10 feet or more. Groundwater naturally discharges to the surface as springs and seeps from alluvial deposits, the Dakota Formation, and weathered Tropic Shale.

Thirteen springs and seeps on and immediately adjacent to the tract have been monitored for water quantity and quality (Table 3.16.5). Additionally, a zone of alluvial groundwater seepage into the Lower Robinson Creek stream channel has been monitored. At 10 of these locations, sufficient water has been present (on at least one occasion) to allow collection of spring discharge samples for laboratory water

quality analysis. At most locations in the tract, discharge rates from these springs and seeps are meager, and water quality is often poor (with TDS concentrations commonly exceeding 2,000 mg/L) (Petersen Hydrologic 2013). As a consequence, the potential for use of this groundwater resource is limited (see Table 3.16.5).

Table 3.16.5. Discharge and Water Quality Information for Springs and Seeps in the Tract

Spring/Seep	Block Location	Flow Range (gpm)	Maximum Specific Conductance (µS/cm)	Minimum TDS (mg/L)	Maximum TDS (mg/L)	Suitable for Irrigation Use (1,200-mg/L criteria)	Suitable for Stock Watering Use (2,000-mg/L criteria)
Spring 1 (Pond Spring)	NW	12.3–17.5	2,710	2,190	2,420	No	No
Spring 2 (Hill spring)	NW	1.2–2.3	3,450	3,020	3,250	No	No
Seep 1 (Alkali Seep)	CWN	< 0.5	6,160	2,790	3,250	No	No
Seep 2 (April Seep)	NW	< 0.5	9,200	7,360	9,160	No	No
Seep 3 (Car Seep)	NW	< 0.5	2,180	1,450	1,680	No	Yes
SP-41 (Dakota Seep)	CWS	0	–	–	–	–	–
Seep 4 (Priscilla Seep)	NW	< 0.5	11,180	12,200	12,600	No	No
Seep 6 (Seep Y)	NW	< 0.5	15,430	–	–	–	–
Seep 7 (Seep Z)	NW	< 0.5	7,950	6,560	6,560	No	No
SP-27 (Clampett Seep)	S	< 0.5	5,070	3,780	6,550	No	No
SP-38 (south swale alk)	S	< 0.5	17,910	4,400	14,900	No	No
SP-39 (Seep in CHM area)	C	< 0.5	2,640	–	–	–	–

µS/cm = micro-Siemens per centimeter.

The Tropic Shale bedrock consists predominantly of marine shale and claystone with very low permeability (see 3.16.2.1.1). The quality of groundwater that has interacted with Tropic Shale bedrock (or Tropic Shale–derived unconsolidated deposits) is usually poor, which further limits its potential for use. Consequently, the Tropic Shale has no appreciable potential as a developable groundwater resource. The Dakota Formation, which consists predominantly of interbedded lenticular sandstones, shales, and coal deposits, underlies the Smirl Coal Zone to be mined (Petersen Hydrologic 2007). Due to the low permeability of these units, groundwater from the Tropic Shale and Dakota Formation does not contribute measurable baseflow to streams in the tract (Petersen Hydrologic 2007). However, springs and seeps in and adjacent to Block NW do contribute appreciably to the baseflow in Simpson Hollow Creek. Table 3.16.4 includes information on developed wells in and adjacent to the tract. Although shallow groundwater resources are present beneath the tract, most of these groundwater resources are not supportive of a readily developable groundwater resource due to low permeability or limited extent of the associated geologic units. Accordingly, no water production wells are present in the tract. Although permeable alluvial deposits are present within narrow stream valleys in some portions of the tract, these deposits are generally limited in both vertical and aerial extent (Tilton 2001). These localized alluvial deposits would likely not support appreciable developable groundwater resources. However, a water well screened in saturated alluvial sediments adjacent to Kanab Creek approximately 0.8 mile north of the tract was developed by the town of Alton for municipal use. Additionally, appreciable alluvial groundwater resources are present in Sink Valley (southeast of the tract) where thicker sequences of alluvial deposits (up to 150 feet thick) are present and flowing artesian conditions exist in the alluvial groundwater system (Petersen Hydrologic 2007).

Currently, groundwater is being extracted from a well in the Sink Valley alluvial groundwater system for use at the Coal Hollow Mine. No water supply wells are known to exist in either the Tropic Shale or the Dakota Formation in the tract, demonstrating the inability of these formations to transmit useful quantities of water to wells. There is no indication of any successful historical development of groundwater resources in the Dakota Formation locally, even though it is present at or near the surface in many locations in and adjacent to the tract (see Map 3.10). This is likely due to the reported poor potential for groundwater to migrate vertically or horizontally over substantial distances through the Dakota Formation (Petersen Hydrologic 2007). It is unlikely that appreciable groundwater resources could be developed in the Dakota Formation.

The first significant quantities of groundwater underlying the tract are from the deep Navajo Sandstone aquifer. On a regional scale, groundwater from the Navajo Sandstone is used for domestic, agricultural, and municipal wells. This groundwater also provides baseflow to springs and streams in the region. However, the Navajo Sandstone aquifer is not tapped by any operating wells in or adjacent to the tract. In the early 1960s, Nevada Power Company drilled two large diameter wells into the Navajo Sandstone to depths of approximately 1,400 and 1,600 feet in an attempt to develop groundwater. Neither well obtained sufficient water at the final depth to be considered even moderately successful (Doelling et al. 1972). Within the tract, the depth of the Navajo Sandstone ranges from approximately 1,300 to 2,450 feet below land surface (see Figure 3.6.1b). Therefore, the groundwater resources available in the Navajo Sandstone aquifer are not reasonably available for development near the tract because of the high costs of well construction and groundwater pumping. The Navajo Sandstone aquifer is effectively isolated from the proposed mining areas in the tract by more than 1,000 feet of low-permeability rock strata of the Dakota and Carmel formations. These formations contain large thicknesses of low-permeability shales, siltstones, mudstones, and bentonite. Therefore, the Navajo Sandstone aquifer is not further evaluated.

During the period of operation at the adjacent Coal Hollow Mine, only limited amounts of groundwater have been intercepted by the mine pits (ACD, permit files at DOGM [2013]). Typically, the total inflow of intercepted groundwaters from all sources into the mine pit area at any one time has not exceeded approximately 25 gpm. Over the operational history of the Coal Hollow Mine, most of the groundwater encountered in the pit areas has originated from areas where saturated fluvial channel sediments are exposed in the mine highwall. At any given time, the combined inflow rates from intercepted alluvial groundwater systems in the pit areas have typically been on the order of 20 gpm or less. The rates of inflow of groundwater from the Tropic Shale bedrock where it is exposed in the pit walls (beneath the alluvium and above the coal seam) have been minimal (generally less than 1 gpm). Minor seepage of groundwater from the Smirl Coal Zone into the mine pit areas has been observed. These inflows, which have typically occurred when the coal seam was first exposed in the mine pit floor, have been estimated at 1–2 gpm typically. Under normal operating conditions at the existing Coal Hollow Mine, most of the water intercepted in the mine pit areas has been used for dust-suppression activities, and discharge of water from the mine has not been necessary.

3.16.2.1 BLOCK C

3.16.2.1.1 Groundwater Occurrence and Use

In Block C, only limited amounts of groundwater naturally discharge to the surface as seeps and springs.

Groundwater discharge within this block has been identified at a single seep and also as streambed and streambank seepage along Lower Robinson Creek. SP-39 is in the currently permitted surface-disturbance area of the Coal Hollow Mine in the southeast portion of Block C (see Map 3.17). The discharge monitored at this spring has been meager, ranging from a maximum of less than 0.05 gpm to damp soil only. This seep is believed to be associated with shallow, seasonal snowmelt waters migrating through the

shallow subsurface, and does not appear to be associated with a substantial groundwater system (see Appendix F). The limited quantity of water at the seep is principally used by wildlife. The potential for stock watering use at the seep is minimal because of the small quantity of water available.

Seepage of alluvial groundwater into the streambed and streambanks in Lower Robinson Creek near the south boundary of Block C (along the south border of Section 19, Township 39 South, Range 6 West) occurs. This groundwater seepage occurs where the alluvial groundwaters in saturated alluvial sediments surrounding the stream channel are forced to the surface at the intersection of the stream channel and the underlying low-permeability bedrock atop the Dakota Formation (see Appendix F). The alluvial seepage water in Lower Robinson Creek (which is monitored at BLM-1 and SW-5) commonly persists in the stream channel to the confluence with Kanab Creek. At other times, the water is lost to evapotranspiration or infiltrates the gravelly Lower Robinson Creek channel substrate near the confluence with Kanab Creek. Water in this reach of the stream is used by wildlife and for stock watering directly along the stream.

As measured at well Y-53C, which is screened in the Smirl Coal Zone in the upland, east portion of Block C, the depth to groundwater in this area has ranged from approximately 176 to 184 feet below the land surface (Petersen Hydrologic 2013). Thick alluvial sediments, which could support shallow alluvial groundwater systems in the upland areas, are generally not present in the upland areas of Block C (Petersen Hydrologic 2013; Tilton 2001).

In the alluvial sediments adjacent to Lower Robinson Creek in Block C, water levels in the southeast portion of Block C (see sites LR-45, Y-101P, and UR-70) are generally within approximately 20–30 feet of the ground surface (DOGM 2013b; Petersen Hydrologic 2013). In lower-lying locations outside the coal zone in the west and south portions of Block C, the Dakota Formation and quaternary alluvium are present at the land surface (see Map 3.10). The Dakota Formation consists predominantly of interbedded claystones, shales, siltstones, and sandstones, and generally has poor water-transmitting characteristics (Petersen Hydrologic 2007). No appreciable Dakota Formation springs have been identified in this area. The quaternary alluvial sediments exposed in erosional escarpments along Kanab Creek consist primarily of clays and silts, with lesser amounts of sand and gravels (Petersen Hydrologic 2013). Seepage of appreciable amounts of groundwater from the exposed alluvial sediments adjacent to Kanab Creek within Block C has not been observed. Likewise, appreciable gains in stream discharge rates in Block C during baseflow conditions have not been observed (see Figure 3.16.4), suggesting a lack of groundwater discharge from either the Dakota Formation or the alluvial sediments adjacent to Kanab Creek in the Block C area.

3.16.2.1.2 Groundwater Hydrology

Only limited quantities of groundwater naturally discharge in Block C. Within the block, only one spring (SP-39, which discharges at less than 0.05 gpm) and the alluvial seepage zone in the lower reaches of the Lower Robinson Creek stream channel (which typically discharges at less than about 7 gpm) have been identified. The lack of appreciable groundwater discharge over most of the block is likely attributable largely to the presence of the Tropic Shale at or near the land surface over much of Block C (see Map 3.10). The Tropic Shale is a regionally extensive formation that mostly consists of soft, low-permeability marine shales (see Section 3.6). Locally, the alluvial deposits in Block C consist largely of clayey sediments derived from the weathering and transport of clayey sediments sourced from the Tropic Shale. Accordingly, snowmelt waters and precipitation waters falling on the formation tend to run off as surface water to receiving drainages rather than infiltrating into the subsurface as groundwater recharge. To quantify the permeability of the Tropic Shale, a drilling core consisting of unweathered Tropic Shale was analyzed at the laboratory for coefficient of permeability (the core sample was remolded and compacted at the laboratory prior to the analysis). The low laboratory result for the coefficient of permeability (8.24×10^{-8} cm per second) supports the conclusion that the potential for groundwater migration through the Tropic Shale is low. The pervasive presence of the Tropic Shale and Tropic Shale–derived clayey

sediments 1) minimizes the potential for vertical groundwater recharge to the unit and to deeper, underlying geologic formations; and 2) minimizes the potential for appreciable lateral or vertical flow of groundwater through the formation to potential discharge locations.

As previously described, seepage of alluvial groundwater into the streambed and streambanks in the lower reaches of Lower Robinson Creek occurs near the south boundary of Block C. This groundwater seepage occurs where the alluvial groundwaters in saturated alluvial sediments surrounding the stream channel are forced to the surface where the stream channel intersects the underlying low-permeability bedrock at the top of the Dakota Formation (see Appendix F). The alluvial seepage water in Lower Robinson Creek commonly persists in the stream channel to the confluence with Kanab Creek. At other times, the water is lost to evapotranspiration or infiltrates into the gravelly Lower Robinson Creek channel substrate near the confluence with Kanab Creek.

Unlike conditions in Sink Valley to the southeast (where many springs discharge and flowing artesian wells are present), no appreciable spring discharge has been identified in the alluvial sediments north of the Lower Robinson Creek drainage. This condition is likely related to the lack of any major surface-water drainages emanating from the Paunsaugunt Plateau east of Block C that could provide recharge to alluvial groundwater systems. (Several substantial surface-water drainages, including Lower Robinson Creek, Water Canyon, and Swapp Hollow, emanate from the Paunsaugunt Plateau east of Sink Valley.)

3.16.2.1.3 Groundwater Quality

Only a single seep has been identified in Block C. The discharge from SP-39 is meager, and standing water sufficient to measure field water-quality parameters was present on only one occasion. At that time, the discharge was estimated to be less than 0.05 gpm. The specific conductance of the groundwater was 2,640 micro-Siemens per centimeter (µS/cm). The temperature of the mostly stagnant water was 14.1°C, and the pH was 7.76. The specific conductance value measured at the seep (which is elevated relative to waters in Sink Valley) is attributable to interactions with the Tropic Shale sediments near the seep location.

The alluvial groundwater seepage that is present in the lower reaches of Lower Robinson Creek has routinely been monitored at monitoring site SW-5 and also at BLM-1. During times when ephemeral discharge is present in the drainage, the alluvial groundwater seepage is inundated by upstream surface water, and the chemical composition measured in the creek is not representative of the chemical composition of the alluvial seepage water. TDS concentrations of alluvial groundwater seepage at BLM-1 range from 867 to 1,320 mg/L, averaging 1,133 mg/L. The alluvial seepage groundwater in Lower Robinson Creek is commonly of the magnesium-bicarbonate-sulfate chemical type.

The TDS concentrations of groundwater monitored at well UR-70, which is screened in Tropic Shale–derived alluvial sediments adjacent to Lower Robinson Creek, have ranged from 4,046 to 5,208 mg/L, averaging 4,882 mg/L. The water at UR-70 is of the mixed cation-sulfate chemical type. It is noteworthy that the groundwater sampled at UR-70 is similar in composition to the surface water sampled in Lower Robinson Creek during low-flow conditions (DOGM 2013a).

3.16.2.2 BLOCK NW

3.16.2.2.1 Groundwater Occurrence and Use

Eight springs and seeps in and immediately adjacent to Block NW have been identified and monitored for discharge rates and water quality (see Table 3.16.5; Petersen Hydrologic 2013). These include Spring 1, Spring 2, Seep 2, Seep 3, Seep 4, Seep 6, and Seep 7 (see Map 3.17). Of these eight springs and seeps, all but Seep 4 discharge from the no-coal zone (see Map 3.17). Seep 4 discharges as shallow, diffuse seepage from weathered Tropic Shale and/or Tropic Shale–derived clayey soils.

The presence of saturated near-surface sediments and soils in the spring and seep areas and also in regions topographically below irrigated fields suggests high water table conditions in these areas. Water levels in monitoring well Y-56, which is screened in alluvial sediments in Block NW, are within approximately 5 feet of the land surface.

Spring 1, which discharges from the southwest portion of Block NW, has the highest discharge rate of any spring in the tract, ranging from 12.3 to 17.5 gpm. The discharge from this spring flows into the reservoir below the spring area. Stock watering also occurs directly from the spring area at Spring 1, although the TDS concentrations of water from this spring are consistently above 2,190 mg/L, which exceeds the 1,200-mg/L stock watering standard. Measurable discharge from Spring 2 has also always been present during monitoring events at the spring. Discharge rates measured at Spring 2 have ranged from 1.15 to 2.34 gpm, averaging 1.68 gpm. Discharge from Spring 2 flows to small stock watering ponds immediately below the spring area. The TDS concentrations measured in water from Spring 2 have always exceeded the 1,200-mg/L irrigation standard, ranging from 3,020 to 3,250 mg/L. Measurable discharges are rarely present at any of the other six springs monitored in Block NW, and the water quality characteristics at these springs are highly variable. Seep 4 discharges at low rates from the northeast portion of Block NW in the Smirl Coal Zone (see Map 3.17). The seepage area is situated topographically below a large irrigated hay field. During the four monitoring events at Seep 4, the discharge did not exceed 0.25 gpm. Discharge from Seep 2 is also meager. During five monitoring events at the seep, measurable discharge was not observed, but rather only wet soil and a few small puddles have occasionally been present there. In most instances, groundwater discharge at the six low-flow springs consists of slow, diffuse seepage that is not measurable. The TDS concentrations of waters sampled at these six seeps has ranged from 1,450 to 14,900 mg/L. The low-flow rates and elevated TDS concentrations of these waters greatly limit the potential for irrigation or stock watering use at these seeps (see Table 3.16.4). Ultimately, these spring waters flow southward to Simpson Hollow Creek and enter Kanab Creek in the northwest quarter of Section 24, Township 39 South, Range 6 West. In this area, Kanab Creek is diverted into transmission ditches that store the water in earthen ponds for irrigation.

3.16.2.2.2 Groundwater Hydrology

Although discharge from Spring 1 averages 14.6 gpm and the discharge from Spring 2 averages 1.7 gpm, measurable discharges from the other springs are rare and usually meager (usually less than 0.1 gpm). Additionally, zones of increased vegetation and saturated ground are present south of the irrigated fields within Block NW (Frontier Corporation USA 2012).

The precise mechanisms controlling groundwater recharge and groundwater discharge characteristics in Block NW are not known. The potential for the vertical or lateral migration of appreciable quantities of water through unweathered shale or clay deposits in the Tropic Shale or Dakota Formation is low. However, it is possible that groundwater flows to some of the spring areas through fractured sandstone channel deposits (which are visible at the surface near several of the seepage locations). Although groundwater flow through sandstone channels in the Dakota Formation occurs, because of the lenticular, discontinuous nature of permeable and impermeable strata in the Dakota Formation, the potential for the Dakota to transmit appreciable quantities of groundwater over considerable distances is limited. It is likely for this reason that groundwater discharge from the Dakota Formation is very limited over the tract. The potential for groundwater recharge and groundwater flow in Block NW may also be enhanced locally as a result of increased bedrock hydraulic conductivity associated with coal burn in areas where the coal seam is burned. Such burned zones are common in the Alton Coal Field near coal seam outcrop areas or in locations where the coal seam is present in the shallow subsurface.

The precise recharge and discharge mechanisms for the two springs with the most substantial discharge in Block NW (Springs 1 and 2) have not been determined. However, the discharge hydrographs for both springs show similar and rapid responses to seasonal recharge events (Figure 3.16.10). Although the magnitude of the flow rates at the two springs are dissimilar, and solute compositions of the water discharged at these two springs are somewhat variable, the notable similarity of the discharge hydrographs suggests similar mechanisms. The recharge location(s) for the groundwater systems that support Pond Spring are not known. However, possible recharge mechanisms include 1) the infiltration of irrigation waters in nearby upgradient agricultural fields, and/or 2) the infiltration of the sometimes copious amounts of late-winter and early-spring snowmelt that occurs in the area.

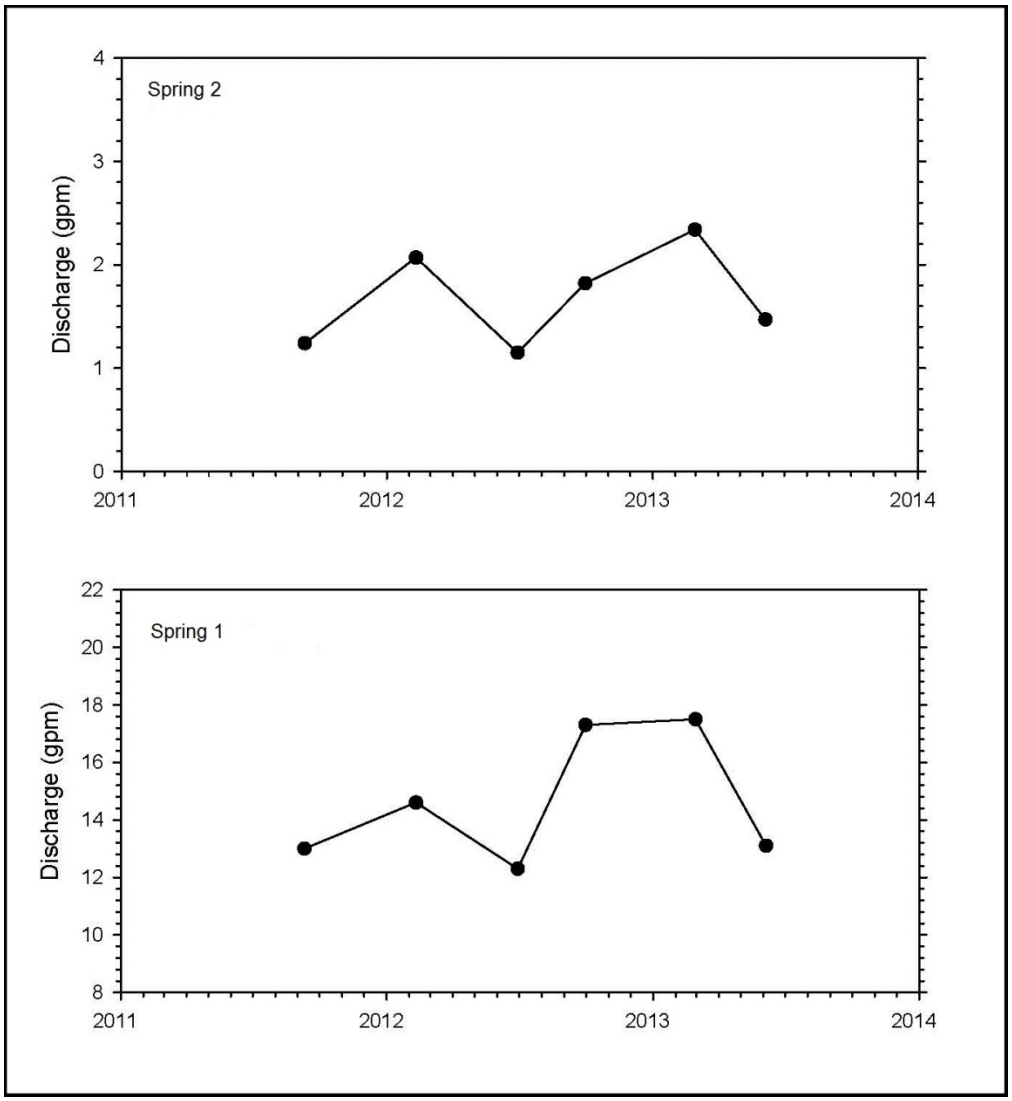

Figure 3.16.10. Discharge hydrographs for Springs 2 and 1.

3.16.2.2.3 Groundwater Quality

The water quality characteristics of the eight springs and seeps monitored in the Block NW area are variable. Generally, the TDS concentrations of springs and seeps are elevated, and the spring water does not meet state standards for irrigation (1,200 mg/L) or stock watering (1,200 mg/L) (Petersen Hydrologic 2013). Spring water sampled from Spring 1, which discharges from the southwest portion of Block NW

and has the highest discharge rate of any in the tract (average 14.6 gpm), has TDS concentrations ranging from 2,190 to 2,420 mg/L, averaging 2,190 mg/L. The water at Spring 1 is of the magnesium-sulfate geochemical type. Spring 2, which discharges at approximately 1.7 gpm on average, has measured TDS concentrations ranging from 3,020 to 3,250 mg/L, averaging 3,133 mg/L. The water at Spring 2 is of the mixed-cation-sulfate geochemical type. TDS concentrations measured at the other six seeps are variable, ranging from 1,450 mg/L at Seep 3 to 12,600 mg/L at Seep 4. As indicated in Table 3.16.5, the Utah TDS standard for irrigation water (1,200 mg/L) and the standard for stock watering (1,200 mg/L) are usually not met in groundwaters in Block NW. Most groundwaters sampled in Block NW are of the magnesium-sulfate geochemical type. The geochemical evolution resulting in the magnesium-sulfate geochemical type in groundwater at Block NW is not known. However, the dissolution of epsomite ($MgSO_4 \cdot 7H_2O$) is a possible source for the magnesium and sulfate in the water.

3.16.2.3 BLOCKS CWN AND CWS

3.16.2.3.1 Groundwater Occurrence and Use

No appreciable groundwater discharge has been observed in Block CWS (Petersen Hydrologic 2007). A single seep area (SP-41) has been identified near Block CWS in Dakota Formation sediments outside the coal zone. Measurable discharge has never been observed at this seep. Rather, only damp soil has occasionally been present. A high water table condition and associated vegetation were noted in a small (0.20 acre) portion of an ephemeral wash along the west boundary of Block CWS (Frontier Corporation USA 2012). However, no water at the surface was present in this location. Historically, when mining occurred at the Alton Mine in the Smirl Coal Zone in Block CWS, the mine was noted as being dry (Doelling and Graham 1972). There are no known uses of groundwater resources in Block CWN.

Similarly, no appreciable groundwater discharge has been observed in Block CWN (Petersen Hydrologic 2013). A single groundwater seep (Seep 1) has been identified near Block CWN in Dakota Formation sediments outside the coal zone. Measurable discharge has not been observed at this seep, although small stagnant pools of water are usually present at the seep area. The TDS concentrations of water monitored at Seep 1 have ranged from 2,790 to 3,250 mg/L (Petersen Hydrologic 2013), which exceeds both the 1,200-mg/L irrigation standard as well as the 1,200-mg/L stock watering standard. The meager quantities of water present at the seep and the poor water quality characteristics greatly limit the potential for use of this water.

3.16.2.3.2 Groundwater Hydrology

Blocks CWN and CWS are isolated bedrock hills that rise above the surrounding lowland regions (see Map 1.2). The Smirl Coal Zone outcrops along the perimeters of the hills, isolating the coal zone from surrounding strata. The isolated hills are capped by low-permeability Tropic Shale bedrock, which greatly limits the potential for vertical recharge to the coal zone or underlying strata. Because of the lack of vertical recharge potential, and because the rock strata are truncated by erosional escarpments along the margins of the hills, there are likely no appreciable groundwater systems present at or above the level of the coal seam in Blocks CWN and CWS. The Alton Mine, which operated within Block CWS in the 1960s, was noted as being a dry mine (Doelling and Graham 1972), further supporting this conclusion.

Minor diffuse groundwater seepage does occur from the Dakota Formation in the no-coal zone surrounding both Block CWN and CWS. Very small amounts of groundwater seep from the lower northeast hillside at SP-41. No measurable flow has been observed at SP-41, rather only wet soil. A single seep (Seep 1) has also been identified adjacent to Block CWN in the no-coal zone. Seep 1 discharges at very low rates from the lower eastern hillside in the no-coal zone. Measurable discharge at Seep 1 has not been observed, although stagnant puddles are usually present.

3.16.2.3.3 Groundwater Quality

There are no appreciable groundwater systems in the Block CWN and CWS areas. The TDS concentrations measured at Seep 1, which is in the no-coal zone adjacent to Block CWS, range from 2,790 to 3,250 mg/L. These concentrations exceed both the irrigation standard and the stock watering standard for TDS.

3.16.2.4 BLOCKS S AND SA

3.16.2.4.1 Groundwater Occurrence and Use

Two seep areas have been identified in and immediately adjacent to Blocks S and Sa. These include SP-38 and SP-27. SP-38 discharges from clayey sediments near the mouth of an ephemeral drainage in the no-coal zone in the south portion of Blocks S and Sa (see Map 3.17). Flowing water is only rarely present at SP-38. However, small isolated puddles are sometimes present. The water quality measured at SP-38 is poor, with TDS concentrations ranging from 4,400 to 14,900 mg/L at the spring (which greatly exceed both the 1,200-mg/L state irrigation standard and the 1,200-mg/L state stock watering standard). Accordingly, because of the small quantity of water available at the spring and its poor quality, the potential for use of water at SP-38 is low.

SP-27 is on the southeast border of Block S and Sa. The seep discharges at low rates from weathered strata near the outcrop of the Smirl Coal Zone. Discharge has only rarely been observed at SP-27 (Petersen Hydrologic 2013) and, when discharge has occurred, the flow rates have not exceeded 0.5 gpm. The water quality measured at SP-27 has been poor, with TDS concentrations ranging from 3,780 to 6,550 mg/L (which greatly exceed both the 1,200-mg/L state irrigation standard and the 1,200-mg/L state stock watering standard). It was noted that the water sampled at SP-27 in June 2005 was black in color. Because of the low flow rates and poor water quality characteristics of water at SP-27, there is little potential for use of this water.

3.16.2.4.2 Groundwater Hydrology

Blocks S and Sa are in the upland region between Sink Valley on the east and the Kanab Creek valley on the west. Because these upland areas are topographically higher than are the surrounding lowlands, recharge to shallow groundwater systems likely occurs through direct infiltration of precipitation and snowmelt waters in the area. Because the low-permeability Tropic Shale and Dakota Formation are present at the surface over almost the entire land surface in Blocks S and Sa (see Map 3.10), groundwater recharge rates are likely low.

SP-38 discharges from clayey sediments near the mouth of an ephemeral wash in the no-coal zone in the south portion of Blocks S and Sa (see Map 3.17). Discharge from the spring is present only intermittently, and the spring is commonly dry or nearly dry (with damp clayey soils usually being present). When present, discharge is typically less than approximately 0.5 gpm. SP-38 discharges from shallow, near-surface sediments at the mouth of the narrow wash. The intermittent nature of the flow at SP-38 and the fact that the spring emanates from the shallow near-surface sediments suggest a shallow, seasonal recharge source for the groundwater at the spring. These factors indicate that the spring recharges in areas to the north, where precipitation runoff and snowmelt waters are concentrated in the wash.

SP-27 discharges from the hillside on the east boundary of Blocks S and Sa (see Map 3.17). The discharge location for the seep is near the outcrop of the Smirl Coal Zone. Discharge is only rarely present, and the hillside is usually completely dry during drought years. Measured seep flows have not exceeded 0.5 gpm. These factors suggest a shallow, climate-dependent recharge source.

There is an isolated hill in the west portion of Blocks S and Sa that is similar to the two hills in the CWS and CWN blocks described previously (see Map 1.2). Because the coal seam is truncated by erosional escarpments around the hill and is capped with low-permeability Tropic Shale bedrock, which minimizes the potential for vertical recharge, it is likely that there is no appreciable groundwater system near this isolated hill.

Information from water monitoring wells in Blocks S and Sa indicates depths to water of several tens of feet in this area. Several wells screened in the Smirl Coal Zone indicate the presence of water at approximately 50 feet below the ground surface (there is little or no alluvium at most drill hole locations and drilling logs indicate that appreciable water was not encountered in the bedrock overburden strata above the Smirl Coal Zone) (UII 1987a). Some monitoring wells completed in the Smirl Coal Zone in Block S and Sa have historically been dry (Petersen Hydrologic 2013; UII 1987a). Several water-monitoring wells completed in alluvial sediments along the western margins of Sink Valley adjacent to the southeaster border of Block S and Sa indicate depths to water ranging from approximately 0 to 10 feet (DOGM 2013b).

3.16.2.4.3 Groundwater Quality

The groundwater resources in the Block S and Sa area are meager. Measurable discharge from the two seeps identified in and immediately adjacent to the blocks is only rarely present. No alluvial groundwater systems have been identified in Block S and Sa. TDS concentrations range from 4,400 to 14,900 mg/L at SP-38 (which greatly exceed both the 1,200-mg/L state irrigation standard and the 1,200-mg/L state stock watering standard). The water at SP-38 is of the sodium-sulfate geochemical type. TDS concentrations measured at SP-27 have ranged from 3,780 to 6,550 mg/L (which greatly exceed both the 1,200-mg/L state irrigation standard and the 1,200-mg/L state stock watering standard). It was noted that the water sampled at SP-27 in June 2005 was black in color. The water at SP-27 is of the sodium-bicarbonate geochemical type, with substantial sulfate concentrations.

3.16.2.5 SINK VALLEY

3.16.2.5.1 Groundwater Occurrence and Use

Based on estimates provided by Petersen Hydrologic (2010), approximately 10,000 acre-feet of groundwater are available in the zone (generally alluvial sediments) from which groundwater resources could be extracted from Sink Valley Wash alluvial groundwater systems. This is a first-order approximation of the available alluvial groundwater resource in Sink Valley that is based on conservative assumptions, including 1) an aerial extent of approximately 1.5 square miles, 2) an average saturated thickness of approximately 45 feet, and 3) an average effective porosity value of approximately 0.25 (porosity values are unitless and are the ratio of interconnected pore spaces to the volume of the rock or sediment). Although tritium and radiocarbon dating of the alluvial groundwaters in Sink Valley indicate modern (post-1951) recharge (Petersen Hydrologic 2007), the rate at which recharge to the alluvial groundwater system occurs has not been determined.

3.16.2.5.2 Groundwater Hydrology

The alluvial deposits in Sink Valley approach a thickness of 50 feet, and are reported to be 120–140 feet thick along the east edge of the valley (Petersen Hydrologic 2007). The alluvial deposits in Sink Valley are also capped by a thick sequence (up to 60 feet) of clayey material. Also unique to Sink Valley is the presence of the Tropic Shale along its margins that creates a hydrogeologic boundary that, in essence, creates a “bathtub” in the valley (UII 1987b). Furthermore, Sink Valley is at the base of numerous drainages (Petersen Hydrologic 2007) that are recharged from the Paunsaugunt Plateau. Therefore, numerous springs and wells are in Sink Valley, a groundwater discharge area. See Section 3.16.3.4 for discussion of AVFs.

Because groundwater discharge from Sink Valley does not support measurable baseflow in the ephemeral Sink Valley Wash south of the tract (Petersen Hydrologic 2007), it follows that baseflow discharge from Sink Valley does not contribute to surface-water flows in Kanab Creek. (Sink Valley Wash flows into Kanab Creek approximately 5.5 miles south of the tract [see Map 3.17]).

3.16.2.5.3 Groundwater Quality

Groundwater quality data are available for 11 wells and 26 springs near the southeast border of the tract. All these sampling sites are in or near Sink Valley (see Map 3.17), and are not representative of groundwater conditions in the entire tract. Groundwater quality data for the 11 wells and 26 springs are listed in Table 3.16.6 for select parameters. These data are summarized from data obtained from the DOGM water quality database. Groundwater quality data for TDS are available for six wells and 10 spring monitoring sites near the southeast border of the tract. All of these sampling sites are in or near Sink Valley Wash. The average TDS concentrations measured in groundwater from wells and springs in Sink Valley Wash are 623 and 394 mg/L, respectively. These concentrations are well below the state standard for irrigation and stock watering. Groundwater collected from a well (Y-36) completed in the Smirl Coal Zone had a TDS concentration of 1,320 mg/L. This TDS result slightly exceeds the state standard for irrigation; however, only one sample result was available. The average selenium concentration measured in groundwater from all wells and springs was less than laboratory detection limits (typically 0.001–0.02 mg/L). The average boron concentration measured in groundwater from all wells and springs was 0.2 mg/L.

Table 3.16.6. Summary of Selected Groundwater Quality Data Adjacent to the Alton Coal Tract

Groundwater Source	Parameter	Minimum	Maximum	Average
Wells in Sink Valley Wash alluvium	pH	7.0	8.0	7.4
	Conductivity (µS/cm)	602	2,680	910
	TDS (mg/L)	378	2,060	623
Wells in Lower Robinson Creek	pH	6.6	7.9	7.2
	Conductivity (µS/cm)	1,622	5,490	3,365
	TDS (mg/L)	1,172	5,208	3,197
Well in the Smirl Coal Zone of Sink Valley Wash	pH	7.2	7.9	7.6
	Conductivity(µS/cm)	1,320	1,320	1,320
	TDS (mg/L)	784	815	800
Springs in Sink Valley Wash alluvium	pH	7.0	9.1	7.6
	Conductivity (µS/cm)	482	4,150	1,045
	TDS (mg/L)	381	1,182	662
Springs in Lower Sink Valley Wash	pH	7.0	7.8	7.5
	Conductivity(µS/cm)	686	2,470	1,662
	TDS (mg/L)	394	594	518

Notes: Wells in Sink Valley Wash alluvium include the following sites: C5-130, LS-15, LS-60, LS-85, SS-15, SS-30, Y-102, and Y-61.
Wells in Lower Robinson Creek include the following sites: LR-45 and UR-70.
Alluvium Sink Valley Wash Springs include the following sites: Sorenson Spring, SP-14, SP-15, SP-16, SP-17, SP-18, SP-19, SP-20, SP-21, SP-22, SP-23, SP-24, SP-25, SP-26, SP-28, SP-29, SP-30, SP-31, SP-32, SP-33, SP-35, SP-6, and SP-8.
Lower Sink Valley Wash Springs include the following sites: SP-3, SP-34, and SP-4.

3.16.3 Wetlands, Riparian Areas, Floodplains, and Alluvial Valley Floors

3.16.3.1 WETLANDS

A preliminary JD was completed in November 2012 (USACE 2012b). It concludes that approximately 54.0 acres of wetlands present in the tract are potential waters of the U.S. regulated under Section 404 of the CWA. The BLM must also comply with EO 11990 (Protection of Wetlands [May 24, 1977]), which directs federal agencies to provide leadership and take action to minimize the destruction, loss, or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands. In all, 24 individual wetlands areas were identified during the delineation. These wetland areas were classified into three habitat types: approximately 18.5 acres were classified as riparian wet meadow wetlands; 31.6 acres were classified as irrigated wet meadow wetlands; and 3.8 acres were classified as mixed riparian scrub-shrub/wet meadow wetlands (see Map 2.4).

Riparian wet meadows are typically found throughout the tract in topographically distinct drainage bottoms. The drainages may or may not have stream channels present. These are herbaceous vegetation communities lacking tree and shrub layers and tend to be heavily grazed. Spring runoff, surface drainage, and a seasonally high water table appear to be the main sources of hydrology for these wetlands (Frontier Corporation USA 2012).

Irrigated wet meadow wetlands basically have the same vegetation community composition as riparian wet meadow wetlands, but they do not occur in distinct drainages. Rather, these are slope wetlands found in association with drainage coming off irrigated alfalfa fields in the northwest portion of the tract. The portions of these wet meadows that are situated inside livestock exclosure fences for the alfalfa fields are not heavily grazed. Irrigation return flows, natural surface drainage, and a seasonally high water table appear to be the main sources of hydrology for these wetlands (Frontier Corporation USA 2012).

The mixed riparian scrub-shrub/wet meadow wetland type was only identified along the south reach of Kanab Creek. The creek's active floodplain in this reach is composed chiefly of cobble, gravel, and sand. These alluvial substrates have sparse amounts of soil present in scattered small depositional pockets and abandoned channel meanders. The cobble/gravel/sand areas are dominated by a scrub-shrub layer of narrow-leaf willow (*Salix exigua*), and the smaller depositional pockets and abandoned channel meanders are typically vegetated with herbaceous wet meadow species. Seasonal flooding and near-surface groundwater associated with the alluvial aquifer appear to be the main sources of hydrology for these wetlands (Frontier Corporation USA 2012).

3.16.3.2 RIPARIAN AREAS

There are approximately 55.3 acres of riparian area on the tract (approximately 1.5% of the total tract) largely along Kanab Creek and Lower Robinson Creek (see Map 3.18). Species such as willow, cottonwood, Russian olive, and tamarisk occur in the overstory of the tract's riparian communities. Understory species include wiregrass and saltgrass as well as disturbed-area weedy species such as curlycup gumweed and broom snakeweed (SWCA 2007b).

3.16.3.3 FLOODPLAINS

Approximate floodplain locations and extents in and adjacent to the tract were assessed as part of the reconnaissance-level AVF investigation conducted by Petersen (see Appendix F) described in Section 3.16.3.4 below. Petersen's investigation indicates that map-able floodplains (and associated terraces) in the tract are adjacent to Kanab Creek in the no-coal zone (see Map 3.18). The total acreage of this floodplain/terrace area in the tract is approximately 57 acres. Petersen's study area for the AVF investigation also includes areas adjacent to the tract. Kanab Creek north and south of the tract boundary also has an associated map-able floodplain/terrace complex, in addition to lower Sink Valley Wash southeast of the tract. The total approximate acreage of floodplains/terraces outside of the tract defined in the AVF investigation is approximately 476 acres. Areas mapped as floodplains and terraces include terrace areas that are outside the active floodplain areas and are generally not prone to flooding. This is likely because in most locations in the tract, Kanab Creek is deeply incised into its associated alluvial deposits. This condition has left the old, pre-incision floodplains isolated by up to several tens of feet above the current, active floodplains adjacent to the creek (i.e., the old floodplains are now considered as terrace features). In addition to the floodplains and associated terraces assessed here, approximately 57 acres of floodplains associated with essentially all of the numerous small, narrow washes distributed over the tract are also present. Floodplains are protected by EO 11988 (Floodplain Management). This EO requires federal agencies to take action to reduce the risk of flood loss; minimize the impact of floods on human safety, health, and welfare; and restore and preserve the natural and beneficial values served by floodplains.

3.16.3.4 POTENTIAL OCCURRENCE OF ALLUVIAL VALLEY FLOORS

Areas identified as AVFs are subject to special mining considerations and protections under SMCRA. The intent of these special considerations is to protect certain alluvial valleys that are of special importance to farming in the arid and semiarid western United States (west of the 100th meridian). Accordingly, it is useful to delineate areas that may be determined to be AVFs in future mine permitting activities. Under the governing State of Utah coal mining rules (R645-302: Special Categories and Areas of Mining), if AVFs are present in or adjacent to a proposed mining area, special rules apply to coal mining there. The special rules are generally more restrictive, and reclamation requirements are more stringent for AVF areas than for other areas. Specifically, mining in or adjacent to an AVF is prohibited except where it can be shown that mine-related activities will not 1) interrupt, discontinue, or preclude farming on AVFs; or 2) cause material damage to the quantity of water in surface or underground water systems that supply AVFs. Statutory exclusions from these considerations are granted where the pre-mining land use of an AVF is undeveloped rangeland that is not significant to farming, or where farming on the AVF that would be affected is of such small acreage as to be of negligible impact on a farm's production. Exclusion is also granted where significant mining at an operation occurred in or adjacent to an AVF prior to August 3, 1977.

A reconnaissance-level AVF investigation was conducted on the tract in spring 2008 (see Appendix F for the complete report). This study was intended to provide baseline information concerning potential AVFs occurring on and adjacent to the tract. The performance of detailed, site-specific AVF studies typically involves the collection and analysis of large amounts of data, and requires considerable effort and expense. Consequently, where necessary, detailed, site-specific AVF studies are typically performed during the permitting stage of mine development rather than at the leasing stage, when the successful bidder and detailed mine plans are unknown.

The identification criteria used to delineate probable AVFs in the reconnaissance study were based on the information provided in *Alluvial Valley Floor Identification and Study Guidelines* published by the OSM (1983). Although the concept of an AVF may have a technical meaning to a geologist, in the context of

SMCRA, an AVF is a regulatory term that has been defined in statute and clarified in legislative history, court decisions, regulations, and ongoing administrative decisions (1983). The AVF identification criteria established by SMCRA and outlined by OSM were strictly adhered to in the reconnaissance investigation. These delineation criteria are summarized below.

The SMCRA definition of an AVF is based on agricultural water use and the surficial geologic characteristics of a stream valley. An AVF is defined by SMCRA as follows:

> The unconsolidated stream-laid deposits holding streams with water availability sufficient for subirrigation or flood irrigation agricultural activities but does not include upland areas which are generally overlain by a thin veneer of colluvial deposits composed chiefly of debris from sheet erosion, deposits formed by unconcentrated runoff or slope wash, together with talus, or other mass-movement accumulations and windblown deposits. (30 USC 1234–1328)

Regulations, judicial review, and administrative decisions have expanded and clarified the statutory definition as follows (1983):

- The geologic criteria of an AVF are understood to be
  - a topographic valley with a continuous perennial, intermittent, or ephemeral stream channel running through it; and
  - those surface landforms that are either floodplains or terraces if these landforms are underlain by unconsolidated deposits; and
  - within that valley, those side-slope areas that can reasonably be shown to be underlain by alluvium, and which are adjacent to floodplain or terrace landform areas.
- The water availability criteria are met if
  - water is available by surface-water irrigation or subirrigation and is being or has successfully been used to enhance production of agriculturally useful vegetation; or
  - surface water is available in sufficient quantities to support agricultural activities.

Additionally, stream valleys that do not have any agricultural importance or whose importance is not related to the greater water availability of the valleys are not AVFs (1983). Any areas meeting all the geologic criteria and one of the water availability criteria are considered probable AVFs for the purposes of initial, reconnaissance-level identification (1983).

Based on the reconnaissance-level identification study criteria outlined above, six probable AVF areas were identified (see Map 3.18). The delineations of these six probable AVF areas were determined based on 1) specific water availability criteria for each area, 2) the physical capability and historical extent of flood irrigation of the land in each area, and 3) the presence or absence of floodplain and terrace geomorphic features in each area. Those areas that satisfied the geologic and water availability criteria were delineated as probable AVF areas in the reconnaissance investigation. Areas not meeting both criteria were excluded as probable AVFs. The six areas identified as probable AVFs in the tract are along the Kanab Creek and Sink Valley Wash drainages (see Map 3.18). These areas encompass those lands in Petersen's study area that appear to have the greatest likelihood for being potential AVFs (probable AVFs in OSM parlance). The total acreage of probable AVFs in the study area is approximately 533 acres. Of this, approximately 57 acres of probable AVFs occur in the tract. Approximate floodplain acreages and locations described above are the same as approximate acreages and locations of probable

AVFs described here. See Appendix F for a more detailed description of the investigation conducted and the study results.

3.17 Wildlife: General

The wildlife species addressed in this section consist of animal species that are 1) wildlife species managed by the UDWR; 2) avian species protected under federal acts such as the MBTA, and conservation plans such as Birds of Conservation Concern (BCC) (USFWS 2002) and Partners in Flight (PIF) (Parrish et al. 2002); or 3) common wildlife. Fish and wildlife habitats are generally managed according to the guiding principles outlined in the BLM's *Utah Riparian Management Policy* (IM UT-2005-091 (BLM 2005a), *A Strategy for Future Waterfowl Habitat Management on Public Lands* (BLM 1991), and other species- and species-specific direction, such as the KFO RMP (BLM 2008b). The wildlife analysis area comprises the Alton Coal Tract as defined under each action alternative, and the reasonably foreseeable coal haul transportation route.

Under the *Utah Comprehensive Wildlife Conservation Strategy*, mule deer is a species of particular concern (Tier III) with potential to occur in the wildlife analysis area. According to the strategy, "Tier III includes species that are of conservation concern because they are linked to an at-risk habitat, have suffered marked population declines, or there is little information available regarding the ecology or status of the species" (UDWR 2005).

3.17.1 Regional Overview

Wildlife species with potential to occur on or adjacent to the tract or reasonably foreseeable coal haul transportation route are listed in Table 3.17.1. Common wildlife species with potential to occur on the tract are listed in Tables 3.17.2 and 3.17.3. The tract and reasonably foreseeable coal haul transportation route are in the northwest corner of Kane County, the west edge of Garfield County, and the east half of Iron County. The status and habitats of species were obtained from the BLM, Utah Conservation Data Center (2008), and wildlife surveys conducted by SWCA in 2007 and 2008. Appendix I's reconnaissance survey report lists the wildlife species eliminated from detailed analysis and any reasons the species were not analyzed.

Table 3.17.1. Big Game and Migratory Bird Species with Potential to Occur on the Tract and/or Reasonably Foreseeable Coal Haul Transportation Route

Common Name (*scientific name*)	Status
Big Game Species	
Mule deer (*Odocoileus hemionus*)	UDWR-managed
Pronghorn antelope (*Antilocapra americana*)	UDWR-managed
Rocky Mountain elk (*Cervus canadensis*)	UDWR-managed
Migratory Bird Species	
Bendire's Thrasher (*Toxostoma bendirei*)	BCC, PIF
Black-chinned Sparrow (*Spizella atrogularis*)	BCC
Black-throated Gray Warbler (*Setophaga nigrescens*)	BCC, PIF
Brewer's Sparrow (*Spizella breweri*)	BCC, PIF
Broad-tailed Hummingbird (*Selasphorus platycercus*)	PIF
Gambel's Quail (*Callipepla gambelii*)	PIF
Gray Vireo (*Vireo vicinior*)	BCC, PIF
Loggerhead Shrike (*Lanius ludovicianus*)	BCC

Table 3.17.1. Big Game and Migratory Bird Species with Potential to Occur on the Tract and/or Reasonably Foreseeable Coal Haul Transportation Route

Common Name (*scientific name*)	Status
Lucy's Warbler (*Oreothlypis luciae*)	PIF
Mountain Plover (*Charadrius montanus*)	BCC, PIF
Northern Harrier (*Circus cyaneus*)	BCC
Peregrine Falcon (*Falco peregrinus*)	BCC
Pinyon Jay (*Gymnorhinus cyanocephalus*)	BCC
Prairie Falcon (*Falco mexicanus*)	BCC
Red-naped Sapsucker (*Sphyrapicus nuchalis*)	BCC
Sage Sparrow (*Amphispiza belli*)	BCC, PIF
Swainson's Hawk (*Buteo swainsoni*)	BCC
Virginia's Warbler (*Oreothlypis virginiae*)	BCC, PIF

BCC = birds of conservation concern (2002).

PIF = Utah Partners in Flight priority species (Parrish et al. 2002).

Vegetation on the tract is primarily pinyon-juniper woodland, sagebrush/grassland, and sagebrush/grassland (treated; where pinyon pine and Utah juniper cover has been mostly removed by vegetation treatments in response to juniper encroachment) (see Map 3.15). Table 3.17.2 shows land cover acreages and associated wildlife species for the tract. These vegetation communities are based on a survey of the tract conducted in fall 2007 (SWCA 2007b). As indicated in Table 3.17.2, there is considerable overlap in the habitat associations of the species addressed in this section. See the Vegetation section of Chapter 3 for a detailed description of the vegetation communities presented in Table 3.17.2.

The sagebrush/grassland (treated) cover type and the sagebrush/grassland cover type differ in that 1) sagebrush/grassland contains an occasional Utah juniper or pinyon pine, and 2) understory species composition and grass/forb cover may be reduced in sagebrush/grassland (treated) due to the presence of chipped tree remnants. However, any reduction in value for wildlife species following treatment would be temporary, and some wildlife species would use these disturbed areas in the interim due to the more open landscape and production of understory species. The vegetation treatment projects that created the sagebrush/grassland (treated) vegetation community are discussed in more detail in Section 3.18.3.4.2.

Table 3.17.2. Vegetation Community Acreages in the Alton Coal Tract and Associated Wildlife Species

Vegetation Community	Associated Wildlife Species	Acres	Percentage of Tract
Pinyon-juniper woodland	Elk, Sharp-shinned Hawk (*Accipiter striatus*), Cooper's Hawk (*Accipiter cooperii*), Black-throated Gray Warbler, Gray Vireo, Loggerhead Shrike, Virginia's Warbler, Black-capped Chickadee (*Poecile atricapillus*), Townsend's Solitaire (*Myadestes townsendii*), Pinyon Jay, Red-naped Sapsucker	1,430.0	40.0%
Sagebrush/grassland	Elk, mule deer, Brewer's Sparrow, Sage Sparrow, Mountain Bluebird (*Sialia currucoides*), Green-tailed Towhee (*Pipilo chlorurus*), Sage Thrasher (*Oreoscoptes montanus*)	860.2	24.1%
Sagebrush/grassland (treated)	Elk, mule deer, Brewer's Sparrow, Sage Sparrow, Mountain Bluebird, Green-tailed Towhee, Sage Thrasher	749.1	20.9%

Table 3.17.2. Vegetation Community Acreages in the Alton Coal Tract and Associated Wildlife Species

Vegetation Community	Associated Wildlife Species	Acres	Percentage of Tract
Annual and perennial grasses	Elk, mule deer, Peregrine Falcon, Prairie Falcon, Swainson's Hawk, Rough-legged Hawk (*Buteo lagopus*) (winter), Mountain Bluebird, Bendire's Thrasher	324.1	9.1%
Mountain brush	Elk, Black-throated Gray Warbler, Gray Vireo, Virginia's Warbler, Spotted Towhee (*Pipilo maculatus*), Gambel's Quail, Black-chinned Sparrow	62.8	1.8%
Meadow (wetland)	Elk, mule deer, Lesser Goldfinch (*Spinus psaltria*), Red-winged Blackbird (*Agelaius phoeniceus*)	62.8	1.8%
Riparian	Elk, Northern Harrier, Red-tailed Hawk (*Buteo jamaicensis*), Great-horned Owl (*Bubo virginianus*), Western Screech-Owl (*Megascops kennicottii*), Downy Woodpecker (*Picoides pubescens*), American Dipper (*Cinclus mexicanus*), Yellow-breasted Chat (*Icteria virens*), Yellow Warbler (*Setophaga petechial*)	55.3	1.5%
Rabbitbrush	Elk, Gambel's Quail, Brewer's Sparrow, Sage Sparrow, Mountain Bluebird, Green-tailed Towhee, Sage Thrasher	10.7	0.3%
Bedrock, cliff, and canyon	Peregrine Falcon, Prairie Falcon, Rock Wren (*Salpinctes obsoletus*)	0.0	0.0%
Open water	Mallard (*Anas platyrhynchos*), shorebirds, fish, amphibians	4.1	< 0.1%
Roads	None	17.4	0.5%
Total		**3,576.5**	**100.0%**

Land cover types described for the tract and reasonably foreseeable coal haul transportation route differ for several reasons: 1) land cover classification was based on detailed vegetation community surveys for the tract, 2) land cover classification was based on SWReGAP coverage for the coal haul transportation route, and 3) land cover types are not identical between the tract and coal haul transportation route. Vegetation community surveys were not conducted along the coal haul transportation route because SWReGAP analysis was deemed to be sufficient for assessment and quantification of habitat areas. Land cover adjacent to the 115-mile reasonably foreseeable coal haul transportation route is primarily sagebrush habitats (39.0%) and developed areas (38.7%). Table 3.17.3 shows land cover miles and associated wildlife species for the coal haul transportation route.

Table 3.17.3. Land Cover Miles Adjacent to the Reasonably Foreseeable Coal Haul Transportation Route and Associated Wildlife Species

Cover Type	Associated Wildlife Species	Miles	Percentage of Route
Agriculture	Elk, mule deer, pronghorn antelope, Peregrine Falcon, Prairie Falcon, Swainson's Hawk, Say's Phoebe (*Sayornis saya*), Western Kingbird (*Tyrannus verticalis*)	7.3	6.4%
Bedrock, cliff, and canyon	Peregrine Falcon, Prairie Falcon, Rock Wren	1.1	1.0%
Developed*	American Kestrel (*Falco sparverius*), Western Kingbird, American Robin (*Turdus migratorius*), Brown-headed Cowbird (*Molothrus ater*), Brewer's Blackbird	41.6	36.3%
Grassland (native and invasive grasses/forbs)	Elk, mule deer, pronghorn antelope, Rough-legged Hawk (Winter), Mountain Bluebird, Bendire's Thrasher	0.2	0.2%
Open water	Mallard, shorebirds, fish, amphibians	< 0.1	< 0.1%

Table 3.17.3. Land Cover Miles Adjacent to the Reasonably Foreseeable Coal Haul Transportation Route and Associated Wildlife Species

Cover Type	Associated Wildlife Species	Miles	Percentage of Route
Pinyon-juniper woodland	Elk, Sharp-shinned Hawk, Cooper's Hawk, Black-throated Gray Warbler, Gray Vireo, Loggerhead Shrike, Virginia's Warbler, Townsend's Solitaire, Pinyon Jay, Red-naped Sapsucker	11.7	10.2%
Riparian	Red-tailed Hawk, Great-horned Owl, Western Screech-Owl, Broad-tailed Hummingbird, Gambel's Quail, Lucy's Warbler, Peregrine Falcon, Downy Woodpecker, American Dipper, Yellow-breasted Chat, Yellow Warbler	0.8	0.7%
Sagebrush	Elk, mule deer, pronghorn antelope, Brewer's Sparrow, Sage Sparrow, Green-tailed Towhee, Sage Thrasher	49.4	43.1%
Salt desert scrub	Pronghorn antelope, Bendire's Thrasher, Black-chinned Sparrow, Brewer's Sparrow, Gambel's Quail, Loggerhead Shrike, Lucy's Warbler, Mountain Plover, Northern Harrier, Prairie Falcon, Sage Sparrow, Black-throated Sparrow, Gambel's Quail	< 0.1	< 0.1%
Shrub-steppe	Elk, mule deer, pronghorn antelope, Brewer's Sparrow, Sage Sparrow, Green-tailed Towhee, Sage Thrasher	0.2	0.2%
Woodland-shrubland	Elk, Black-throated Gray Warbler, Gray Vireo, Virginia's Warbler, Ash-throated Flycatcher (*Myiarchus cinerascens*), Black-capped Chickadee, Spotted Towhee, Black-chinned Sparrow	2.2	1.9%
Total		**114.7**	**100.0%**

* Developed land cover is composed of open space and low-intensity development (i.e., human-modified land cover such as lawns and parks), and medium-to-high-intensity development (i.e., roads, other paved surfaces, and structures).

3.17.2 Wildlife Occurring on the Tract and Coal Haul Transportation Route Analysis Areas

Crucial summer and substantial value summer habitats for mule deer, and crucial summer and year-long substantial habitats for Rocky Mountain elk are present on the tract and/or reasonably foreseeable coal haul transportation route. Crucial winter and crucial year-long pronghorn antelope habitats occur along the coal haul transportation route. Suitable habitat for fish, amphibians, raptors, other resident birds, neotropical migratory birds, and insects is also present on or adjacent to the tract and coal haul transportation route. The tract is within UDWR's Paunsaugunt Primary Management Area. The area encompasses approximately 894,000 acres and is managed as a trophy-hunting unit.

3.17.2.1 BIG GAME

UDWR manages big game species and delineates habitat by season and value for each species. BLM has adopted UDWR's designations and manages the habitat accordingly (BLM 2008b). The habitat values are defined as follows:

- Crucial Value: Any particular range or habitat component that directly limits a community, population, or subpopulation to reproduce and maintain itself at a certain level over the long term
- High-Value: Any particular habitat that sustains a community, population, or subpopulation
- Substantial Value: Any particular habitat that is common or of intermediate importance

3.17.2.1.1 Mule Deer

Mule deer are widespread in Utah, but are present in the greatest densities in shrublands on rough, broken terrain with abundant browse and cover. Deer migrate into the same areas every winter, regardless of forage availability or condition. Winter range habitat consists primarily of shrub-covered, south-facing slopes and often coincides with areas of concentrated human use and occupation (BLM 2008b). Sagebrush serves as primary forage for mule deer during the winter season. Mule deer summer range habitat types include spruce/fir, aspen, alpine meadows, and large grassy parks at higher elevations.

Crucial and high-value mule deer habitats exist in the west portions of Kane County and throughout Garfield County (BLM 2008b). UDWR manages mule deer in the Alton area as a part of the Paunsaugunt herd management unit (HMU) (#27). This management unit consists of 312,882 acres of summer habitat, 105,443 acres of crucial summer habitat, and 207,439 acres of substantial value summer habitat. The management unit also contains 608,996 acres of winter habitat, 156,971 acres of crucial winter habitat, and 452,025 acres of substantial value winter habitat (UDWR 2006). There are 108.9 acres of crucial mule deer summer habitat on the tract (0.1% of crucial summer habitat in the HMU) and 2,005 acres of substantial value summer habitat (1.0% of substantial value summer habitat in the HMU) (Map 3.20). The reasonably foreseeable coal haul transportation route crosses 21.2 miles of crucial winter habitat (18.4% of the route), 18.6 miles of crucial summer habitat (16.2% of the route), 11.7 miles of year-long substantial value habitat (10.2% of the route), 8.6 miles of substantial value summer habitat (7.5% of the route), and 10.2 miles of substantial value winter habitat (8.9% of the route).

3.17.2.1.2 Elk

The Rocky Mountain elk is a habitat generalist that inhabits grasslands, woodlands, riparian, shrub, sagebrush, and pinyon-juniper habitats (2008). UDWR manages elk in the Alton area as a part of the Paunsaugunt HMU (#27). This management unit consists of 957,122 acres of habitat, including 83,854 acres of substantial summer, 175,970 acres of year-long substantial, and 17,489 acres of crucial winter habitat (UDWR 2012). There are 3,505.5 acres of substantial summer habitat (4.2% of the habitat in the management unit) (see Map 3.20) and 71.1 acres of year-long substantial value habitat on the tract (less than 0.1% of the habitat on the management unit). The reasonably foreseeable coal haul transportation route crosses 15.8 miles of substantial value winter habitat (13.7% of the route) and 10.4 miles of substantial value summer habitat (9.0% of the route).

3.17.2.1.3 Pronghorn Antelope

In Utah, pronghorn antelope prefer desert, grassland, and sagebrush habitats (2008). Suitable pronghorn habitats exist on the sagebrush/grassland, sagebrush/grassland (treated), and annual and perennial grasses of the tract, which totals 1,933 acres (54.0% of the tract). However, there are no UDWR-designated pronghorn habitat areas on the tract. The reasonably foreseeable coal haul transportation route crosses 54.0 miles of crucial year-long habitat (47.0% of the route) and 5.9 miles of crucial winter habitat (5.1% of the route).

3.17.2.2 RAPTORS

Habitat needs for raptors include nesting sites, foraging areas, and roosting or resting sites. Roosting generally occurs in riparian areas and on cliff faces. Potential nesting and roosting sites occur primarily in riparian habitats on approximately 55 acres (2%) of the tract, and in cliff and canyon habitats along approximately 1 mile (1%) of the reasonably foreseeable coal haul transportation route. Cliff and canyon habitat does not occur on the tract. Stream and riparian habitats occur on approximately 38 acres within

100 feet of the coal haul transportation route (the maximum likely distance that coal could be transported from the route). Habitat loss and disturbance to nest sites, reduction of the prey base, electrocution from power lines, and environmental contaminants are the primary threats to raptor species (Parrish et al. 2002). Common raptor species with potential to occur on the tract include Northern Harrier, Cooper's Hawk, Sharp-shinned Hawk, Red-tailed Hawk, Swainson's Hawk, Rough-legged Hawk (winter only), American Kestrel, Prairie Falcon, Peregrine Falcon, Great-horned Owl, and Western Screech-Owl.

3.17.2.3 MIGRATORY BIRDS

Migratory birds require nesting and brooding habitat, nonbreeding foraging and resting habitat, habitat along migratory routes, and wintering habitat. Neotropical migratory bird populations are in decline due to habitat fragmentation, habitat loss and modification, urban expansion, loss of nonbreeding habitats and habitats along migratory routes, and brood parasitism (Parrish et al. 2002).

In addition to the BCC and PIF species listed in Table 3.17.1, other common migratory bird species have the potential to occur on the tract or reasonably foreseeable coal haul transportation route. These species are listed in Tables 3.17.2 and 3.17.3. As indicated in Parrish et al. (2002), riparian, wetland, agriculture, and desert scrub are particularly important as breeding and wintering migratory bird habitats.

3.17.2.4 AMPHIBIANS

Most amphibian species require water sources or wet soils to complete their life cycles. Common amphibians could occur in the wetland or riparian vegetation communities on the tract. Common amphibians that could occur in the tract include Great Basin spadefoot (*Spea intermontana*), red-spotted toad (*Bufo punctatus*), Woodhouse's toad (*Bufo woodhousii*), Western chorus frog (*Pseudacris triseriata*), and tiger salamander (*Ambystoma tigrinum*).

3.17.2.5 FISH

The flow rates of Kanab Creek and Lower Robinson Creek, which are the two largest streams on the tract, are too variable to support and sustain fish populations. Kanab Creek is categorized in the National Hydrography Dataset as a perennial stream that has flow throughout the year. However, observed flow in Kanab Creek is highly dependent on climate and upstream water use and has been observed to run very low (less than 0.1 cfs) through the tract during the summer (Petersen Hydrologic 2007). Flows in Lower Robinson Creek are usually minimal. In its upper and middle reaches, Robinson Creek is an ephemeral wash with discharge occurring rarely (Petersen Hydrologic 2013).

Perennial rivers and creeks with sustained flows parallel the reasonably foreseeable coal haul transportation route, including the Sevier River, Threemile Creek, and Bear Creek. These water bodies contain fish habitat and populations of trout, including brown (*Salmo trutta*), brook (*Salvelinus fontinalis*), cutthroat (*Oncorhynchus clarkii*), and rainbow (*O. mykiss*). Trout are stocked in the Sevier River.

3.18 Wildlife: Special Status Species

The special status species addressed in this section consist of animal species that are 1) federally listed as threatened, endangered, candidate, proposed, or petitioned; 2) Utah BLM state director's sensitive species; 3) species protected under the Bald and Golden Eagle Protection Act (BGEPA), as amended; or 4) UDWR sensitive species. The federal ESA of 1973 (PL 93-205, as amended) protects federally listed species from actions that may jeopardize their existence. This could occur through direct harm; activities resulting in increased stress during critical life history stages such as nesting, migration, or wintering; loss or degradation of critical habitat; or loss or degradation of occupied or potential habitats. Fish and wildlife habitats are generally managed according to the guiding principles outlined by the BLM's *Utah Riparian Management Policy* (IM UT-2005-091) (BLM 2005a), *A Strategy for Future Waterfowl Habitat Management on Public Lands* (BLM 1991), and other species- and species-specific direction, such as the IM 2012-043 (BLM 2011c) describing Greater Sage-Grouse interim management policies and procedures, and the KFO RMP (BLM 2008b).

The special status species analysis area includes the Alton Coal Tract as defined under each action alternative, and the reasonably foreseeable coal haul transportation route; this analysis area applies to all species except the Greater Sage-Grouse, which is described in detail in Section 3.18.3.4.

The wildlife special status species section is divided into three subsections. The first provides a regional overview of special status animal species with potential to occur on the tract and/or reasonably foreseeable coal haul transportation route (Section 3.18.1). The second describes all special status species with potential to occur on the tract except for Greater Sage-Grouse (Section 3.18.2). The third section (3.18.3) is devoted solely to Greater Sage-Grouse.

3.18.1 Regional Overview

Special status species with potential to occur on or adjacent to the tract or reasonably foreseeable coal haul transportation route are listed in Table 3.18.1. The tract and reasonably foreseeable coal haul transportation route are in the northwest corner of Kane County, the west edge of Garfield County, and the east half of Iron County. The status and habitats of listed species were obtained from the BLM, from the Utah Conservation Data Center (2008), and from wildlife surveys conducted in 2007 and 2008. Appendix I's reconnaissance survey report lists the special status animal species eliminated from detailed analysis and any reasons the species were not analyzed.

Table 3.18.1. Special Status Animal Species with Potential to Occur on the Tract and/or Reasonably Foreseeable Coal Haul Transportation Route

Common Name (*scientific name*)	**Status**
Federally Listed Species	
California condor (*Gymnogyps californianus*)	Federally endangered
Utah prairie dog (*Cynomys parvidens*)	Federally threatened
Greater Sage-Grouse (*Centrocercus urophasianus*)	Federal candidate species under ESA, BLM sensitive, SPC
Sensitive Species	
Allen's big-eared bat (*Idionycteris phyllotis*)	BLM sensitive, SPC
Arizona toad (*Bufo microscaphus*)	BLM sensitive, SPC

Table 3.18.1. Special Status Animal Species with Potential to Occur on the Tract and/or Reasonably Foreseeable Coal Haul Transportation Route

Common Name (*scientific name*)	**Status**
Bald Eagle (*Haliaeetus leucocephalus*)	SPC, BGEPA
Big free-tailed bat (*Nyctinomops macrotis*)	BLM sensitive, SPC
Black Swift (*Cypseloides niger*)	BLM sensitive, SPC, PIF
Bonneville cutthroat trout (*Oncorhynchus clarki utah*)	BLM sensitive, CS
Burrowing Owl (*Athene cunicularia*)	BLM sensitive, SPC
Desert sucker (*Catostomus clarki*)	SPC
Ferruginous Hawk (*Buteo regalis*)	BLM sensitive, SPC
Fringed myotis (*Myotis thysanodes*)	BLM sensitive, SPC
Golden Eagle (*Aquila chrysaetos*)	BGEPA
Kit fox (*Vulpes macrotis*)	SPC
Leatherside chub (*Gila copei*)	BLM sensitive, SPC
Lewis's Woodpecker (*Melanerpes lewis*)	BLM sensitive, SPC
Long-billed Curlew (*Numenius americanus*)	BLM sensitive, SPC
Northern Goshawk (*Accipiter gentilis*)	BLM sensitive, CS
Pygmy rabbit (*Brachylagus idahoensis*)	BLM sensitive, SPC
Short-eared Owl (*Asio flammeus*)	BLM sensitive, SPC
Spotted bat (*Euderma maculatum*)	BLM sensitive, SPC
Three-toed Woodpecker (*Picoides tridactylus*)	BLM sensitive, SPC
Townsend's big-eared bat (*Corynorhinus townsendii*)	BLM sensitive, SPC
Virgin spinedace (*Lepidomeda mollispinis*)	CS
Western toad (*Bufo boreas*)	SPC

SPC = wildlife species of concern (2008).

CS = Species receiving special management under a conservation agreement to preclude the need for federal listing (2008).

BGEPA = species protected under the Bald And Golden Eagle Protection Act.

PIF = Utah Partners in Flight priority species (Parrish et al. 2002).

Vegetation on the tract is primarily pinyon-juniper woodland, sagebrush/grassland, and sagebrush/grassland (treated; where pinyon pine and Utah juniper cover has been mostly removed in response to juniper encroachment) (see Map 3.15). Table 3.18.2 shows land cover acreages and associated special status animal species for the tract. These vegetation communities are based on a survey of the tract conducted in fall 2007 (2007b). The vegetation treatment projects that created the sagebrush/grassland (treated) vegetation community are discussed in more detail in Section 3.18.3.4.2. As indicated in Table 3.18.2, there is considerable overlap in the habitat associations of the species addressed in this section. See the Vegetation section of Chapter 3 for a detailed description of the vegetation communities presented in Table 3.18.2.

Table 3.18.2. Vegetation Community Acreages in the Alton Coal Tract and Associated Special Status Animal Species

Vegetation Community	Associated Wildlife and Special Status Animal Species	Acres	Percentage of Tract
Pinyon-juniper woodland	Allen's big-eared bat, Arizona toad, Ferruginous Hawk, Lewis's Woodpecker, Townsend's big-eared bat	1,430.0	40.0%
Sagebrush/grassland	Burrowing Owl, Ferruginous Hawk, fringed myotis, Golden Eagle, Greater Sage-Grouse, kit fox, Long-billed Curlew, pygmy rabbit, Short-eared Owl, spotted bat, Townsend's big-eared bat	860.2	24.1%
Sagebrush/grassland (treated)	Burrowing Owl, Ferruginous Hawk, fringed myotis, Golden Eagle, Greater Sage-Grouse, kit fox, Long-billed Curlew, pygmy rabbit, Short-eared Owl, spotted bat, Townsend's big-eared bat	749.1	20.9%
Annual and perennial grasses	Ferruginous Hawk, Long-billed Curlew, Short-eared Owl	324.1	9.1%
Mountain brush	Ferruginous Hawk, Lewis's Woodpecker	62.8	1.8%
Meadow (wetland)	Western toad	62.8	1.8%
Riparian	Allen's big-eared bat, Arizona toad, Bald Eagle, big free-tailed bat, Lewis's Woodpecker, Northern Goshawk, western toad	55.3	1.5%
Rabbitbrush	Burrowing Owl, Ferruginous Hawk, Golden Eagle, Greater Sage-Grouse, kit fox, pygmy rabbit, Short-eared Owl, spotted bat	10.7	0.3%
Bedrock, cliff, and canyon	Allen's big-eared bat, Black Swift, big free-tailed bat, Golden Eagle, fringed myotis, spotted bat, Townsend's big-eared bat	0.0	0.0%
Open water	Black Swift	4.1	< 0.1%
Roads	None	17.4	0.5%
Total		**3,576.5**	**100.0%**

The sagebrush/grassland (treated) cover type and the sagebrush/grassland cover type differ in that 1) sagebrush/grassland contains an occasional Utah juniper or pinyon pine, and 2) understory species composition and grass/forb cover may be reduced in sagebrush/grassland (treated) due to the presence of chipped tree remnants. However, any reduction in value for wildlife species following treatment would be temporary, and some wildlife species would use these disturbed areas in the interim due to the more open landscape and production of understory species.

Land cover types described for the tract and reasonably foreseeable coal haul transportation route differ for several reasons: 1) land cover was based on detailed vegetation community surveys for the tract, 2) land cover was based on SWReGAP coverage for the reasonably foreseeable coal haul transportation route, and 3) land cover types are not identical between the tract and reasonably foreseeable coal haul transportation route. Vegetation community surveys were not conducted along the reasonably foreseeable coal haul transportation route because SWReGAP analysis was deemed to be sufficient for assessment and quantification of habitat areas. Land cover adjacent to the 115-mile reasonably foreseeable coal haul transportation route is primarily sagebrush habitats (39.0%) and developed areas (38.7%). Table 3.18.3 shows land cover miles and associated special status animal species for the reasonably foreseeable coal haul transportation route.

Table 3.18.3. Land Cover Miles Adjacent to the Reasonably Foreseeable Coal Haul Transportation Route and Associated Wildlife and Special Status Animal Species

Cover Type	Associated Wildlife and Special Status Animal Species	Miles	Percentage of Route
Agriculture	Ferruginous Hawk, Long-billed Curlew, Short-eared Owl	7.3	6.4%
Bedrock, cliff, and canyon	Allen's big-eared bat, black swift, big free-tailed bat, fringed myotis, spotted bat, Townsend's big-eared bat, California condor	1.1	1.0%
Developed*	None	41.6	36.3%
Grassland (native and invasive grasses/forbs)	Burrowing Owl, elk, Ferruginous Hawk, fringed myotis, Long-billed Curlew, Short-eared Owl, Utah prairie dog	0.2	0.2%
Open water	Black Swift, Bonneville cutthroat trout	< 0.1	< 0.1%
Pinyon-juniper woodland	Allen's big-eared bat, Arizona toad, Ferruginous Hawk, Lewis's Woodpecker, Townsend's big-eared bat	11.7	10.2%
Riparian	Allen's big-eared bat, Arizona toad, Bald Eagle, big free-tailed bat, Lewis's Woodpecker, Northern Goshawk, Western toad	0.8	0.7%
Sagebrush	Burrowing Owl, Ferruginous Hawk, fringed myotis, Golden Eagle, Greater Sage-Grouse, kit fox, pygmy rabbit, Short-eared Owl, spotted bat, Townsend's big-eared bat	49.4	43.1%
Salt desert scrub	Big free-tailed bat, Burrowing Owl, Ferruginous Hawk, Golden Eagle, kit fox, long-billed Curlew, Short-eared Owl, spotted bat	< 0.1	< 0.1%
Shrub-steppe	Burrowing Owl, Ferruginous Hawk, Golden Eagle, Greater Sage-Grouse, kit fox, Long-billed Curlew, pygmy rabbit, Short-eared Owl, spotted bat, Townsend's big-eared bat, Utah prairie dog	0.2	0.2%
Woodland-shrubland	Black Swift, elk, Ferruginous Hawk, Lewis's Woodpecker, Three-toed Woodpecker	2.2	1.9%
Total		**114.7**	**100.0%**

* Developed land cover is composed of open space and low-intensity development (i.e., human-modified land cover such as lawns and parks), and medium-to-high-intensity development (i.e., roads, other paved surfaces, and structures).

3.18.2 Special Status Species (except Greater Sage-Grouse)

3.18.2.1 PYGMY RABBIT

The pygmy rabbit requires dense, tall stands of sagebrush (*Artemisia* spp., especially *A. tridentata*) with sandy or alluvial soils that are conducive to burrowing (Bosworth 2003). Population densities vary in response to habitat quality, but the habitat or environmental factors that cause population fluctuations are poorly understood (Green et al. 1980). The species is believed to have declined from historic levels in response to reduced habitat quality and quantity. Habitat loss and degradation are primarily due to changes in fire regimes, land conversion for development and agriculture, livestock grazing, and weed invasions (Bosworth 2003).

The home range of pygmy rabbits is centered on a grouping of burrows, which they construct themselves and occupy year-round. A study conducted in Idaho by Heady and Laundré (Heady 2005) found that the mean home range sizes of female and male rabbits were 91.9 and 167.8 acres (37.2 and 67.9 hectares), respectively. However, they also found that the rabbits spent a disproportionate amount of time within 60 meters of their burrows. Heady and Laundré also suggest that the pygmy rabbit is possibly limited in distribution and abundance by available burrow sites. Like most burrowing mammals, pygmy rabbits seek protection in burrows when disturbed.

It is unknown whether pygmy rabbits are present on the tract. If they are present, they are likely not abundant or occur in discrete habitat patches. One incidental sighting has been reported on the tract; however, no systematic surveys have been conducted for this species, and it is unknown if any burrow systems are on the tract. Potential habitat for this species occurs in rabbitbrush, sagebrush/grassland, and sagebrush/grassland (treated) habitats on approximately 1,620 acres (45%) of the tract. The species is known to occur on the reasonably foreseeable coal haul transportation route. Forty-seven miles (42%) of the route consist of sagebrush and shrub-steppe habitat. Pygmy rabbits are likely found in a patchy distribution within that habitat type along the route.

3.18.2.2 UTAH PRAIRIE DOG

The Utah prairie dog is endemic to southwest Utah in the southern Bonneville Basin and in central Utah at high elevations (Bosworth 2003). Critical habitat has not been designated for the species. A revised recovery plan was completed for the Utah prairie dog in 2012 (USFWS 2012), and the Utah Prairie Dog Interim Conservation Strategy was completed in 1997 (Utah Prairie Dog Implementation Team 1997). The UDWR initiated a translocation program in 1972 to move Utah prairie dogs from private lands to areas of historical occupancy on public lands. The prairie dog translocation program has become a key element in Utah prairie dog management and recovery, and is authorized by the USFWS under the ESA. The tract and a portion of the reasonably foreseeable coal haul route are in the Paunsaugunt Utah Prairie Dog Recovery Unit. This recovery unit has sustained a population hovering around 1,000 individuals since 1995 (USFWS 2012). The remainder of the reasonably foreseeable coal haul route is on the West Desert Recovery Unit, which sustains a population of approximately 4,000 individuals (USFWS 2012).

Prairie dog habitats consist of continuous grassland and other vegetation on flat plains (BLM 2008b). Succulent vegetation is crucial for Utah prairie dog survival during drought (Crocker-Bedford et al. 1981). Populations have declined dramatically from historic levels to the current total of approximately 7,200 adults (Crowther 2013). The primary threats to the species are direct habitat loss from development and agricultural use and plague (Crowther 2013). Bubonic plague and sylvatic plague can cause dramatic population fluctuations, and poisonings and shootings have affected populations in some areas (Crowther 2013). Populations of Utah prairie dog are not present on the tract or on BLM-managed lands elsewhere in Kane County, but populations are known to exist along the reasonably foreseeable coal haul transportation route. Suitable Utah prairie dog habitat occurs in sagebrush, grassland, and shrub-steppe habitats adjacent to US-89, SR-20, I-15, and SR-56 along approximately 47 miles (43%) of the reasonably foreseeable coal haul transportation route. The USFWS has established a 350-foot buffer as the range within which normal behavior of individual Utah prairie dogs may be disrupted by noise or human presence (Fox 2010). Known Utah prairie dog colonies occur within 350 feet of the reasonably foreseeable coal haul transportation route on 673 acres and are estimated to contain approximately 1,768 prairie dogs, or 24% of the total known Utah prairie dog population (Crowther 2013). Note that it is impossible to know exactly how many prairie dogs would be in the 350-foot buffer at any one time. Some colonies straddle the buffer, and the count reported of individuals within the buffer includes the entire count for all colonies where even a small portion is in the buffer.

3.18.2.3 KIT FOX

The kit fox inhabits the western United States and northern Mexico, but is not widely abundant in Utah (UDWR 2008). The species prefers sparsely vegetated greasewood, shadscale, or sagebrush-dominated habitats (Crowther 2013), and has the potential to occur on the tract and along the reasonably foreseeable coal haul transportation route. The kit fox's specific distribution is not known, but high- and substantial-value habitats exist on or near the west portion of the reasonably foreseeable coal haul transportation route in Iron County (UDWR 2008). Suitable habitats consist of sagebrush/grassland, sagebrush/grassland (treated), and rabbitbrush habitats on 1,620 acres (45%) of the tract, and on sagebrush and shrub-steppe habitats along 47 miles (43%) of the reasonably foreseeable coal haul transportation route. Reports of average kit fox home range size are approximately 11 km^2, or 2,718 acres (List et al. 2003; White et al. 1993). Exact home range sizes depend on the regional climate, habitat availability, and prey availability. If this home range size is correct for the habitat of the tract, the tract likely provides part of the home range for one kit fox individual.

3.18.2.4 BAT SPECIES

Five special status bat species have suitable habitats on the tract and reasonably foreseeable coal haul transportation route. These bat species occupy a variety of habitats, but their ecological needs are fundamentally the same and consist of secure roosting sites and insect prey. Reductions in the prey base from pesticide use, disturbance of roost sites, and mine closures are the primary threats to bat species (UDWR 2005). The species addressed here use rocky cliffs, crevices, or outcroppings as roost sites. However, caves or mines in any habitat may be used as a roosting site. Bat roost sites in cliff and canyon habitats do not exist on the tract, but do exist along approximately 1 mile (1%) of the reasonably foreseeable coal haul transportation route. Some bat species are also known to use stream and riparian habitats, which are quantified within 100 feet of the reasonably foreseeable coal haul transportation route based on the maximum likely distance that coal could be transported from the route.

Allen's big-eared bat occurs in Garfield and Kane counties (UDWR 2005). The species prefers riparian areas dominated by cottonwood and willow trees, forested mountain areas, and pinyon-juniper habitats (Foster et al. 1996). In addition to roosting sites in cliff and canyon habitat, suitable roosting and foraging areas occur in pinyon-juniper woodland and riparian habitats on 1,485 acres (42%) of the tract and along 10 miles (9%) of the reasonably foreseeable coal haul transportation route. There are approximately 38 acres of riparian habitat within 100 feet of the route.

The **big free-tailed bat** inhabits rugged, rocky terrain, and roosts in rock crevices and cliff faces (Foster et al. 1996). The species forages in desert scrub and riparian habitats. In addition to roosting habitat in cliff and canyon habitat types along the reasonably foreseeable coal haul transportation route, foraging habitats exist in riparian habitat on 55 acres (2%) of the tract and in salt desert scrub along 0.1 mile (0.1%) of the route. There are approximately 38 acres of riparian habitat within 100 feet of the route.

The **fringed myotis** is associated with rocky outcroppings, cliffs, and canyons (Crowther 2013), and are known to use sagebrush and grasslands as foraging habitats (Foster et al. 1996). In addition to suitable roosting sites in cliff and canyon habitat, foraging habitats for this species include sagebrush/grassland and sagebrush/grassland (treated) habitats on 1,609 acres (45%) of the tract, and in sagebrush and grassland habitats along 43 miles (39%) of the reasonably foreseeable coal haul transportation route.

The **spotted bat** is associated with deep, narrow, rocky canyons with precipitous cliffs and crevices in cliff walls. The species is known to use open sagebrush or desert scrub as foraging habitat (Foster et al. 1996). In addition to roosting sites in cliff and canyon habitat, foraging habitats for this species include sagebrush/grassland, sagebrush/grassland (treated), and rabbitbrush habitats on 1,620 acres (45%) of the tract, and sagebrush, shrub-steppe, and salt desert scrub along 47 miles (43%) of the reasonably foreseeable coal haul transportation route.

Townsend's big-eared bat occurs in sagebrush steppe, pinyon-juniper, and other habitat types with caves or mines for roost sites (Foster et al. 1996). In addition to roosting sites in cliff and canyon habitat (where caves are present), foraging habitat for this species occurs in pinyon-juniper woodland, sagebrush/grassland, and sagebrush/grassland (treated) habitats on 3,039 acres (85%) of the tract, and in sagebrush, pinyon-juniper woodland, and shrub-steppe along 56 miles (51%) of the reasonably foreseeable coal haul transportation route.

3.18.2.5 RAPTOR SPECIES

Habitat needs for raptors include nesting sites, foraging areas, and roosting or resting sites. Roosting generally occurs in riparian areas and on cliff faces. Potential nesting and roosting sites occur in riparian habitats on approximately 55 acres (2%) of the tract, and in cliff and canyon habitats along approximately 1 mile (1%) of the reasonably foreseeable coal haul transportation route. Cliff and canyon habitat does not occur on the tract. Stream and riparian habitats occur on approximately 38 acres within 100 feet of the reasonably foreseeable coal haul transportation route (the maximum likely distance that coal could be transported from the route). Habitat loss and disturbance to nest sites, reduction of the prey base, electrocution from power lines, and environmental contaminants are the primary threats to raptor species (Parrish et al. 2002). In addition to the six raptor species addressed here, migratory raptor species are discussed in the Migratory Birds section.

The **Bald Eagle** winters in Utah along rivers, streams, lakes, reservoirs, ponds, and sewage lagoons within riparian or sub-montane woodlands (Crowther 2013). There are no active breeding sites in Garfield, Kane, or Iron counties (Crowther 2013). Riparian areas on the tract and reasonably foreseeable coal haul transportation route, quantified above, could provide wintering habitat for this species.

The **Burrowing Owl** prefers sagebrush steppe, desert scrub, and other shrub-dominated habitats with abandoned animal burrows for nesting sites (Crowther 2013). Suitable nesting and foraging habitats in sagebrush/grassland, sagebrush/grassland (treated), and rabbitbrush occur on 1,620 acres (45%) of the tract, and in sagebrush, shrub-steppe, grassland, and salt desert scrub habitats along 47 miles (43%) of the reasonably foreseeable coal haul transportation route.

The **California Condor** has experienced an extremely reduced distribution and dramatic decline in abundance since European settlement (USFWS 2013b). The current distribution occurs only in California and Mexico, with an experimental population centered on the Vermillion Cliffs of northern Arizona. This species is very wide-ranging and may travel 50–100 miles in a single day. It requires great expanses of foraging habitat because it depends on widely spaced sources of carrion for food. Individuals from the northern Arizona experimental population have been observed in southern Utah flying through areas such as Bryce Canyon National Park. There are no recorded observations of this species on the tract, but it could occasionally fly through the area in search of carcasses. It may also search for road kill carcasses along the reasonably foreseeable coal haul transportation route.

The **Ferruginous Hawk** forages in grasslands, agricultural lands, mixed shrub habitats, and on the periphery of pinyon-juniper forests. Breeding occurs in pinyon-juniper and juniper shrub habitat assemblages and sagebrush steppe (Walters et al. 1983). Suitable nesting and foraging habitats occur in pinyon-juniper woodland, sagebrush/grassland, sagebrush/grassland (treated), annual and perennial grasses, mountain brush and rabbitbrush on 3,437 acres (96%) of the tract, and in pinyon-juniper woodland, sagebrush, agriculture, shrub-steppe, woodland-shrubland, grassland and salt desert scrub along 66 miles (60%) of the reasonably foreseeable coal haul transportation route.

The **Golden Eagle** nests in cliff habitats and forages in high desert scrub (Parrish et al. 2002). Suitable foraging habitats in sagebrush/grassland, sagebrush/grassland (treated), and rabbitbrush occur on 1,620 acres (45%) of the tract, and in sagebrush, shrub-steppe, and salt desert scrub along 47 miles (43%) of the reasonably foreseeable coal haul transportation route.

The **Northern Goshawk** prefers mountain forest and riparian habitats and is a year-round resident of Utah (UDWR 2008). Winter foraging and roosting habitats occur in pinyon-juniper woodlands on 1,430 acres (40%) of the tract. Potential nesting habitats are limited to riparian habitats on 55 acres (2%) of the tract, and 38 acres within 100 feet of the reasonably foreseeable coal haul transportation route.

The **Short-eared Owl** is a ground-nesting species that inhabits arid grasslands, croplands, cold desert shrub, and sagebrush-rabbitbrush habitats (Crowther 2013). The species may migrate or remain as a year-round resident in Utah (UDWR 2008). Suitable foraging and nesting habitats in sagebrush/grassland, sagebrush/grassland (treated), annual and perennial grasses, and rabbitbrush occur on 1,944 acres (54%) of the tract, and in sagebrush, agriculture, shrub-steppe, grassland, and salt desert scrub along 54 miles (49%) of the reasonably foreseeable coal haul transportation route.

3.18.2.6 MIGRATORY BIRD SPECIES

Migratory birds require nesting and brooding habitat, nonbreeding foraging and resting habitat, habitat along migratory routes, and wintering habitat. Neotropical migratory bird populations are in decline due to habitat fragmentation, habitat loss and modification, urban expansion, loss of nonbreeding habitats and habitats along migratory routes, and brood parasitism (Parrish et al. 2002). Four special status migratory bird species have potential to occur in the tract and reasonably foreseeable coal haul route.

The **Black Swift** is very rare in Utah with no confirmed nesting sites in Garfield, Kane, or Iron counties (Crowther 2013; Parrish et al. 2002). The species only nests near or behind waterfalls, and no potential breeding sites are known to exist on the tract or within 100 feet of the reasonably foreseeable coal haul transportation route. The species is migratory, arriving in Utah in late May or early June and remaining as late as October (Parrish et al. 2002). The Black Swift feeds exclusively on flying insects, and may forage over rivers and streams up to 25 miles from nesting colonies (Parrish et al. 2002). Loss of nesting habitat due to reduction or loss of water flow, reduced prey base due to pesticide use, and direct disturbance to nesting sites are the primary causes of reduced distribution and declining populations (Parrish et al. 2002). Foraging habitat may occur in association with riparian areas on 55 acres (2%) of the tract and on 38 acres of the reasonably foreseeable coal haul transportation route.

Lewis's Woodpecker is a cavity nesting species that breeds in ponderosa pine (*Pinus ponderosa*) habitats, but may also use riparian cottonwoods or montane shrub habitats (Parrish et al. 2002). The species eats insects during breeding season, and nuts and berries in fall and winter (Ehrlich et al. 1988). Lewis's Woodpecker inhabits open habitats with widely spaced trees and an understory of grasses and shrubs to provide insect prey and plant forage (Parrish et al. 2002). Loss of habitat due to tree removal and changes in forest structure as well as grazing by livestock are the primary threats to the species (Parrish et al. 2002). Secondary breeding habitat may occur in pinyon-juniper woodland, riparian, and mountain brush habitats on 1,548 acres (43%) of the tract, and in pinyon-juniper woodland and woodland-shrubland habitats along 12 miles (11%) of the reasonably foreseeable coal haul transportation route. In addition, there are approximately 38 acres of riparian habitat within 100 feet of the reasonably foreseeable coal haul transportation route.

The **Long-billed Curlew** is a migrant and summer resident in Utah that requires short grass and bare-ground breeding habitats with shade and abundant small vertebrate prey (Pampush 1980; Parrish et al. 2002). Uncultivated rangelands and pastures support most of the breeding population in Utah. Loss and modification of breeding habitats and predation by foxes and domestic pets are the primary threats to the species and have caused dramatic population declines. Breeding habitats include pasture, meadow, and sagebrush/grassland. Suitable breeding habitats include sagebrush/grassland, sagebrush/grassland (treated), and annual and perennial grasses on 1,933 acres (54%) of the tract, and in agriculture, shrub-steppe, grassland, and salt desert scrub habitats along 11 miles (10%) of the reasonably foreseeable coal haul transportation route.

The **Three-toed Woodpecker** is a cavity nesting species that breeds and winters in high-elevation coniferous forests in Utah (Parrish et al. 2002). The species requires coniferous trees (living and dead) to support its prey of wood-boring insect larvae, but may also use mixed forest habitats (Hill et al. 2001). Populations fluctuate in response to bark beetle outbreaks. Tree removal and fire suppression that remove standing dead trees are the primary threat to the species (Parrish et al. 2002). Suitable breeding and foraging habitats are limited to woodland-shrubland habitats along approximately 2 miles (2%) of the reasonably foreseeable coal haul transportation route. No suitable coniferous forest habitat occurs on the tract.

3.18.2.7 AMPHIBIAN SPECIES

The **Arizona toad** is present in Kane County with most of its Utah distribution concentrated to the west in the Virgin River basin in Washington County (UDWR 2005). In Utah, this species inhabits juniper-dominated habitats and low-elevation riparian habitats near permanent or semipermanent water bodies (Crowther 2013). The Arizona toad lays eggs on the bottoms of shallow, slow-moving streams. Threats to this species include loss of native vegetation and riparian corridors (UDWR 2005) as well as water withdrawals (Crowther 2013). Suitable habitats in pinyon-juniper habitats near water bodies and riparian habitats occur on a maximum of 1,430 acres (40%) of the tract. In addition, there are approximately 38 acres of riparian habitat within 100 feet of the reasonably foreseeable coal haul transportation route.

The **western toad** inhabits montane areas in riparian, shrub, mixed conifer, and aspen-conifer habitats associated with permanent bodies of water, and breeds in small bodies of water and along creeks and rivers (Crowther 2013). Suitable western toad habitat in meadow wetlands and riparian habitat occurs on 118 acres (3%) of the tract. In addition, there are approximately 38 acres of riparian habitat within 100 feet of the reasonably foreseeable coal haul transportation route.

3.18.2.8 FISH SPECIES

The **Bonneville cutthroat trout** inhabits major rivers and lakes in parts of Utah, Idaho, Nevada, and Wyoming. Like most trout species, it is found in relatively cool and clean habitats that provide complexity in terms of depth, velocity, and substrate (Lentsch et al. 2000). It is known to occur in the Sevier River watershed, including Threemile Creek in Garfield County, a creek that would be intersected by the reasonably foreseeable coal haul transportation route.

No special status fish species are known to occur on the tract.

3.18.3 Greater Sage-Grouse

The analysis area for Greater Sage-Grouse is defined as the 607,210-acre area presented in Map 3.21. This area also defines the approximate limits of the Panguitch sage-grouse population, and the Panguitch Management Area in the *Greater Sage-grouse (*Centrocercus urophasianus*) Conservation Objectives: Final Report* (USFWS 2013a). The tract is in the south portion of the analysis area. A subset of the Panguitch population breeds near the tract, as described in detail below.

Areas occupied by the Greater Sage-Grouse are defined by seasonal usage and are mapped by UDWR. According to management action SSS-53 of the KFO RMP, the BLM manages habitat according to UDWR's habitat layer. Consistent with the BLM Washington Office IM-2012-043, the Greater Sage-Grouse habitat data layer updated in 2012 is presented in this document as the best available information, except where site-specific information is available, as described below.

Site-specific information derived from studies conducted by Dr. Nicki Frey (Utah State University) was used to assess the existing condition and potential impacts for this species. Between 2005 and 2009, Dr. Frey placed radio transmitters on 31 sage-grouse (12 male, 4 female, 15 juvenile) trapped at the Alton–

Sink Valley and Hoyt's Ranch leks to determine 1) home range size and seasonal habitat use (Frey et al. 2013b); 2) habitat use, including use of areas where vegetation treatments were completed (Frey et al. 2013a); 3) the extent of connectivity between lek locations (Frey 2010; Frey et al. 2008); 4) potential predators (Curtis et al. 2007); and 5) the rate of fence line mortality (Curtis et al. 2007). Nesting locations were also observed. However, although some nesting activity was documented, it must be noted that the study contained a very small sample size of female grouse; therefore, it is inappropriate to draw explicit conclusions from the gathered information on habitat use of nesting females. The purpose of the radio transmitters placed on birds trapped near the Hoyt's Ranch lek was to document movement between breeding centers within the population and also to document use of areas that have undergone vegetation treatments, as described below (Frey 2010).

Additionally, annual progress reports written by Dr. Steven Petersen (sage-grouse population and habitat consultant for ACD) were also used to gather information specific to the group of birds using the area—see Petersen (2013b, 2013a) as well as the compilation of Petersen annual sage-grouse reports in Appendix 3-5 of the Coal Hollow permit application package (ACD 2007 - 2008). These reports were submitted to DOGM to document the actions taken by ACD to increase available habitat through off-site mitigation, as well as all sage-grouse sightings on and near the Coal Hollow operation.

3.18.3.1 REGULATORY STATUS

Greater Sage-Grouse is listed by USFWS as a candidate species. On March 5, 2010, the service determined that listing the species is warranted but precluded by other listings, as detailed in *Endangered and Threatened Wildlife and Plants; 12-month Findings for Petitions to List the Greater Sage-Grouse (*Centrocercus urophasianus*) as Threatened or Endangered; Proposed Rule* (50 CFR 17, *Federal Register* 75:13910–14014). Additionally, under the *Utah Comprehensive Wildlife Conservation Strategy*, Greater Sage-Grouse is a species of particular concern (Tier II). According to the strategy, "Tier II species include those listed on the Utah Species of Concern List under sole state authority" (UDWR 2005).

Currently, the BLM manages Greater Sage-Grouse and its habitat according to BLM Washington Office IM-2012-043. The intent of this IM is to ensure that interim conservation policies and procedures are implemented when field offices authorize or carry out activities on public land while the BLM develops and decides how to best incorporate long-term conservation measures for Greater Sage-Grouse into applicable land use plans. Under this IM when evaluating proposed leases for solid minerals (e.g., coal), BLM is directed to "cumulatively maintain or enhance Greater Sage-Grouse habitat" through minimization and on- and off-site mitigation measures.

In Utah, sage-grouse populations are currently managed by UDWR under the sage-grouse conservation plan (UDWR 2013). The sage-grouse conservation plan reflects sage-grouse recommendations that were provided to the Governor of Utah by a multi-disciplinary group of stakeholders in early 2012. The BLM is currently evaluating an amendment to multiple land use plans under which the sage-grouse conservation plan is one of the action alternatives under consideration. See Section 1.7.1.1 for a more detailed description of the land use plan amendment process.

3.18.3.2 GENERAL HABITAT NEEDS

The Greater Sage-Grouse is a sagebrush-obligate species that requires contiguous sagebrush-dominated habitats (Connelly et al. 2004). In Utah, nesting sage-grouse have been demonstrated to prefer sagebrush more than 16 inches (40 cm) tall and a 15%–50% canopy cover of tall grasses and other concealing vegetation (Connelly et al. 2004). These conditions are consistent with mature, well-developed sagebrush communities. Rangewide, sage-grouse also forage in riparian, wet meadow, and agricultural habitat types during the spring and summer nesting and brood-rearing season, and they are dependent on mature sagebrush stands for forage and shelter in the winter (Connelly et al. 2004).

Leks are open areas where strutting male grouse congregate to compete for the opportunity to mate with females. Sage-grouse congregate near or on lek locations every spring for breeding. Leks normally occur in the same location each year, with some lek locations persisting for over 85 years (Connelly et al. 2011). They often occur in complexes, with one or more primary leks occurring near other lek locations that support fewer males (Connelly et al. 2011). Some variation, or shifting, of lek locations has been observed. Shifting the lek location may occur for several reasons, including persistent disturbance and/or alternation of vegetative cover (Connelly et al. 2011; Holloron 2005; Walker et al. 2007). It is thought that the most important factor affecting a lek location is the proximity to and configuration and abundance of nesting habitat (Connelly et al. 2011; Connelly et al. 2000) and that males form leks opportunistically at sites in or adjacent to this habitat (Connelly et al. 2000). Lek habitat is not considered limiting to sage-grouse populations (Connelly et al. 2011). The lek location is therefore indicative of the location of high-quality nesting habitat, and may change if the quality of that particular nesting habitat declines. It is thought the most important factors for increasing sage-grouse population growth are nest success, chick survival, and female survival, respectively (Taylor et al. 2012). Therefore, maintaining high-quality nesting and brood-rearing habitat is the most essential component to increase or maintain population abundance.

3.18.3.3 DISTRIBUTION AND THREATS

Greater Sage-Grouse population numbers have declined rangewide, and they now occupy approximately 56% of their historic range. The exact decline in sage-grouse population numbers since pre-settlement times is unclear, because estimates were largely anecdotal before the implementation of systematic surveys in the 1950s (USFS 2013). In Utah, Greater Sage-Grouse are present in scattered populations north and west of the Colorado River (UDWR 2002) on approximately 40% of their historic range (Beck et al. 2003).

Population declines are primarily due to habitat loss, habitat fragmentation, and reduced habitat quality resulting from energy development, urban expansion, conversion of habitats to agriculture, and alteration of habitats by invasive species that reduce habitat quality by reducing herbaceous forage and/or increasing the frequency and intensity of ground fires (Bosworth 2003; UDWR 2002). Sagebrush steppe habitats (which are very important to this species) and associated herbaceous understory have been reduced by improper grazing, invasive plant species, altered fire regimes, conifer encroachment, and oil and gas industry expansion (UDWR 2005). Other threats specific to this species include limited distribution and predation by both native and invasive animal species (Connelly et al. 2004; UDWR 2005). Fences can also pose a threat to sage-grouse as vertical barriers, collision risks, and raptor perches (Curtis et al. 2007).

Conifer woodland encroachment into sagebrush habitats has reduced the quality and quantity of sagebrush stands and contributed to the rangewide decline in sage-grouse abundance (Connelly et al. 2004). Juniper encroachment is especially widespread in the analysis area, and is discussed in more detail below (Connelly et al. 2004). The group breeding in Sink Valley has also experienced relatively high mortality from predation, with a relatively large number of sage-grouse known to have been killed by predators since 2005 (Curtis et al. 2007). Increasing predation by predators (domestic pets, red foxes, raccoons) and ravens is of concern (Frey et al. 2008).

3.18.3.4 ANALYSIS AREA DESCRIPTION

The analysis area for the Greater Sage-Grouse is the 607,210-acre area that is referred to as the Panguitch SGMA (see Map 3.21) in the sage-grouse conservation plan and the Panguitch Management Area in the *Greater Sage-grouse (*Centrocercus urophasianus*) Conservation Objectives: Final Report* (UDWR 2013, USFWS 2013a). This analysis area was chosen for this species because in addition to including the tract area, it encompasses the approximate extent of habitat used by the Panguitch sage-grouse population, which is managed by UDWR as a single population unit.

The tract occurs in the south portion of the analysis area. The extreme south boundary of the analysis area is also the southern-most distribution of the species rangewide. The tract does not exhibit textbook habitat characteristics, possibly because the tract is near the southernmost edge of the species' distribution. For most animal species, habitat conditions near the edge of a species' distribution are often considered suboptimal when compared to habitat near the core of the distribution. Populations that occupy this "fringe" habitat are also more prone to extirpation from stochastic, or unpredictable, events (Doherty et al. 2003); however, these populations may also exhibit important adaptations to suboptimal habitat.

Furthermore, the quality of the sagebrush habitats in the analysis area has declined due to conifer encroachment as well as an increase in dense stands of sagebrush that has occurred regionally since European settlement. Long-term fire suppression efforts, coupled with excessive historical browsing and grazing by wildlife and livestock, have led to the conversion of sagebrush steppe communities into dense shrubland areas and juniper woodlands (BLM 2010c) (Map 3.22), neither of which provides high-quality habitat for sage-grouse. It is evident that the sagebrush habitat has experienced extensive conifer encroachment because vast expanses of the analysis area consist of conifer woodlands with an intact sagebrush understory. Classic conifer encroachment occurs in a contained zone or band where sagebrush and conifer woodland vegetation types abut, but the encroachment in the analysis area has occurred uniformly throughout very large patches.

3.18.3.4.1 Connectivity and Movement between Leks

The Panguitch sage-grouse population is distributed throughout the analysis area. Grouse from this population primarily use the available patches of suitable sagebrush habitat as well as suboptimal agricultural and juniper habitat patches. In the analysis area, connectivity between sagebrush habitat patches has become increasingly blocked by juniper encroachment (Petersen 2006). For the population, it is important to retain connectivity between habitat patches to ensure genetic flow and maintain the fitness of individual breeding groups. It is thought that historical levels of connectivity within the population may have been significantly altered by juniper encroachment, and are likely a factor in the observed decline in use of the Alton–Sink Valley lek (described below).

Observations indicate that although the Sink-Valley group may remain in the Alton–Sink Valley area year-round (described further below), there is dispersion and movement of grouse into and through Sink Valley. Movement of birds has been documented from the Hoyts Ranch lek (north of Alton) to areas south of the tract in the summer, fall and winter (Curtis et al. 2007; Frey 2010). Additionally, evidence of grouse winter use (including observations of large groupings of grouse) has been observed approximately 8 miles southeast of the tract in Ford's Pasture (Petersen 2013a), indicating that birds pass through Sink Valley to get to more southerly wintering habitats. Lastly, two juveniles captured in Sink Valley moved north of Hoyt's Ranch during the winter, and returned to the Sink Valley the following summer (Curtis et al. 2007). Because birds have been documented moving between Sage Hen Hollow, near the town of Panguitch, to Hoyt's Ranch, there is potential for the normal movement patterns of this population to range a linear distance of almost 35 miles, from Sage Hen Hollow in the north to Ford's Pasture in the south (Frey 2009); however, this link has not been directly observed and may currently be altered due to movement corridors blocked by conifer encroachment.

3.18.3.4.2 Completed Analysis Area Vegetation Treatments

As an ongoing objective to improve the habitat of the analysis area for sage-grouse, the BLM and ACD completed a combined 28,296 acres of vegetation treatments in the analysis area between 2009 and 2013, including 1,076.9 acres of treatments within the tract (Maps 3.23 and 3.24). Vegetation treatment locations were chosen to increase habitat availability for the Panguitch population of sage-grouse, as well as to increase connectivity between existing habitat patches. Most vegetation treatments consisted of juniper removal in areas experiencing conifer encroachment of intact sagebrush understories, and

subsequent seeding of forbs and grasses. The juniper removal was accomplished mechanically (i.e., with a brush-hog) and by hand-thinning. Cut trees were mulched, and the mulch was spread on the ground as cover for seed. Immediately after tree removal, the treatment area was reseeded with a mixture of forbs and grasses standard for southern Utah. Vegetation treatments typically cost between $79 and $396 per acre. Due to the unique vegetative conditions of the area (i.e., vast areas of juniper encroachment with an intact sagebrush understory), the juniper removal was accomplished while still maintaining the sagebrush understory and leaving much of the shrub community intact. After treatment, the shrub and forb canopy cover increased with the absence of competition from the juniper and filled in the areas where the trees had previously been (Frey et al. 2013a).

Since mining began in 2010, ACD has completed vegetation treatment projects, consisting of juniper removal as described above, to maintain compliance with the Coal Hollow mining permit. These treatments, especially the 808 acres treated on private lands in 2009–2011 (referred to as the Heaton Property) were designed with the intent to increase connectivity for sage-grouse between the Alton–Sink Valley lek and Hoyt's Ranch to the north.

Vegetation treatments consisting of juniper removal from areas with an intact sagebrush understory, like those described above, are generally thought to provide a timely and effective increase of available habitat for local sage-grouse (Baruch-Mordo et al. 2013; Commons et al. 1999). This is especially true for areas immediately adjacent to habitat already occupied by sage-grouse. The Alton–Sink Valley is unique in that there are large expanses of habitat that fit this description; juniper encroachment into sagebrush habitat is evident in uniform patches throughout the analysis area. Potential locations for additional juniper removal treatments in the analysis area are abundant. In fact, BLM has completed NEPA analyses on 172,927 acres of juniper-encroached habitat in the analysis area in the *Upper Kanab Creek Watershed Vegetation Management Project Environmental Assessment* (BLM 2010d) and the *South Canyon Vegetation Enhancement Environmental Assessment* (BLM 2010c) (see Map 3.23) to treat the existing conifer encroachment and improve habitat for wildlife species that use sagebrush habitat, such as the Greater Sage-Grouse. By comparison, a small percentage of lands approved for vegetation treatments have been completed. As funding becomes available, BLM plans to continue to conduct vegetation treatments in the analysis area to accomplish the objective of stabilizing the local population decline by providing additional habitat and increasing connectivity throughout the population.

Many of the juniper removal treatments completed in the analysis area were studied for post-treatment use by sage-grouse. All of the studied areas were used within a year of project completion (Frey et al. 2013a; Frey 2010; Frey 2008). The treatments on the tract resulted in increased sagebrush, forb, and grass cover and increased use of treated areas by sage-grouse in the summer and fall (Frey et al. 2013a). Immediately after the treatment was completed in fall 2005, birds were documented using the treated area, even though there was little vegetation growing (Frey et al. 2013a). The preference for the treated area was most pronounced during fall of the first year, and may be explained by an increased availability of invertebrates as a food source (Frey et al. 2013a). Sage-grouse also demonstrated a strong preference for treated habitat during the brood-rearing season immediately after treatment, suggesting that sufficient brood-rearing habitat had previously been unavailable. For the subsequent four years of telemetry observations, grouse shifted preferential habitat use away from suboptimal agriculture and pinyon-juniper habitat and toward treated sagebrush habitat. This quick response might have been due to the sudden availability of habitat in areas where suitable sagebrush habitat is limited for the sage-grouse (Frey et al. 2013a).

The Heaton Property vegetation treatment was also used by sage-grouse within the year after project completion while grouse were moving south toward winter habitat (Frey 2010). The purpose of this vegetation treatment project was to increase connectivity between Hoyt's Ranch and Sink Valley, and the observed use by sage-grouse suggests it may have indeed increased the connectivity.

Lastly, male breeding behavior (strutting) was observed off the traditional lek and in one of the treated areas of the tract in 2013 (Petersen 2013b; Schaible 2013b). This is described in more detail below.

3.18.3.4.3 Coal Hollow Mining Operation

ACD has conducted mining activities on private lands adjacent to the tract (i.e., the Coal Hollow Mine) since fall 2010. As a condition of the mining permit, sage-grouse have been counted and monitored (both systematically and opportunistically) since 2005 to detect changes in the amount of birds in the area as well as document habitat use. In addition, to fulfill permit obligations, ACD has improved sage-grouse habitat through juniper removal vegetation treatments (as described above). Mining on the Coal Hollow parcel has provided an opportunity to observe how the Panguitch population is affected by the types of activities described in the Proposed Action.

During both systematic and opportunistic surveys before and after mining began, sage-grouse were most often observed in the "Sagebrush Flat" area, an area including parts of Block S of the tract (Petersen 2013b). Flocks of grouse were flushed and otherwise in this area year-round, with flock size increasing to above 61 in fall and winter (Petersen 2013b). Breeding behavior was also observed in this area starting in 2009 (before mining began) and has continued through 2013. It is thought that most birds breeding in the area have nests in the Sagebrush Flat (including Block S); however, nesting has rarely been directly observed (Petersen 2013b).

Despite the research results from oil and gas development in Wyoming (i.e., Holloran 2005), mining at Coal Hollow, in the short term, has not resulted in a reduction of breeding grouse; the number of sage-grouse using the Alton–Sink Valley area was in decline before mining began (described below), but has appeared to remain relatively stable, albeit at low numbers, throughout mining activities (see Table 3.18.4) (Petersen 2013b). The absence of a decline could be for three reasons: 1) to date, ACD has not yet mined all the sagebrush habitat within its current permit boundary, including that adjacent to the federal Block S and the traditional Alton–Sink Valley lek location (described below); 2) the vegetation treatments completed by BLM and ACD have provided additional habitat for sage-grouse (as described above), which has helped stabilize the population decline; and 3) a time-lag effect of impacts has not yet been realized (Harju et al. 2010), meaning that impacts may become evident in the future. Sage-grouse observations and behavior monitoring suggest that mining has had little impact on local sage-grouse behavior (Petersen 2013b). Sage-grouse have been observed in and around the actively mined areas of Coal Hollow, including strutting on the spoils piles as well as drinking from water pooled in surface mining areas. They have also been observed flying over the active mining operations, and are thought to display a tolerance for the mining equipment because they have not been displaced from the area of active mining and do not flush when equipment approaches (Petersen 2013b).

Mining has been completed in one area of the Coal Hollow parcel, which is currently undergoing reclamation activities. During the first year post-reclamation, it exhibited high plant growth and plant cover from triticale (a short-lived grass often used for reclamation). During the second year, some forbs became established. Due to the locally wetter climate of the Alton area and the fact that the sagebrush species planted on the site are black sagebrush and mountain big sagebrush, it is likely that the reclaimed site could provide quality nesting and brood-rearing habitat within 15–20 years (Petersen 2013b).

3.18.3.5 SAGE-GROUSE USE OF THE TRACT

The following section describes the ways in which sage-grouse have been observed and are thought to currently use the habitat provided by the tract. First, observations of the Alton–Sink Valley lek are provided. Next, the results of UDWR's annual counts are reported, which provide an estimate for the amount of grouse using the tract. Last, seasonal habitat use of the tract is described in detail.

3.18.3.5.1 Lek Description

The traditional Alton–Sink Valley lek is on the private lands of the Coal Hollow mining permit area (east of the tract), and is approximately 0.7 mile from active mining activities. The location of the traditional lek has not been directly altered by mining activities. Since 2008, males were observed displaying breeding behavior on other nearby locations in addition to the traditional location (Petersen 2013a; Schaible 2013b). Most recently, lekking behavior was observed on the spoils piles of the Coal Hollow parcel in 2012 and on BLM-managed lands (Block S of the tract) in 2012 and 2013 (Schaible 2013b). Three to four males were displaying at the time of each observation off the traditional lek location. During recent surveys, most males have been observed displaying consistently on the tract lek location (Schaible 2013b). The Alton–Sink Valley lek is now considered to be a complex of lekking locations, with one centroid located on the tract and another on the traditional lek location (Map 3.26; lek locations are masked due to sensitivity). These leks are hereafter referred to as the traditional Alton Sink-Valley lek (located on private land), and the new Alton–Sink Valley lek (located on federal land) and collectively as the Alton–Sink Valley lek complex. The new lek location occurs in one of the "limited-touch" areas of Block S. The term *limited-touch area* describes areas of intact sagebrush stands outside the area where coal occurs. Surface-disturbing activities in limited-touch areas would be avoided completely for mining activities, and would be avoided if possible for the routing of roads and location of dispersed facilities.

The Alton–Sink Valley sage-grouse lek complex includes the southernmost active Greater Sage-Grouse lek in North America (Curtis et al. 2007; BLM 2008b). There are two abandoned leks south of the Alton–Sink Valley lek at Skutumpah and Ford Pasture. These leks have been inactive since 1994 and 1982, respectively, and may represent the southern limit of the species' range, because birds continue to use the areas in the winter (Schaible 2013b). The closest active lek to the Alton–Sink Valley lek is the Hoyt's Ranch lek, approximately 6 miles north of Alton. In 2013, the maximum male count on that lek was 11, implying that approximately 33 sage-grouse were using the area for breeding (Schaible 2013b). Additional active leks with consistently high levels of grouse attendance are in the north portion of the analysis area (e.g., Sage Hen Hollow and Dog Valley).

3.18.3.5.2 Counts and Estimate

Because sage-grouse exhibit fidelity to lekking and nesting sites (Fischer et al. 1993), lek counts are widely used to estimate the local population size (Connelly et al. 2004). The historic (pre-settlement) size of the group of sage-grouse that breed in the Alton area is not known, but is believed to have never been large (Frey 2009). Anecdotal documentation from lifetime residents of Alton suggests that sage-grouse populations near the town have fluctuated over time and always persisted over the last 100 years, but never reached high numbers as seen in other parts of the analysis area (Frey 2008).

Lek count data since 1955 indicate fluctuations in male grouse attendance at the traditional Alton–Sink Valley lek, with declines in lek attendance in 2002 and 2003 (presumably in response to extreme drought in the region), an upturn in lek attendance in 2005, and occasional years without any lek activity(Frey et al. 2008). Lek attendance at the Alton–Sink Valley lek complex declined from approximately 20 males in 1984 to 12 males in 2013 (Frey et al. 2008). Lek attendance at the Alton–Sink Valley complex was in decline before mining began on Coal Hollow in 2010. It is generally thought that abundance of the group that breeds in Alton–Sink Valley has been in decline due to increasing habitat loss and reduced connectivity to other breeding groups—impacts ultimately from the conifer encroachment described above.

Table 3.18.4 lists the maximum male attendance counts for the Alton–Sink Valley lek complex according to counts done by the UDWR (all lek locations within the complex combined). No males were observed displaying breeding behavior in 2011, but males were observed in subsequent years. The reason for this documented absence may be because an extremely harsh winter made observer access to the lek location

impossible until later in the breeding season (Schaible 2013b). It is possible the breeding displays had taken place before the lek location could be surveyed. Additionally, it is possible that the breeding displays had taken place at other locations in the complex, but the deep snow made it difficult to search for other active lek locations (Schaible 2013b). It is unknown whether this periodic documented absence represents an actual lapse in breeding behavior in response to the heavy winter, or is a result of survey timing. The observed increase in breeding activity in 2013 may have been in response to a mild winter (Schaible 2013b).

Table 3.18.4. Alton–Sink Valley Lek Complex Counts 2004–2013

Year	Maximum Males in Attendance
2004	5
2005	12
2006	13
2007	4
2008	3
2009	2
2010	1
2011	0*
2012	4*
2013	12*

Source: Personal communication, Schaible (2013).

* Indicates years where active mining was occurring at the Coal Hollow Mine adjacent to the tract during the breeding season. See Map 1.2.

The total amount of birds breeding in the area is estimated at approximately three times the annual male lek count. Lek counts have resulted in an estimate of 30–39 birds inhabiting Sink Valley, ranging over the years sampled from 0 to 39. However, UDWR cautions against placing an exact estimate on such a small part of the population, because actual connectivity with other areas is still not well understood (Schaible 2013b).

3.18.3.5.3 Tract and Transportation Route Habitat

Frey et al. (2013a) documented sage-grouse habitat preferences using radio telemetry in the Alton area from 2005 to 2009. The observed habitat use was unique in that grouse used agricultural habitats almost as much as sagebrush habitats. Also, the Alton grouse often used pinyon-juniper habitat, a behavior that is atypical when compared to other populations throughout its distribution. This unusual use of habitat may indicate 1) these grouse have adapted to habitats atypical for other grouse because they occur on the fringe of the distribution; or 2) the grouse are responding to a lack of suitable habitat in the area by occupying atypical habitat types. In support of the second theory, Connelly and Doughty (1989) report similar use of agricultural areas, and suggest that this use was indicative of a lack of available forbs in the brood-rearing season, as cited in Frey et al. (Frey et al. 2013a). Frey et al. (2013a) also suggest that the use of pinyon-juniper habitat may be because the birds are searching for shade in summer and cover in winter in response to a lack of sagebrush canopy cover. The documented use of completed vegetation treatments by grouse (as described in Section 3.18.3.4.2) further supports this theory.

Table 3.18.5 displays the seasonal habitat types designated by the UDWR, as well as high-use vegetation cover types present in the tract and transportation route (as described in the Vegetation section). Note that these acres overlap and do not sum to the total tract acreage. For context, Table 3.18.5 also presents the percentage of the analysis area these habitat types represent.

Table 3.18.5. Greater Sage-Grouse Habitat in the Tract and Transportation Route

	Tract (Acres/% of Tract)	Amount of Habitat in Analysis Area (total acres/% of analysis area represented by tract)	Transportation Route (linear miles/% of route)*
UDWR Habitat			
Occupied†	3,550.8/99%	271,617.1/1.3%	–
Brood-rearing	–	–	37.9/34.5%
Winter	–	–	2.8/2.6%
Vegetation Cover Types			
Sagebrush/grassland, sagebrush/grassland (treated), and rabbitbrush,	1,620/45%	244,180/0.6%	–
Annual and perennial grasses and meadow (wetland, including agriculture)	387/11%	20,482/1.9%	–
Shrub-steppe	–	–	3.5/3.2%

Source: UDWR (2011).

* Includes habitat in the Panguitch and Bald Hills SGMAs.

† The tract habitat is designated by UDWR as brood-rearing habitat, but based on site-specific information available to date (i.e., Frey et al. 2013; Frey 2010; (Curtis et al. 2007); the Petersen reports in Appendix 3-5 of the Coal Hollow permit application package (ACD 2007-2008), it is evident the species does not use the tract habitat solely for brood rearing; therefore, throughout this document, the term *occupied* is employed.

The radiotelemetry study described above concluded that the birds using the Alton–Sink Valley area are not migratory. Throughout all seasons (breeding, summer, late summer/fall, winter), grouse individuals made movements between the habitats near the lek and the croplands near the town of Alton, although use of the agricultural habitat declined over time with the increase in available sagebrush habitat from the vegetation treatments described above. In all, the sage-grouse observed in the Alton–Sink Valley were found to have an average year-round home range size of approximately 5,026 ± 378 acres (Frey et al. 2013b). This home range size estimate includes 90% of the documented locations of grouse observations. The average home range size for the year-round core activity, including 50% of documented locations, was 1,391 ± 94 acres (Frey et al. 2013b). This "average" home range includes most of the tract, and extends beyond the tract to the northwest and southeast. Map 3.26 displays the 90% and 50% average home range for the breeding and brood-rearing seasons, respectively, as well as the 95% home range for both the late brood-rearing and winter seasons.

The tract is not formally recognized by UDWR as wintering habitat; although, it is evident that it supports wintering individuals. Because the tract is at the fringe of the sage-grouse distribution, the wintering habitat may be suboptimal when compared to habitat in the core of the species distribution.

3.18.3.5.3.1 Breeding, Nesting, and Brood-rearing Habitat in the Tract

The UDWR identified 3,550.8 acres of the tract (99% of the tract and 1.3% of the analysis area) as occupied habitat (see Map 3.25 and Table 3.18.5). Breeding and nesting habitats (February–April) include sagebrush/grassland and sagebrush/grassland (treated) habitats in the southeast portion of the tract (Block S). Because only four of the 31 radio-collared birds were female, the small sample size prevents any definitive determinations on the true extent of nesting habitat. However, based on the telemetry information, some sage-grouse nest in sagebrush habitats adjacent to the Alton–Sink Valley traditional lek (Curtis et al. 2007). During the nesting season, male individuals were also documented using the agricultural habitats of Block NW. See Map 3.26 for the 90% and 50% average breeding season home range calculated from 2005 to 2009 (Frey et al. 2013b). These areas encompass 5,589 and 1,305 acres, respectively, for a total of 6,894 acres of documented breeding habitat.

Summer brood-rearing habitats (early: May–July; late: August–October) include sagebrush/grassland, sagebrush/grassland (treated), and annual and perennial grasses in the south portion of the tract, and grassland, meadow, and agricultural habitats in the north portion of the tract. During summer brood-rearing season, approximately 1/3 of nesting females moved their chicks from nesting habitats to horse pastures and wetlands north of the tract (Curtis et al. 2007), and the remaining 2/3 used Block S (Frey et al. 2013b). See Map 3.26 for the 90% and 50% average early brood-rearing season home range and the 95% average late brood-rearing season home range (Frey et al. 2013b). According to the telemetry data (Frey et al. 2013), the 90% and 50% early brood-rearing home range consist of 7,057 and 1,789 acres, respectively. The late brood-rearing home range consists of 3,647 acres.

3.18.3.5.3.2 Wintering Habitat in the Tract

As mentioned previously, though habitat in the tract is not identified as wintering habitat by UDWR (Table 3.18.5; State of Utah 2013), recent research has verified that birds are using the habitat in the tract for wintering, in addition to nesting and raising broods (Frey et al. 2013b). Map 3.26 displays the average winter home range size, accounting for 95% of documented locations, for birds that breed in the Alton–Sink Valley, consisting of 3,988 acres.

In addition to the local birds that remain in the area year-round, relatively large numbers of sage-grouse (60–70) visit Alton–Sink Valley in the winter (Frey 2009). The number of sage-grouse wintering in the Alton–Sink Valley area exceeds the estimated number of sage-grouse in the local area year-round. A small flock was documented moving from Hoyt's Ranch to the Alton–Sink Valley area in the late summer (Frey 2010), indicating that some wintering birds may move to the area from northern breeding locations, such as Hoyt's Ranch. Additionally, 56 sage-grouse were observed in the Ford's Pasture area in January 2013 (Petersen 2013a), which indicates that birds may also move through Sink Valley while en route to more southerly wintering habitat.

3.18.3.5.3.3 Transportation Route Habitat

The Greater Sage-Grouse habitat intersected by the hauling route includes habitats occupied by the Panguitch population as well as the adjacent Bald Hills population. Approximately 38 miles, or 34.5%, of the hauling route intersects with brood-rearing habitat. An additional 2.8 miles, or 2.6%, of the route intersects with winter habitat.

CHAPTER 4. ENVIRONMENTAL CONSEQUENCES

CHAPTER 4. ENVIRONMENTAL IMPACTS

4.1 Introduction

In accordance with 40 CFR 1502.16, this chapter presents the anticipated environmental consequences of the actions proposed under each of the alternatives described in Chapter 2: Alternative A (No Action), Alternative B (Proposed Action Alternative), Alternative C, and Alternative K1.

For the purposes of this document, an *environmental impact* is defined as a change in the quality and/or quantity of a given resource due to a modification in the existing environment resulting from decisions related to the Alton Coal Tract. Impacts may be beneficial or adverse, may be direct or indirect, and may be permanent or temporary in a long-term or short-term duration. Unless otherwise specified, *short-term* is the period when the development of the mine and the mining of coal would occur. Under the Proposed Action, this would be approximately 25 years, under Alternative C, this would be approximately 21 years, and under Alternative K1, this would be approximately 16 years. *Long-term* effects are defined as those effects that would occur or remain after the cessation of coal mining and during, or continuing into the period following, the reclamation and monitoring period (also referred to as the bond release period). Long-term effects would occur for 25–35 (or more) years under the Proposed Action beginning with the onset of mine development. Under Alternative C, long-term effects would occur for 21–31 (or more) years beginning with the onset of mine development. Under Alternative K1, long-term effects would occur for 16–26 (or more) years beginning with the onset of mine development. Impacts may vary in degree from a slightly discernible change in the environment to a total change in the environment. The significance of these impacts is determined using the criteria set forth by the CEQ (40 CFR 1508.27) and the professional judgment of the specialists doing the analyses. Impact significance may range from negligible to substantial and may be significant during mining but reduced to less than significant following reclamation. The context where impacts occur can be local, regional, and national.

Impacts on private land are analyzed because the tract under the action alternatives includes split estate lands. In the tract, where the surface estate is privately owned, the minerals beneath the surface estate are administered by the BLM. These lands are therefore eligible for inclusion in the tract and analysis of impacts to them is required to comply with NEPA. Likewise, where the surface estate is owned and administered by the BLM, the subsurface estate is also administered by the BLM, and these lands are also included in the tract and analyzed in this EIS.

4.1.1 Types of Effects

Direct and indirect effects (also referred to as impacts) are the primary and secondary results, respectively, of the No Action Alterative, the Proposed Action, Alternative C, or Alternative K1. Direct impacts are caused by the action and occur at the same time and place. An example of a direct impact would be the removal of vegetation as part of the surface mining process on the tract. Indirect impacts from an action occur later in time and/or are removed in space. An example of an indirect impact would be an increase in recreational use on adjacent undisturbed and unrestricted land due to the direct impact of disturbing and/or precluding access on recreation lands in the tract. In many cases, direct and indirect impacts are described together in the analysis rather than differentiating between them. The impacts analysis area for direct and indirect impacts can vary between the resources analyzed. However, at a minimum, the tract is in the impacts analysis area for all resources, with the exception of transportation, which primarily considers the reasonably foreseeable coal haul transportation route in the analysis of impacts. The reasonably foreseeable coal haul transportation route is also considered in the impacts analysis area for direct and indirect impacts to other resources, such as aesthetics (namely noise), air resources, cultural resources, hazardous materials and hazardous and solid waste, recreation,

socioeconomics, water resources, and wildlife and special status species. The coal haul transportation route that is used for analysis purposes is the most reasonably foreseeable route, but it is impossible to predict the exact route that a successful bidder might choose. Sections 4.2 through 4.18 describe the direct and indirect impacts of the No Action Alternative, the Proposed Action, Alternative C, and Alternative K1 for each resource brought forward for analysis in this EIS.

Cumulative impacts result from the incremental impacts of an action when added to other past, present, and RFFAs, regardless of who is responsible for such actions. Cumulative impacts may result from individually minor, but collectively significant actions occurring over a period of time (40 CFR 1508.7). The cumulative impacts assessment area (CIAA), a list and descriptions of other RFFAs, and the cumulative impacts analysis for each resource are contained in Section 4.19 Cumulative Impacts. Impacts from surface-mining operations on the adjacent Coal Hollow Mine and an additional potential private mine area north of the Coal Hollow Mine (see Map 1.1) are addressed in the cumulative impacts section. See Section 4.19 for a complete list of actions, including the private coal mines, which are analyzed in the cumulative impacts analysis.

Unavoidable adverse impacts would result from the Proposed Action, Alternative C, or Alternative K1 after the application of potential mitigation measures. Potential mitigation measures are intended to reduce impacts that are not already incorporated into the action alternatives as design features or existing regulatory requirements (i.e., under State of Utah, federal, and or local law and lease stipulations) and that may be applied to further reduce impacts following the results of the impacts analysis. Unavoidable adverse impacts may be permanent or may eventually subside or no longer result in adverse conditions over time. When unavoidable adverse impacts are permanent, the impacts are characterized as irreversible. Irreversible impacts are disclosed separately and described below.

The relationship between the short-term use of the environment or resource versus long-term productivity as it relates to the extraction of coal and resource-use sustainability are intertwined with direct and indirect effects. The mining of 44.9 million (Proposed Action), 38.1 million (Alternative C), or 30 million (Alternative K1) tons of coal from the tract would be a short-term use of the environment that would provide benefits in terms of the various potential uses of the coal resource in society. Following a lease sale, should BLM decide (as a result of this EIS) to offer the tract for competitive leasing, DOGM would have to permit mining on the tract prior to the beginning of mining activities. The permitting process is designed to 1) protect the long-term productivity of resources after the cessation of mining and 2) ensure that impacts to resources occurring during the mining process are minimized to the extent possible in the context of an economical, primarily surface-mining operation. Mining would alter many resources' ability to function naturally in the short term; however, the required topsoil salvaging and replacement, topographic recontouring to AOC, and revegetation (including seeding and, in some locations, planting seedlings) would promote the following long-term resource effects:

- Soil productivity reestablishment
- Native and suitable non-native vegetation reestablishment
- Wildlife and wildlife habitat rehabilitation
- Livestock grazing use
- Groundwater, surface water, and watershed function and stabilization
- Recreational use

Based on the analysis in this chapter, following mining activities the function of these resources and resource uses is expected to return to a condition approximating pre-mining conditions. To provide a clear context of the relationship between short-term use of the environment and long-term productivity, further discussions of these relationships are presented in each resource impacts analysis section in this chapter.

Irreversible and irretrievable commitments of resources (in other words, irreversible and irretrievable impacts) are also disclosed in the impacts analysis section for each resource. Irreversible impacts are those impacts that would result in changes to the environment that cannot be reversed, reclaimed, or repaired. An example of an irreversible impact would be the removal of coal from the tract. Once the in-place coal reserves present in the tract are removed, they can never be replaced or reclaimed. Irretrievable impacts, on the other hand, are those impacts that result in the temporary loss or degradation of the resource for a period of time. An example of an irretrievable impact would be the removal of vegetation from the tract as part of the mining process. During mining operations, the impact of vegetation removal would be irretrievable until the reclamation process is complete. Following reclamation, vegetative cover would be restored to the area.

Where possible, effects are quantified primarily through the use of geographic information systems (GIS) applications that allow for calculations of surface disturbance over portions of the tract under the Proposed Action, Alternative C, and Alternative K1, and through modeling and other analyses that provide estimates of loads, concentrations, noise and light levels, acres, and other measurable quantities.

4.1.2 Required Regulatory Actions, Design Features and Monitoring Measures, and Lease Stipulations

As indicated in Section 1.1, the issuance of a lease for the BLM-administered lands is a prerequisite for mining, but is not the enabling action that would allow mining to start. All mining and reclamation operations would comply with SMRCA, Utah statutes, and BLM lease stipulations developed for the tract. This impacts analysis considers all standing measures required by federal, State of Utah, and local regulatory authorities, as well as other design features, as part of the Proposed Action, Alternative C, and Alternative K1. Table 2.6.1 in Chapter 2 presents a table summarizing the existing, required State of Utah, federal, and local mitigation and monitoring requirements inherent to the Proposed Action, Alternative C, and Alternative K1. This table also includes the required lease stipulations that would be inherent to the Proposed Action, Alternative C, and Alternative K1. Required regulatory actions, mitigation and monitoring measures, and lease stipulations particular to each resource are also identified in the impacts analysis section under each resource. See Section 2.6.1.9 for a detailed discussion of design features (as summarized above) and the distinction between design features and potential mitigation measures.

4.1.3 General Analytical Assumptions, Guidelines, and Notes

This EIS assumes that all design features (required regulatory actions, mitigation and monitoring measures, and lease stipulations identified in Table 2.6.1) would be successfully implemented in the effectiveness limits of the measures undertaken. If such measures were not implemented, additional adverse impacts could occur. Additional assumptions that apply to all resource values and uses relate to 1) the analysis of impacts as a result of the placement of dispersed facilities on the tract and 2) the relocation of KFO Route 116 in the tract.

Because the exact location of dispersed facilities is not known at this time, the analysis of impacts as a result of the placement of dispersed facilities on the tract involved a set of assumptions that allowed for conservative estimates of the expected impacts. The estimated acreage necessary for dispersed facilities under each alternative (listed below and in Table 2.8.1 in Chapter 2 and tables in various resource sections) was provided by ACD based on experience and industry standards. Under the No Action Alternative, it was assumed that no dispersed facilities would be required because no mining would occur on the tract under this alternative. Under the Proposed Action it was assumed that

- dispersed facilities would include such items as water control structures (diversion ditches, sedimentation ponds, etc.), temporary light use roads (direct mine use and for transporting coal from areas of active mining to the centralized facilities), and temporary stockpiles of topsoil and/or overburden;

- dispersed facilities would require approximately 160 acres of land;
- dispersed facilities would be located wholly in the no-coal zone;
- acres of vegetation community type (or soil type, etc.) disturbed by dispersed facilities would be proportional to the percentage of each vegetation type in the no-coal zone;
- it would not be possible to avoid disturbance in established avoidance areas (sagebrush/grass communities and riparian areas); and
- standard mitigation measures would be required (e.g., BMPs) as part of the Proposed Action to reduce or eliminate impacts.

Analysis assumptions under Alternative C are the same as those described for the Proposed Action except that dispersed facilities would require approximately 135 acres of land under Alternative C. Likewise, analysis assumptions under Alternative K1 are the same as those described for the Proposed Action, except that dispersed facilities would require approximately 92 acres of land.

As with dispersed facilities, the exact location of the KFO Route 116 relocation is not known at this time; therefore, the analysis of impacts from the KFO Route 116 relocation involved a set of assumptions that allowed for conservative estimates of the expected impacts. These assumptions allowed for the creation of a theoretical/conceptual road alignment used to generate acres of disturbance figures and to determine possible impacts due to this aspect of the mining operation. Under the No Action Alternative, it was assumed that no road relocation would be required because no mining would occur on the tract under this alternative. Under the Proposed Action, the following are assumed:

- The relocation of KFO Route 116 would be temporary (for the life of mine), and the road would be reestablished in its approximate original roadbed following mining.
- The temporary alignment of the relocated KFO Route 116 would generally be north–south because the current alignment of KFO Route 116 is generally north–south.
- The temporary relocation of KFO Route 116 would occur wholly in the no-coal zone except in the northwestern portion of the tract (Block NW). In Block NW, the road would be temporarily relocated onto previously mined surface prior to reestablishment in the approximate original roadbed following mining of this block (the road relocation in Block NW would only be for the life of mining operations in this portion of the tract).
- The temporarily relocated KFO Route 116 would be 100 feet from the pit disturbance line and centralized facilities.
- The temporarily relocated KFO Route 116 would take the shortest distance from point of departure from the existing road to point of reconnection with the existing road in the confines of the other assumptions listed.
- The temporary relocation of KFO Route 116 would avoid sagebrush/grass communities and riparian areas (defined as a 330-foot buffer on streams as per BLM riparian policy) to the extent possible.
- The temporary relocation of KFO Route 116 would occur on slopes of 30% or less only.
- Standard mitigation measures would be required (e.g., BMPs) as part of the Proposed Action during road construction and maintenance for the life of the temporary road (life of mine);
- The temporary relocation of KFO Route 116 would occur within a 66-foot-wide ROW with a 24-foot-wide road surface.
- Two stream crossings would be required (one for Robinson Creek and one for Kanab Creek) in addition to crossings of washes.
- Appropriate culverts would be installed at stream crossings.
- Road base materials (gravel and other rock) would come from on-site where available and from off-site otherwise.

Analysis assumptions under Alternative C and Alternative K1 are the same as those described for the Proposed Action, except that Block NW is not included in the tract configuration under Alternative C and Alternative K1. Also, Blocks S and Sa are not included in the tract configuration under Alternative K1 and therefore relocation of KFO Route 116 would not be needed in this block under this alternative.

For purposes of analysis for certain resources, it was necessary to make additional assumptions particular to that resource analysis. These assumptions are listed and explained in the impacts analysis section for each resource, where they apply.

Impacts analyses generally considered pit disturbance as a total acreage of disturbance for the life of the mine under each alternative. It is important to note that pit disturbance would not occur all at one time. It would occur on a continuing basis concurrent with reclamation. This approach was taken primarily because the exact mine sequence is unknown at this time. As described in Chapter 2, under the Proposed Action at any one time, active mining operations (open surface-mining pits from which coal is being removed and/or areas where topsoil and overburden are being removed) would involve approximately 120 acres (1 open pit). An additional 120 acres or more would be in some stage of reclamation (overburden replacement and top-soiling, grading to AOC, or seedbed beginning). Under Alternative C, at any one time, active and suspended (due to seasonal timing restrictions) mining operations would involve an estimated 240 acres (2 pits). An additional 240 acres or more would be in some stage of reclamation. Under Alternative K1, at any one time, active mining operations and reclamation would involve the same acreage as the Proposed Action.

Surface-disturbing impacts (613 acres in the tract plus 166 acres outside the tract[1]) resulting from subsidence in the portion of the tract that would be underground mined are considered primarily with respect to the analysis of geology and minerals (see Section 4.6) and water resources (see Section 4.16). For most resources, subsidence is not factored into calculations of surface disturbance because vegetation removal, soil removal, or overburden removal would not occur. No reclamation would occur in this area of the tract either, except for activities to eliminate or repair damage being done to other resources (for example, water resources). Activities to eliminate or repair damage resulting from subsidence include grouting and backfilling. Grouting generally consists of drilling a series of boreholes into the mine voids and filling those voids with a concrete-like mixture that eliminates the likelihood of future subsidence events.

4.1.4 Notes on Data Sources and Tract Acreage

Data and information used to analyze impacts were gleaned from a variety of sources, including internet sources, peer reviewed literature, government agency documents, current and historic permitting documents, and documents reporting the results of studies and data collection efforts completed for this EIS in specific. Greater detail related to these sources is provided in Chapter 3, Section 3.1.

As explained in Table 1.1.1 and 2.3.1 in Chapters 1 and 2, respectively, and reiterated in Section 3.1, in this analysis, a tract acreage of approximately 3,576 acres is used rather than the approximately 3,581.27 acres listed in the NOI. For an explanation of the reason for this 5-acre difference, see Table 1.1.1, Table 2.3.1, or Section 3.1. Finally, some corrections and updates in acreages and other information have been made to develop this SDEIS. This includes new information about the affected resources that has become available since the publication of the DEIS.

[1] Two sets of acres numbers are used. One relates to underground mining acres, and the other is surface related due to subsidence, which is a portion of the underground mining.

4.2 Aesthetic Resources

Four different alternatives are analyzed in this section, and each alternative presents a varying degree of impacts to aesthetic resources in the area of analysis. Each alternative considers different tract boundaries and different levels of mining allowed. When impacts from elements of the Proposed Action and alternatives are similar, their effects are discussed together. Both adverse and beneficial impacts are discussed in this section. Additionally, both direct and indirect impacts are discussed.

Aesthetic resources would be impacted in the short term during the active mining period (life of the mine). In the case of noise and night sky conditions, resources would return to current conditions immediately upon conclusion of the active mining period. In the case of visual resources, conditions would be returned to a more natural landscape during both the active mining period (through ongoing reclamation) and the post-mining reclamation (10 years). Through the evaluation of aesthetic resources (sound, visual resources, and night skies), it was concluded that each has different thresholds for impacts to become significant. Those thresholds are described in more detail below.

4.2.1 Regulatory Framework

There are no state or local noise ordinances in place for the tract. The EPA, however, has defined standards to prevent hearing loss. The EPA has identified a 24-hour exposure level of 70 L_{dn} as the level of environmental noise to prevent measurable hearing loss to human receptors over a lifetime (EPA 1974). The EPA further identifies levels of 55 dBA outdoors and 45 dBA indoors to prevent annoyance to noise-sensitive human receptors.

MSHA also has health standards to prevent hearing loss. Under MSHA standards, mine employees are never permitted to be exposed to noise levels of 115 dBA or greater. MSHA requires that exposure to noise levels between 85 and 115 dBA be mitigated through hearing-protection programs, which can include personal protective equipment if shown to be necessary.

Additionally, MSHA regulations governing the use of explosives for mines specify maximum limits for blasting noise and vibration at “any dwelling, public building, school, church, or community or institutional building” according to the levels presented in 30 CFR 816.67(b)(i). See Chapter 3, Tables 3.2.4 and 3.2.5 for more detail.

FLPMA requires that the BLM periodically prepare and update its land use plans. In that process, the agency establishes objectives for management of visual resources, or landscape protection and change. The public lands in the tract are managed under VRM Class IV objectives. The objective of Class IV is to provide for management activities that require major modifications to the existing character of the landscape. These activities may dominate the view and may be the major focus of the viewer’s attention.

There are no legal or regulatory requirements with respect to skyglow on or near the tract, except for lighting ordinances in the town code of Brian Head, Utah. These ordinances intend to reduce light pollution to protect the night skies of nearby Cedar Breaks National Monument and include provisions for the following:

- Mounting light fixtures to buildings to reduce uplight and light spill
- Shielding lamps to reduce uplight
- Aiming lamps to reduce light spill
- Promoting the use of energy efficient lighting
- Restricting lamp wattage
- Requiring city council reviews of lighting plans for new developments and subdivisions (Sterling Codifiers 2013)

MSHA is the regulatory entity responsible for the administration and enforcement of mandatory federal mine safety and health standards in the United States, including requirements for adequate lighting for nighttime mining activities. MSHA statutes 30 CFR 56.17001 (Illumination of Surface Working Areas) and 30 CFR 77.207 (Illumination) require all mine sites to provide lighting sufficient for safe working conditions. Both statutes state the following: "Illumination sufficient to provide safe working conditions shall be provided in and on all surface structures, paths, walkways, stairways, switch panels, loading and dumping sites, and work areas."

In addition, the NPS is committed to preserving night skies as a resource for future generations (NPS 2012b, 2013c). In particular, Bryce Canyon National Park's dark skies are a major attraction for visitors. The park maintains an active astronomy and night sky program and describes its geographic location with respect to dark skies as "the last grand sanctuary of natural darkness." On average, Bryce Canyon offers 142 astronomy programs each year, holds an annual astronomy festival, and encourages those interested in night sky viewing to visit the park during moon phases when the sky is at its darkest (NPS 2013b).

The KFO RMP (BLM 2008b) does not prescribe any specific surface stipulations for management and protection of aesthetic resources in the tract. However, based on the analysis, the successful bidder would be required to employ skyglow minimization measures for nighttime mining operations as described in Table 2.6.1.

4.2.2 Soundscape

Impacts to noise-sensitive receptors near the tract and along the reasonably foreseeable coal haul transportation route were evaluated based on the changes in ambient noise levels caused by the Proposed Action and alternatives. Noise-sensitive receptors consist of residences, hospitals, libraries, recreation areas, churches, and similar locations. The analysis of noise-sensitive receptors in this section only considers noise as it relates to the human environment. For a discussion of the impacts to wildlife health and behavior from changes in ambient noise levels caused by the Proposed Action and alternatives, refer to Sections 4.17 and 4.18. Four different alternatives are analyzed in this section, and each presents a varying degree of impacts to noise-sensitive receptors near the tract. Each alternative considers different tract sizes as well as different seasonal operational restrictions. Alternative C and Alternative K1 were developed in part to address concerns over impacts to noise-sensitive receptors in the town of Alton.

There are several management prescriptions and considerations common to the action alternatives that would have impacts on noise-sensitive receptors. These include regulatory permit requirements such as MSHA inspections, short haul routes, and the coal loadout location and coal haul transportation route.

MSHA inspections would ensure that the mine is in compliance with the health standards set to minimize the risk of hearing loss among mine employees. Direct protection of the health and safety of mine employees resulting from MSHA inspections would occur under the action alternatives through the duration of the mining operation.

Ambient noise levels would increase as a result of coal truck traffic on the short haul route out of the tract. Impacts to noise-sensitive receptors would vary depending on the final short haul route selected.

The BLM received comments on the DEIS regarding the need to more quantitatively address potential noise impacts to existing soundscapes from the Proposed Action and alternatives. A computerized noise modeling study of potential noise impacts was conducted to address noise-related comments, guided by protocols devised with collaborating agencies such as the NPS. The noise modeling study was done in accordance with the noise modeling technical report (see Appendix L).

4.2.2.1 ALTERNATIVE A: NO ACTION

Under the No Action Alternative, ACD's application to lease the coal included in the tract would not be approved, and the coal included in the tract would not be mined. Rejection of the application would not affect permitted mining activities on private land adjacent to the tract (the Coal Hollow Mine). No impacts to noise-sensitive human receptors from increases in ambient noise levels would occur from the No Action Alternative.

Under the No Action Alternative, the current land uses would continue, including livestock grazing, backcountry driving, hunting, and vegetation treatments to maintain and enhance livestock forage, wildlife habitat, and watershed condition.

4.2.2.2 ALTERNATIVE B: PROPOSED ACTION

The following equipment and associated activities common to the action alternatives would occur under the Proposed Action and would result in impacts to noise- sensitive human receptors:

- Heavy equipment, consisting of dozers, scrapers, excavators, front-end loaders, graders, and water trucks, would be used during surface-mining operations in the tract.
- Diesel generators would be used to power all necessary facilities as well as temporary and permanent light sources.
- Coal haul trucks would travel to and from the tract.
- Coal would be loaded onto rail cars from coal haul trucks.
- Workers would commute to and from the tract.
- A conveyer belt and crusher would be used to process excavated coal.
- Blasting events would occur during the course of mining on the tract.

Under the Proposed Action and alternatives, sensitive noise human receptors on and near the tract, reasonably foreseeable coal haul routes, and proposed rail loadout would experience an increase in noise levels that are above the current conditions. Additionally, vibration emissions would result from blasting events. The extent of expected noise and vibration is discussed in further detail in this section. Noise and vibration impacts from the Proposed Action and alternatives are compared against human receptor thresholds, MSHA thresholds, thresholds of awareness, and existing background noise levels to determine the level of impact that could result. Regulatory thresholds and existing background conditions for noise are discussed in detail in Sections 3.2.1.3 and 3.2.1.4. Background conditions for vibration levels are assumed to be zero. In general, an adverse impact would result if predicted noise or vibration levels exceed MSHA thresholds.

4.2.2.2.1 Noise Impacts

Under the Proposed Action, ambient noise levels in the soundscape analysis area would increase as a result of heavy equipment use, truck traffic, and rail loadout associated with mining activities. Increases in ambient noise levels would result from the following sources of on-tract activity noise: a variety of mobile-source mining equipment, centralized stationary processing equipment, and blasting events. Off-tract increases in ambient noise levels would result from increased vehicular traffic on public roadways from worker-commute trips and coal haul truck trips to and from the tract as well as truck to rail loading at the proposed rail loadout location.

Noise impacts from rail loadout activities are analyzed to determine probable noise impacts to the nearest residential area. The closest residential area to the proposed loadout is an unnamed community approximately 4.5 miles (7.2 km) east of the loadout location. This residential area is in census tract 1103, which is an identified EJ community (see Section 3.12.4). Noise levels at the proposed rail loadout

location and surrounding areas were not included in the modeling analysis because the residential area in census tract 1103 was identified following noise modeling. This analysis uses the classical equation of sound propagation from the source (loadout location) to determine potential impacts (noise levels) to the identified sound receptor (unnamed community).

Baseline conditions at the unnamed community are assumed to be those of the lowest recorded value for Bryce Canyon (40.0 dBA L_{eq}). The sound power level of rail loadout activities is assumed to be 114 dBA; these are actual values measured at a coal rail loadout expected to be similar to proposed activities for the Alton Coal Tract (Queensland Parks and Wildlife Service 2006).

Because the sound source(s) is primarily near or at ground level, a directivity factor equal to two was chosen as most representative of sound propagation from rail loadout activities (sound propagating hemi-spherically from the source). Therefore, using the sound power level of a representative source of 114 dBA and a directivity factor of 2, the following sound pressure levels at certain distances were generated from the classical equation of sound propagation from a source (Figure 4.2.1).

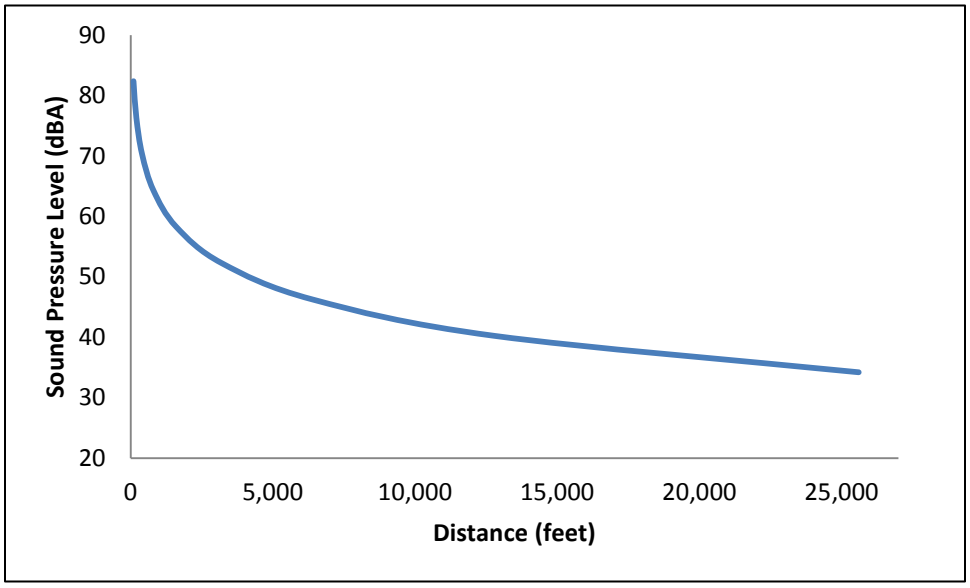

Figure 4.2.1. Rail loadout noise levels vs. distance.

According to Figure 4.2.1, a cluster of residences located a distance approximately 4.5 miles (7.2 km or 23,760 feet) away could expect the noise from rail loadout to attenuate to approximately 35 dBA, well below regulatory thresholds and likely well below ambient background noise.

Traffic noise from nearby roadways would likely be negligible, because noise from the rail loadout would likely be significantly noisier. For example, the highest noise levels anticipated from the roadways analyzed for the sound modeling were approximately 60 dBA at a distance of 100 feet. This is an approximately 20-dB difference from that expected from the rail loadout (20 dB = 2 bels = 100 times higher noise levels from the train loadout); therefore, adding in roadway noise would have a negligible impact to noise levels at given distances from the rail loadout.

4.2.2.2.1.1 Modeling Protocol and Specifications

Noise levels were modeled and analyzed from mobile and stationary mining equipment sources, increased traffic levels on local roadways, and blasting events. See Table 4.2.1 for identified plant and fleet

equipment and associated noise levels. These sources were analyzed and/or modeled to determine if noise impacts would be above existing ambient conditions at several designated sensitive noise receptors: Yovimpa Point, Riggs Spring, and Farview Point in Bryce Canyon National Park; and the towns of Alton, Hatch, and Panguitch along the coal haul transportation route. The model also accounted for on-tract noise. The active area sage-grouse lek was also analyzed and is described further in Section 4.18 (Wildlife: Special Status Species).

Table 4.2.1. Plant and Equipment Fleet for Mining Activities

Source	Quantity	dBA per Equipment	Information Source
Mobile			
Haul truck	5	124	Cowal Gold Mine EIS (Barrick Gold Corporation 2009)
Front-end loader	3	117	Barrick Gold Corporation (2009)
Excavator	1	123	Ensham Central Project Environmental Noise Assessment (Ensham Resources 2006)
Dozer	6	118	Barrick Gold Corporation (2009)
Track hoe	2	121	Barrick Gold Corporation (2009)
Skytrack*	1	123	Barrick Gold Corporation (2009)
Grader	2	110	Ensham Resources (2006)
Water truck	2	118	Ensham Resources (2006)
Scraper	4	116	Barrick Gold Corporation (2009)
Diesel generator	3	100	Ensham Resources (2006)
Drill	1	118	Barrick Gold Corporation (2009)
Total Mobile Equipment	**30**	**134**	**–**
Fixed			
Central processing area (e.g., coal crushing, conveying, stacking, and loading)	–	124	Barrick Gold Corporation (2009)

Notes: Sources are intended to be reasonably representative of equipment that would be used during mining operations, but may vary depending on the availability of exact equipment at the time mining operations would occur.

* Sound power level was assumed to be equivalent to those of an excavator.

SoundPLAN Essential, Version 2.0, was the model chosen to evaluate the noise emissions from mine-related activities. Based on industry-accepted sound power levels from equipment manufacturers and other sources, SoundPLAN estimates noise contours of the overall facility. The model accounts for all sound propagation losses (geometric spreading, existing source absorption, and barrier shielding) and reflections of sound off adjacent structures and the ground.

Three separate modeling runs for mine-related noise were evaluated in each of the mining blocks: Block NW, which is the block closest to the town of Alton; Block C, which is closest to Bryce Canyon National Park; and Block S, which is closest to several sage-grouse leks. Noise-emitting equipment and processes were only evaluated within these three blocks because noise levels from mining activities in the other mining blocks (CWN and CWS) would be of equal or less impact because they are farther away from sensitive receptors. Modeling also included process area sources and roadway area sources around the town of Alton. Two additional modeling runs were conducted for the roadways associated with coal haul traffic in the towns of Hatch and Panguitch.

Impacts to noise-sensitive human receptors would vary depending on the location of active mining operations during the 25-year mine life. Modeling mobile equipment impacts to specific sources is difficult because equipment can travel to any location within the tract. Therefore, mobile equipment types were modeled together as a single 40-acre source assumed to emit at the highest emission level (134 dBA), as if all equipment types were simultaneously operating at full capacity and were "stacked" together. This effectively maximized the additive effects of noise levels from each piece of equipment, representing the most conservative model approach while simultaneously addressing the difficulties inherent in modeling mobile sources.

The 40-acre mobile area source was placed within each mining block closest to the noise-sensitive receptor (human and wildlife) of greatest concern to mining in that block (the town of Alton for Block NW, Bryce Canyon National Park for Block C, the sage-grouse lek for Block S) (Map 4.1). In addition, the model took into account noise generated from centralized facilities modeled as a 35-acre area source block within the tract where stationary processing equipment would be located for the life of the mine. See Map 4.1 for the specific location of these model inputs.

4.2.2.2.1.2 Noise Modeling Results

Modeling results for noise level increases to noise-sensitive receptors under the Proposed Action are summarized in Table 4.2.2 and Table 4.2.3. Table 4.2.2 compares the modeling results to background noise levels, whereas Table 4.2.3 compares modeling results to regulatory thresholds. Under the Proposed Action, mining would occur on each of the mining blocks (Block NW, Block C, and Block S) at various points over the life of the mine.

Table 4.2.2. Modeled Values Compared to Background Values for Sound at Individual Point Receptors as a Result of Mining on Various Blocks under the Proposed Action and Alternatives

Receiver Description	Background Level		Proposed Action* (mining in Block NW)	Alternative C* (mining in Block C)	Alternative K1 (mining in Block C)
	L_{eq} dBA	L_{nat} dBA	dBA	dBA	dBA
Farview Point (Bryce Canyon)	53.0	31.8	0	0	0
Yovimpa Point (Bryce Canyon)	42.0	27.1	0	0	0
Riggs Spring B (Bryce Canyon)	40.0	24.5	0	0	0
Town of Alton (southwest corner of Center Street and 1st East Street)	41.0	–	61.4	50.2	50.2

Notes: L_{nat} is what the NPS considers would be the ambient noise level if human influence were removed. L_{eq} describes the equivalent continuous sound level averaged over a certain timeframe in describing actual measured ambient conditions (for example, this value can be presented as a 1-hour average, a 24-hour average, etc.).

* Model results for mining Block S do not appear in the table because the table reports only the highest modeled values at individual sound receptors, and Block S is the furthest mining block from all four receivers listed. Modeled sound levels from mining on Block S were 0 at all the Bryce Canyon receivers and 43.3 dBA at the Town of Alton.

As detailed in Table 4.2.2, all combined mining activities from both on-tract (mobile and stationary) and off-tract sources (coal haul transportation and worker commuting) while mining on any of the three blocks would produce no detectable noise levels at any of the Bryce Canyon receivers.

Calculated noise levels at the receiver point in the town of Alton (61.4 dBA) from mining on Block NW (the block closest to the town of Alton) under the Proposed Action exceed expected background levels by approximately 20 dBA. Calculated noise levels at the receiver in Alton for mining on Block C exceed background noise levels by approximately 9.2 dBA, and by approximately 2.3 dBA while mining on Block S (the furthest block from Alton). Noise level contributions from the different sources to the various receptor sites are detailed in Appendix L.

As shown in Appendix L, noise level contributions from mining activities on Block NW account for the greatest source of modeled noise to the receptor analyzed in the town, accounting for 61.3 dBA of the 61.4-dBA impact. In contrast, noise level contributions from mining activities on Block C account for the greatest source of modeled noise to the receptor analyzed in the town, accounting for 49.2 dBA of the 50.2-dBA impact. Lastly, noise level contributions from the local roadways running from the tract through the town of Alton are the greatest source of modeled noise while mining in Block S to the receptor analyzed in the town, accounting for 43.1 dBA of the 43.3-dBA impact. Therefore, the greatest noise impacts to the receptor in Alton while mining on Block NW and C come from mining on the tract. In contrast, the greatest noise impacts to the receptor in Alton while mining on Block S come from roadway noise.

Mining activity on Block NW could exceed regulatory thresholds for noise. A continuously emitting noise of 61.4 dBA corresponds to 67.8 dBA L_{dn} (10 dB are added to the noise levels from 10:00 p.m. to 7:00 a.m., and the noise level is then averaged over the full 24-hour period). This noise level would exceed the EPA and HUD regulatory thresholds cited in Section 3.2.1.3 of 55 dBA and 65 dBA L_{dn}, respectively (Table 4.2.3). Even though the total noise level of 61.4 dBA could exceed regulatory noise limits for certain categories of land use under FHWA standards (as shown in Section 3.2.1.3), most of this noise would come from mining activities, not increased traffic on roadways, and therefore the FHWA regulatory thresholds would not be exceeded.

Table 4.2.3. Modeled Values Compared to Regulatory Thresholds for Sound at Individual Point Receptors as a Result of Mining on Various Blocks under the Proposed Action and Alternatives

Receiver Description	Regulatory Threshold			Proposed Action (mining in Block NW) dBA (L_{dn} dBA)	Alternative C (mining in Block C) dBA (L_{dn} dBA)	Alternative K1 (mining in Block C) dBA (L_{dn} dBA)
	EPA (dBA L_{dn})	HUD (dBA L_{dn})	FHWA (dBA L_{eq})*			
Farview Point (Bryce Canyon)	55	–	57	0	0	0
Yovimpa Point (Bryce Canyon)	55	–	57	0	0	0
Riggs Spring B (Bryce Canyon)	55	–	57	0	0	0
Town of Alton (southwest corner of Center Street and 1st East Street)	55	65	67	61.4 (67.8)	50.2 (56.6)	50.2 (56.6)

* This value is for 1-hour L_{eq}.

Notes: L_{dn} definition: day-night sound level (L_{dn}) is the A-weighted equivalent sound level for a 24-hour period with an additional 10-dB weighting imposed on the equivalent sound levels occurring during nighttime hours (10 p.m. to 7 a.m.).

Model results for mining Block S do not appear in the table because the table reports only the highest modeled values at individual sound receptors, and Block S is the furthest mining block from all four receivers listed. Modeled sound levels from mining on Block S were 0 at all the Bryce Canyon receivers and 43.3 dBA (49.7 dBA L_{dn}) at the town of Alton.

In contrast, noise impacts to the town of Alton from mining on Block C would be lower than those from mining on Block NW. Noise impacts would be approximately 56.6 dBA L_{dn}, which would be in excess of EPA thresholds of 55 dBA L_{dn}, but not HUD thresholds. Sound levels from mining activities in Block S (43.3 dBA; 49.7 dBA L_{dn}) would not exceed regulatory thresholds in the town of Alton for noise.

The noise modeling report contains an appendix (Appendix C of the SDEIS's Appendix L) that presents noise level contributions from the various modeled sources to individual point receptors. The modeling report indicates that noise impacts from roadway noise to the town of Alton receptor would be approximately 43.1 dBA (the remainder of the modeled noise impacts to the town of Alton receptor coming from mining activities on the tract). These impacts would be from both baseline traffic conditions (existing traffic, which is accounted for in the measured background levels) and mine-related impacts from coal haul truck trips and worker commuter trips. This value is significantly below the 67-dBA 1-hour L_{eq} FHWA standard for Category B land uses (residences, motels, churches, libraries, parks, etc.), as identified in Section 3.2.1.3.

In addition to the modeling that took place for specific receptor sites in Bryce Canyon and Alton, as detailed in Tables 4.2.2 and 4.2.3, separate modeling was completed for roadway noise impacts to the towns of Hatch and Panguitch. As can be seen on the contour line and grid noise map for the towns of Hatch and Panguitch (Figure 4.2.2 and 4.2.3), residences and commercial enterprises adjacent to or near the roadway could experience noise levels as high as 64 dBA as a result of mine-related haul and commuter traffic roadway noise along SR-89. This modeled impact included noise from both baseline traffic conditions (existing traffic, which is accounted for in the measured background levels) and mine-related impacts from coal haul truck trips and worker commuter trips. This is equivalent to the currently measured baseline value of 64 dBA measured in both towns as presented in Section 3.2.1 (Soundscape). Additionally, this value would be below the 67-dBA 1-hour L_{eq} FHWA standard for Category B land uses for both towns.

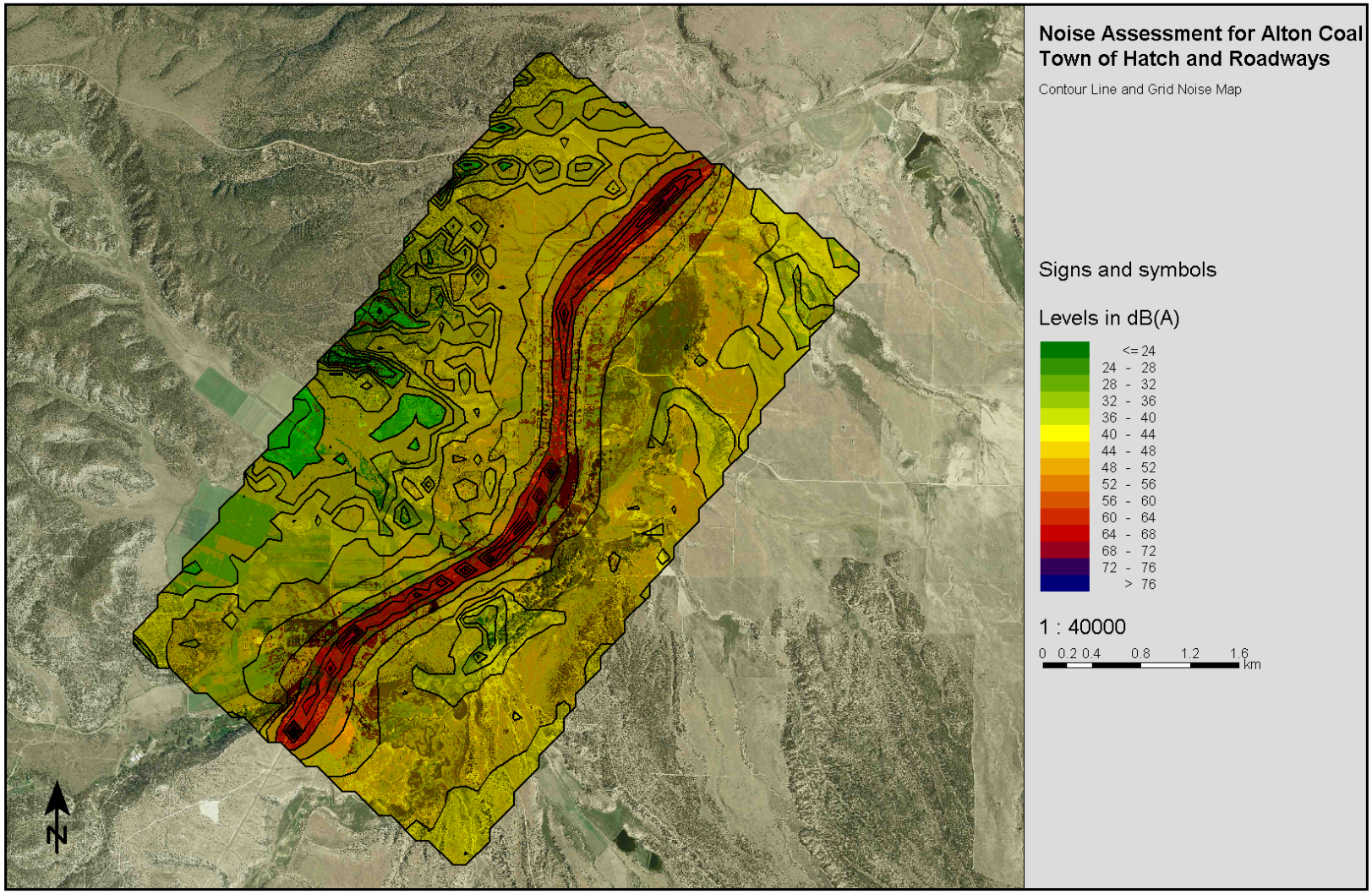

Figure 4.2.2. Contour line and grid noise map for town of Hatch.

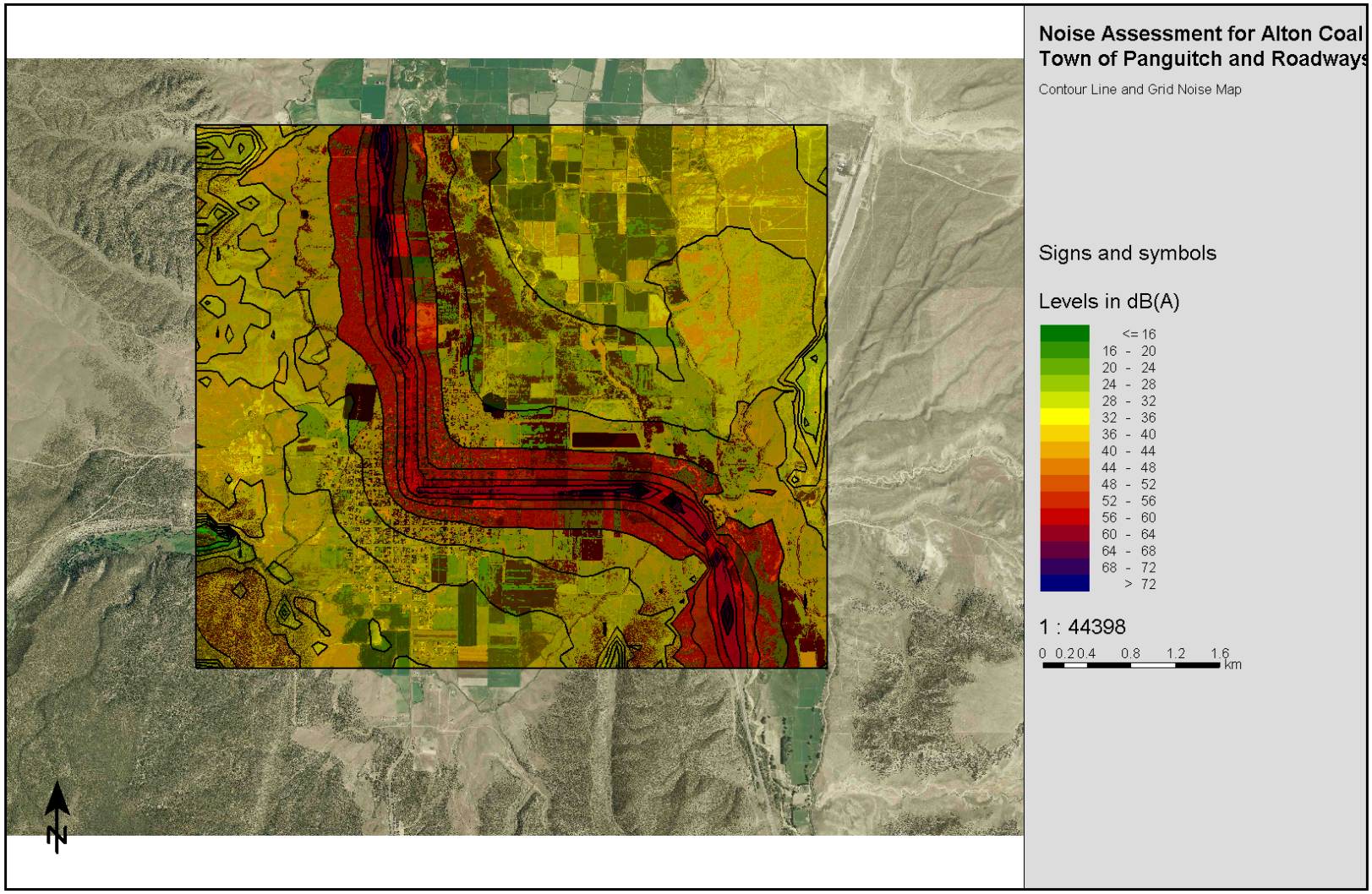

Figure 4.2.3. Contour line and grid noise map for town of Panguitch.

4.2.2.2.2 Blasting Noise and Vibration

Mine blasting can result in substantial vibration. Blasting releases large amounts of energy to fracture, split apart, and/or displace the rock immediately surrounding the explosive charge. The explosive energy released from blasting decreases proportionally with distance to a point where shattering or displacement of the rock no longer occurs. The remaining blasting energy travels through the rock under multiple elastic vibration waveforms (i.e., radial, vertical, and transverse waveforms). Ground vibration at sufficiently high levels can be felt by people or wildlife and can damage buildings. The DOGM requirements in regard to blasting are discussed in Section 2.3.2.4.

Air vibration (or airblast) emissions also result from the pressure or shockwaves emitted during blasting activities. Pressure waves resulting from blasting can quickly increase and decrease the air pressure at a given point from the blast. The airblast noise from blasting can be loud enough to be heard over great distances and even potentially damage the hearing of people or wildlife that are too close to the blast. However, because mine blasting vibrations are both highly transient and occur at a low frequency range, vibrations from mine blasting emissions are generally assessed using empirical equations rather than a computer model. Therefore, equations are used to estimate vibration levels at specific points of interest from blasting emissions.

The analysis conducted for noise and vibration as a result of mine-related blasting assumed the most conservative scenario based on the following factors:

- ACD provided information indicating that the lowest possible maximum charge mass per delay used in blasting would be 17.3 pounds per delay, and that the highest would be 266 pounds per delay. The value of 266 pounds per delay was used in all calculations.
- Calculations assumed the closest possible point of blasting within each mining tract to the closest structure in the town of Alton (as seen on Google Earth).
- The lowest identified regulatory threshold for vibration and airblast noise, human detection, and damage to buildings was used in the discussion for comparison against calculated values.

By using 266 pounds per delay, the shortest distance between two points, and the lowest identified regulatory thresholds for analyzing noise and vibrations as a result of mine blasting, calculated values are presented as worst case scenario impacts and are therefore conservative. Actual impacts would likely be considerably lower than calculated values over the life of the mine.

As discussed in Chapter 3 and the noise modeling report (see Appendix L), the lowest identified threshold for airblast noise at which building damage or human disturbance would be expected is 134 dB linear. The lowest threshold identified at which noise levels from blasting would be barely noticeable for humans is 100 dB linear. The lowest threshold at which building damage could be expected from blasting vibration is 0.5 inch per second. For human awareness of blasting vibration, the threshold varies based on whether or not an individual is outdoors or inside a building. The lowest identified threshold for awareness from blasting vibration outdoors is 0.035 inch per second, whereas the lowest identified threshold of human awareness in buildings is 0.004 inch per second. Table 4.2.4 presents modeled blasting noise and vibration levels alongside regulatory thresholds at various blasting receptor sites for the Proposed Action and its alternatives.

Table 4.2.4. Calculated Vibration Levels at Individual Point Receptors as a Result of Mining on Various Blocks under the Proposed Action and Alternatives

Receptor	Alternative	Distance from Blast (feet)	Threshold Value				Highest Calculated Value	
			Peak Particle Velocity (building damage) (inches per second)*	Peak Particle Velocity (human awareness) (inches per second)†,‡	Sound Pressure Level (building damage) (dB linear)¥	Sound Pressure Level (human awareness) (dB linear)§	Peak Particle Velocity (inches per second)	Sound Pressure Level (dB linear)
50 feet from blast	All Alternatives (Block C, NW, or S)	50	0.5	0.035	134	100	79.8	186
Farview Point (Bryce Canyon)	Alternatives C and K1 (Block C)	65,000	0.5	0.035	134	100	0.0012	90
Yovimpa Point (Bryce Canyon)	Alternatives C and K1 (Block C)	65,000	0.5	0.035	134	100	0.0015	91
Riggs Spring B (Bryce Canyon)	Alternatives C and K1 (Block C)	74,000	0.5	0.035	134	100	0.0015	91
Town of Alton (nearest residence)	Proposed Action (Block NW)	500	0.5	0.004	134	100	2.4	154
Town of Alton (nearest residence)	Alternatives C and K1 (Block C)	5,400	0.5	0.004	134	100	0.065	120
Town of Alton (nearest residence)	Alternative C (Block S)	20,000	0.5	0.004	134	100	0.0088	102

* Data from Chae (1978) and Siskind et al. (1980).

† 0.035 inch/second peak particle velocity for human awareness outdoors (Wiss et al. 1974).

‡ 0.004 inch/second peak particle velocity for human awareness indoors (Jones & Stokes 2004).

¥ MSHA (30 CFR 816.67(b)).

§ Data from Richards and Moore (2009, 1997), and AECOM (2011).

As Table 4.2.4 indicates, blasting noise impacts modeled for the three Bryce Canyon National Park receiver points were either 90 or 91 dB linear, which are well below the 100-dB linear threshold of human awareness. Vibration impacts to Bryce Canyon National Park receiver points analyzed were 0.0012 and 0.0015 inch per second, also below the threshold of human awareness at 0.035 inch per second.

Both noise and vibration impacts from blasting conducted within the mining tract (Block NW) to the closest identified building in the town of Alton would be well in excess of both vibration and noise regulatory thresholds. Damage to buildings may occur, and any persons in the building may experience noise levels in excess of human comfort and regulatory threshold levels (134 dB linear) from blasting.

Blasting noise and vibration calculated from the closest points of mining operation on other mining blocks (Blocks C and S) to the town of Alton indicated vibration levels below those that have the potential to damage buildings under the Proposed Action. However, vibration levels from blasting on Blocks C and S did exceed the lowest identified level for human perception within the building. Additionally, calculated noise levels from blasting on these mining blocks could exceed the threshold for human awareness (100 dB linear for noise; 0.004 inch per second for vibration), but not the threshold for building damage or human annoyance (134 dB linear for noise; 0.5 inch per second).

Impacts from blasting activities are expected to be at or below MSHA maximum limits for the safety of on-site mining personnel because it is assumed that mine operations would comply with MSHA. In addition, the blasting contractor would be responsible for pre-blast and post-blast inspections to establish the minimum safe distance from the blast, and possibly for noise and vibration blast monitoring at structures with the potential to be affected in accordance with MSHA regulations.

In addition to blasting noise and vibration calculated at receptor points, the maximum distance out to which blasting noise and vibration could be expected is calculated in the noise modeling report (see Appendix L). Table 4.2.5 presents the maximum calculated threshold distances out to which these impacts could be expected.

Table 4.2.5. Maximum Airblast Impact Distances

Airblast Threshold Value (noise)		**Impact Distance**
db Linear	**Interpretation**	**Feet (miles)**
134	Lowest threshold at which building damage and human annoyance could be expected	2,057 (0.39)
100	Barely noticeable threshold for human awareness	22,943 (4.3)
Vibration Threshold Value		**Impact Distance**
Inches per second	**Interpretation**	**Feet (miles)**
0.5	Lowest threshold at which building damage could be expected	1,407 (0.27)
0.035	Minimum noticeable threshold for human awareness (outdoors)	3,434 (0.7)
0.004	Minimum noticeable threshold for human awareness (indoors)	33,717 (6.4)

Table 4.2.5 indicates that blasting impacts from airblast overpressure (noise) and vibration under the maximum design scenario for blasting could damage buildings out to a radius from the blast epicenter of approximately 0.39 and 0.27 mile, respectively. The noise from blasting may also be noticeable out to a distance of 4.3 miles from the blast, whereas the vibration may be felt out to 0.7 mile, if outdoors. Someone who is indoors during a blasting event may notice slight disturbances to the building, such as windows rattling or objects shifting, out to a radius of approximately 6.4 miles. These building damage and disturbance levels are for the maximum blasting design scenarios from the Proposed Action, and therefore actual blasting would likely produce less noise and vibration than predicted herein.

The town of Alton, along with most of the residences and sensitive noise receptors, is within approximately 3,000 feet (0.6 mile) of the closest edge of Block NW. Many buildings in the town could, therefore, be damaged from airblast overpressure and/or vibrations from blasting on Block NW. Residents of the town would likely hear and feel the blasts, because most of the town is in the minimal noise and vibration thresholds of disturbance.

Blasting noise and vibration impacts to wildlife including sage-grouse are discussed in Section 4.18.

4.2.2.3 ALTERNATIVE C: REDUCED TRACT ACREAGE AND SEASONAL RESTRICTIONS

In addition to the management prescriptions and considerations common to the action alternatives and additional actions described under the Proposed Action, the tract would be reduced in size under Alternative C to exclude Block NW (the block closest to the town of Alton). In addition, the life of the mine would be 21 years rather than 25, reducing the overall noise and vibration impacts by 4 years.

4.2.2.3.1 Noise Impacts

Because surface-mining operations, including blasting, would occur further away from noise-sensitive receptors in Alton than under the Proposed Action, increases in ambient noise levels would be less than the maximum levels described under the Proposed Action. Because Alternative C excludes Block NW, the highest noise levels in the town of Alton would be 56.6 dBA L_{dn} (from mining in Block C), which is above the EPA standard of annoyance (55 dBA). Noise impacts to receptors in Bryce Canyon (0 dBA) would be the same under Alternative C as the Proposed Action. In addition, roadway impacts to Hatch and Panguitch would be the same as the Proposed Action, because coal haul activities are the same under each alternative.

4.2.2.3.2 Blasting Impacts

Because Alternative C excludes mining in Block NW (the block closest to the town of Alton), vibration impacts to the town would be reduced as compared to the Proposed Action. Under this alternative, 0.065-inch-per-second vibration levels would be felt in Alton during blasting events in Block C (closest to the town, at a 266-pounds-per-delay blast). Blasting in the portion of Block S that is closest to the town of Alton at the same intensity levels would produce vibration levels of 0.0088 inch per second (see Appendix L). This represents a reduction of 2.336 inches per second in Block C and 2.3912 inches per second in Block S when compared to modeled levels of 2.4 inches per second for Block NW.

Under Alternative C, Block C is approximately 5,000–7,500 feet (0.9–1.4 miles) away from buildings in the town of Alton. Based on these distances, blasting would not result in airblast overpressure or vibrations that could damage structures. However, noise levels modeled at 120 dB linear and vibration levels modeled at 0.065 inch per second from blasting in Block C could exceed the lowest identified thresholds (100 dB linear for noise and 0.004 inch per second for vibration) for human awareness, for both noise and vibration. In addition, the life of the mine would be 21 years rather than 25, reducing the overall noise and vibration impacts by four years.

4.2.2.4 ALTERNATIVE K1: REDUCED TRACT ACREAGE

In addition to the management prescriptions and considerations common to the action alternatives and additional actions described under the Proposed Action, under Alternative K1, the tract would be modified to exclude Block NW and Block S (see Map 2.3). In addition, the life of the mine would be 16 years rather than 25, reducing the overall noise and vibration impacts by 9 years.

4.2.2.4.1 Noise Impacts

Noise impacts to the town of Alton under Alternative K1 would be the same as for Alternative C.

4.2.2.4.2 Blasting Impacts

Blasting impacts to the town of Alton under Alternative K1 would be the same as for Alternative C.

4.2.3 Visual Resources

The analysis of impacts to visual resources is an assessment of changes to the landscape caused by the Proposed Action and alternatives. The landscape near the tract is composed of landforms, water features, vegetation, and human modifications to the land. Those modifications include structures and changes to the land, water, and vegetation. The visual resources impacts analysis provides an overview of expected visual impacts as a result of viewshed analyses conducted in the GIS (presented in Section 4.2.3.1), and as a result of a visual resource contrast analysis with discussion of BLM management objectives presented using key observation points (KOPs) in Section 4.2.3.2.

4.2.3.1 VIEWSHED ANALYSIS

The area visible from a specific location is defined as that location's viewshed. A viewshed analysis is a computerized spatial analysis calculation performed in a GIS to determine which portions of a surrounding landscape are visible from a specific location, and vice versa. A viewshed analysis was performed for the tract and surrounding areas using digital elevation models (DEMs, raster files containing an elevation value in each cell of the grid) combined with randomized viewpoint locations. Between 6 and 10 viewshed analysis points in the tract were analyzed for the different action alternatives, resulting in viewshed maps showing visible and nonvisible portions of the landscape (see Map 3.3 and Maps 4.2–4.3) within a 15-mile radius of analyzed track boundaries. Viewshed analysis points were assigned a vertical value of 2 meters above ground elevation to account for an individual's height while standing or traveling in a vehicle. In addition, a viewshed analysis was conducted specifically for Bryce Canyon National Park using ten points, all representing viewpoint locations along the main road that follow the western edge of the park. The results are shown in Map 4.4.

4.2.3.1.1 Alternative A: No Action

Under the No Action Alternative, ACD's application to lease the coal included in the tract would not be approved, and the coal included in the tract would not be mined. The characteristic landscape of the tract would remain unchanged by mining.

4.2.3.1.2 Alternative B: Proposed Action

The viewshed analysis conducted for the Proposed Action used 10 viewshed analysis points positioned on higher elevation areas throughout the tract: one was at the proposed centralized facilities location, and the others were spaced to provide coverage of the proposed mining blocks (except for Block Sa). The results of the analysis (see Map 3.3 and Maps 4.2–4.4) confirm that the tract would not be visible from either

SR-89 or Bryce Canyon National Park under the Proposed Action or alternatives. Within 15 miles of the mine tract under the Proposed Action, the viewshed analysis returned approximately 26,440 acres of "seen" landscape and 542,654 acres of "unseen" landscape. The seen and unseen landscape includes places that could be seen/could not be seen from the tract, and vice versa (places that could see/could not see the tract). In addition, line-of-sight diagrams shown in Figure 4.2.4 show that the Alton Coal Tract is not visible from key viewpoints in Bryce Canyon National Park.

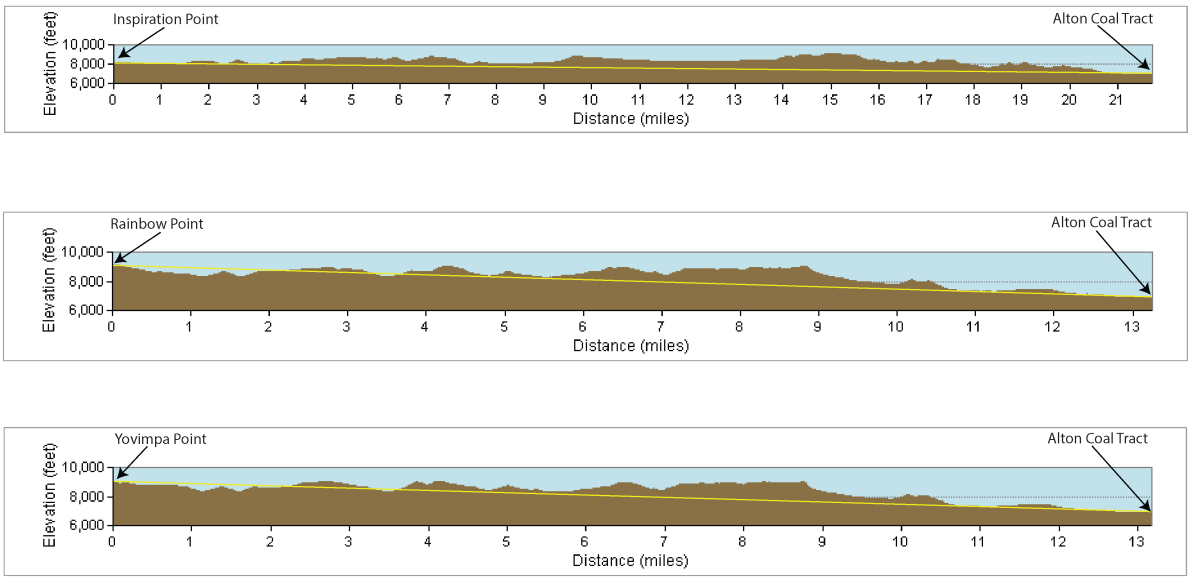

Figure 4.2.4. Elevation cross sections between points in Bryce Canyon National Park and the Alton Coal Tract.

Under the Proposed Action, the tract would be periodically visible from nonmotorized trails in the Dixie National Forest east of the tract. As shown on Map 3.3, the tract would be visible from approximately 3.7 miles of the Grand View trail and 0.9 mile of the Swapp Canyon trail. At an average walking pace of 3 mph, this equates to 1 hour and 14 minutes of impact on Grand View trail and 18 minutes of impact on the Swapp Canyon trail. The height of the surrounding vegetation cover types was not included in the viewshed analysis. Therefore, portions of the trail identified as "visible" in the analysis that also contain intervening trees or shrubbery of sufficient height and density would not be visible from the tract (and vice versa).

Under the Proposed Action, and all other action alternatives, Block Sa (186.2 acres) would not be mined and the lessee would apply pre-mining treatments to the block. The proposed vegetation treatments would aim to remove encroaching woody vegetation such as conifers and be designed to mimic natural appearing edges between vegetation types and to resemble natural openings and clearings in the vegetation patterns such that contrasts in form, line, color and texture would be avoided or minimized so as to meet VRM objectives. If heavy equipment is used to implement treatments, its presence could create visual contrasts, but these would be of short-term duration. In the long term, when stands of various aged vegetation and a less homogeneous mix of vegetation are established, the visual variety created by the Proposed Action could result in a more interesting visual landscape. Treatment areas may be noticeable to the casual observer during implementation and during the short term when dead vegetation or bare ground is visually obvious, but visual resource objectives would be met for the long term.

4.2.3.1.3 Alternative C: Reduced Tract Acreage and Seasonal Restrictions

The viewshed analysis for Alternative C used nine viewshed analysis points: one was at the proposed centralized facilities location, and the others were spaced to provide coverage of the proposed mining blocks (except for Block Sa). Under Alternative C, the viewshed impacts would be the same as under the Proposed Action, except that tract would be periodically visible from the nonmotorized trails in the Dixie National Forest for approximately 2.8 miles (56 minutes of walking) on the Grand View trail and 0.9 mile (18 minutes) on the Swapp Canyon trail (see Map 4.2). In addition, within 15 miles of the mine tract under Alternative C, the viewshed analysis returned approximately 25, 117 acres of "seen" landscape and 533,645 acres of "unseen" landscape.

4.2.3.1.4 Alternative K1: Reduced Tract Acreage

The viewshed analysis for Alternative K1 used six viewshed analysis points: one was at the proposed centralized facilities location, and the others were spaced to provide coverage of the proposed mining blocks. The viewshed impacts would be the same for Alternative K1 as under the Proposed Action, except that tract would be periodically visible from the nonmotorized trails in the Dixie National Forest for approximately 0.9 mile (18 minutes) on the Grand View trail and 0.8 mile (16 minutes) on the Swapp Canyon trail (see Map 4.3). In addition, within 15 miles of the mine tract under Alternative K1, the viewshed analysis returned approximately 20,711 acres of "seen" landscape and 511,433 acres of "unseen" landscape.

4.2.3.2 KEY OBSERVATION POINTS FOR VISUAL RESOURCE CONTRAST ANALYSIS

For each alternative in this section, the analysis is three tiered. The first tier consists of a discussion of changes to the landscape in the tract resulting from the actions prescribed under each alternative. The second tier consists of an assessment of impacts from those same actions as seen from seven KOPs in and near the tract. The KOPs are critical viewpoints of typical landscapes in the tract that have been selected to represent the views of disturbances throughout the life of the mine and that are encountered by the greatest number of people. The third tier consists of an assessment of whether the proposed changes to the landscape would meet the BLM's objectives for management of visual resources, as prescribed in the KFO RMP (BLM 2008b). The location and rationale for the selection of KOPs are identified below. Significant impacts would occur where the results of the Proposed Action and alternatives do not meet BLM objectives.

Seven KOPs were identified to represent typical views of the tract to residents of Alton and visitors to the surrounding area. The KOPs were selected to geographically represent views of the entire tract, to represent views from places where the greatest number of people reside, and to represent views of people traveling through the area (see Appendix N). Each KOP is described below.

KOP 1 is on KFO Route 116 on the east side of the town of Alton. This KOP represents panoramic views of the north area of the tract as seen by residents of Alton, and as seen by visitors traveling through Alton heading south on KFO Route 116.

KOP 2 is at the south end of Main Street in the town of Alton. From this location, the view is south, and looks on the area proposed for underground mining activities. This location represents views of Alton residents and views of ranchers working in agricultural fields between Alton and the tract. The views from this KOP are of agricultural fields directly south of Alton and include the mountains and rolling hills across the tract. Views are wide open and panoramic, with few obstructions.

KOP 3 is at the north end of Main Street in the town of Alton. From this location, the view is south and east and looks on a larger portion of the area proposed for mining activities compared to KOP 2. The views from this KOP are of structures in Alton and include the mountains and rolling hills across the tract. The homes, trees, and fence lines of Alton occur in the foreground. The rolling hills in the tract and surrounding mountains are in the middleground and background. Views are generally wide open, but include some obstructions in the town of Alton.

KOP 4 is along KFO Route 116 south of Alton. From this location, the view is to the north and west and looks on the broad sweeping hills of the tract. Sagebrush and sparse juniper dominate the foreground. The rugged horizon line of the surrounding low mountains and the Paunsaugunt Plateau are in the middleground and background. This location represents the views of people traveling north on KFO Route 116 through the tract.

KOP 5 is at a road junction along KFO Route 116 south of Alton. From this location, the view is to the south and looks on the broad sweeping hills of the tract. Low sagebrush, a narrow drainage channel, fence lines, patchy stands of juniper, and the curving road are in the foreground. The low and rugged horizon line of the Paunsaugunt Plateau occurs in the middleground and background. This location represents the views of people traveling south from Alton on KFO Route 116 through the tract.

KOP 6 is at a cattle guard and fence line along KFO Route 116 south of Alton. From this location, the view is to the north and looks on the town of Alton and the tree-covered terrain sweeping down into the tract. Juniper post fence lines in various directions and the curving road are in the foreground. The homes and taller trees in the town of Alton occur in the middleground. Background views are of distant, low-rising mountains. This KOP represents the views of people traveling north toward Alton on KFO Route 116 through the tract.

KOP 7 is along KFO Route 116 at the far south edge of the tract. From this KOP, the view is to the north and looks on the broad open meadows and tree-covered hills of the south portion of the tract (Block S). Fence lines, homesteads, and the curving road are in the foreground. The fans and washes descending from the Paunsaugunt Plateau appear in the middleground. Background views are of the steeper, rugged plateau itself. This location represents the views of people traveling into the tract from the south on KFO Route 116.

A visual contrast rating worksheet (BLM Form 8400-4) was prepared to analyze the effects that the proposed tract would have on the characteristic landscape, as viewed from each KOP. The analysis looked at the actions that would have the most potential to affect (change) the landscape under the action alternatives (Proposed Action, Alternative C, and Alternative K1). Those actions include surface-mining operations, installation of centralized facilities, installation of dispersed facilities, relocation of KFO Route 116, and surface rehabilitation. The analysis also looks at the actions that would continue under the No Action Alternative and how they affect the landscape. Under the No Action Alternative, existing uses and management actions would continue, including livestock grazing, back country driving, hunting, and vegetation treatments to maintain or improve livestock forage, wildlife habitat, and watershed condition, and to reduce unwanted wildfire. This analysis provides for comparison between the action alternatives and the No Action Alternative. See Appendix N for visual contrast ratings and site photographs.

4.2.3.2.1 Alternative A: No Action

Under the No Action Alternative, ACD's application to lease the coal included in the tract would not be approved, and the coal included in the tract would not be mined. The characteristic landscape of the tract would remain unchanged by mining.

Under this alternative, however, existing uses would continue. Under the KFO RMP (BLM 2008b), the BLM would continue to implement vegetation treatments in pinyon-juniper and sagebrush vegetation communities. Removal of pinyon and juniper trees and dense sagebrush would create changes in the form of each vegetation community, introducing openings in continuous stands of vegetation. The growth of shrubs and grasses in the openings of pinyon-juniper woodlands and creation of mixed-age stands of sagebrush would introduce variety in the form, texture, and color of the vegetation communities. It would also introduce noticeable curvilinear lines in the pinyon-juniper woodlands. The creation of a harmonious variety in the landscape would result in a more visually pleasing scene.

4.2.3.2.2 Alternative B: Proposed Action

Under the Proposed Action, the tract would encompass 3,576 acres, of which 2,280 acres are federal surface and mineral estate and 1,296 acres are split estate: private surface estate and federal mineral estate. Approximately 2 million TPY (MMTPY) of coal would be mined once topsoil stockpiling and initial overburden removal has occurred. Reclamation would be concurrent with mining over the course of the estimated 25-year mine life and would be followed by a minimum 10-year reclamation and revegetation monitoring period.

Surface-mining operations would result in 1,750 acres of pit disturbance occurring at different times over the life of the mine. At any time during the life of the mine, active surface operations would only involve approximately 120 acres (one open pit). Pits would be up to 200 feet deep, and the associated highwall would be up to an additional 600 feet wide. Surface-mining operations would result in a noticeable contrast in landform, line, and color as the natural topography is altered, as vegetation is removed, and as soils that are lighter in color are exposed. The low-rising hills dissected by shallow drainages throughout the tract would be altered during the excavation of pits and construction of highwalls. At any one time, up to 120 acres of rolling terrain common through the tract would be leveled, resulting in a contrasting long, straight horizontal line. Vegetation with varying shapes, colors, and heights would be cleared down to bare soil, removing those varying colors, and leaving a geometric, angular break (lines) in the vegetation. Additionally, at any one time during the 25-year mine life, closed pits would be in various stages of reclamation. Reclamation activities would reduce linear contrasts in topography by recontouring pits to a more natural sweeping line. Additionally, contrasts in texture and color of soil and vegetation would be reduced through revegetation with approved seed mixes.

Under the Proposed Action, views of the tract and areas surrounding the tract could be affected by mine-related subsidence on the tract. Estimated surface impacts due to subsidence from underground mining for all alternatives are projected to be approximately 613 acres on the tract and 166 acres outside the tract. The level of subsidence generally depends on the thickness of the coal extracted and the thickness of the overburden, as well as other geological factors. Subsidence could impact the topography of the area mined, creating visual impacts. At this time, there are not enough details known about these potential mining activities to estimate the level of subsidence that would result. The visual impact from subsidence would generally be small when compared to the surface disturbance caused by surface mining.

The centralized facilities on the tract would be constructed on approximately 36 acres of public land. These facilities would consist of an office, maintenance shop, equipment wash bay, oil and fuel storage tanks, oil and fuel storage containment, truck unloading and coal sizing area, coal stockpile area, and truck loadout area. The buildings and other facilities would result in a noticeable contrast in landform, line, color, and texture on the landscape of that portion of the tract. In the long term, vegetation clearing would introduce a break in the medium/coarse texture and color of the tract. Additionally, construction of centralized facilities would introduce boxy, geometric shapes, hard edged lines, smooth textures, and contrasting colors into the natural, rolling terrain of the tract.

Dispersed facilities necessary to conduct mining operations would consist of temporary light-use roads and haul roads, electrical poles and lines, various temporary ponds/water control structures, temporary topsoil and overburden stockpiles, and temporary berms and screens. These facilities would result in approximately 160 acres of disturbance. Construction of dispersed facilities, including roads, transmission lines, ponds and other water-control structures, stockpiles, and berms, would result in short-term changes to the landscape. Road construction would result in leveling of the landform, including some degree of cutting and filling. This would create horizontal lines and bench-like forms in the landscape. Ponds, water-control structures, and berms would introduce horizontal and angular lines and low, mesa-shaped forms to the landscape. Topsoil and overburden stockpiles would introduce angular lines and conical forms to the landscape. Vegetation clearing for road construction would introduce curvy lines through relatively dense pinyon-juniper woodlands and dense stands of sagebrush, and it would expose varying (often lighter) soil colors. Construction of power lines would introduce vertical lines to the landscape. Following mine operations, however, these facilities would be removed from the site, and disturbances would be reclaimed to their approximate original condition. In the short term, during construction, clearing would change the form and texture of vegetation cover. Currently, most of the tract has a continuous cover of varying vegetation types, including perennial grasses and low gray-green shrubs interspersed with patches of dark green pinyon pine and juniper trees. Clearing would introduce breaks in the medium-textured element of the environment. As the dispersed facilities are relocated, if vegetation with larger shrubs and trees is reestablished, the texture would return to its original condition and the change in vegetation form would revert to its original condition. If the clearings in woodlands are managed for shrubs and grasses following relocation of the dispersed facilities, changes in the form of the pinyon-juniper woodland would remain, and smaller shrubs and grasses would introduce softer textures and new colors to the landscape. These variations in the continuous vegetation cover would add variety to the landscape and new interest and appeal to the scene.

Actions proposed to prevent, minimize, and rehabilitate landscape disturbance consist of recontouring pits to a more natural topography and restoring vegetation with BLM-approved species. At any given time throughout the 25-year life of the mine, 120 or more acres would be in some stage of reclamation. The rehabilitation of disturbances by recontouring pits and planting vegetation would result in a less-developed landscape that more closely resembles the surrounding undisturbed areas.

KOP 1–3. Actions proposed in the tract under the Proposed Action that would be visible from KOPs 1, 2, and 3 consist of surface-mining activities, underground mining activities, dispersed facilities, and rehabilitation of disturbances. These actions would have the same effects on the characteristic landscape as those described above.

KOP 4. Actions proposed in the tract under the Proposed Action that would be visible from KOP 4 consist of surface-mining activities and dispersed facilities. These actions would have the same effect on the characteristic landscape as described above.

KOP 5. Actions proposed in the tract under the Proposed Action that would be visible from KOP 5 consist of surface-mining activities, centralized facilities, and dispersed facilities. These actions would have the same effect on the characteristic landscape as described above.

KOP 6–7. Actions proposed in the tract under the Proposed Action that would be visible from KOPs 6 and 7 consist of surface-mining activities and dispersed facilities. These actions would have the same effect on the characteristic landscape as described above.

Under the Proposed Action, mining and construction of related facilities would noticeably change the landscape. However, as the 120-acre tracks of coal are removed and rehabilitated, the existing character of the landscape would be gradually restored. Depending on the BLM's objectives for management of vegetation, portions of the tract would eventually return to their original vegetation communities, and other parts would be

reestablished to meet other objectives. The KFO RMP prescribes vegetation treatment areas with priority given to wildlife habitat. Incorporating this plan decision into the mine reclamation plan could result in returning pinyon-juniper woodlands to a mix of woodlands with openings of sagebrush and grasses. It may also include converting old-growth sagebrush stands to a mix of age classes. These mining rehabilitation objectives would result in changes to the vegetation component of the landscape, and introduce some variety and appeal to the landscape scene. Under the No Action Alternative, no mining would occur, but the vegetation treatment objectives of the KFO RMP would continue to be implemented, resulting in the same long-term effect on the visual resources (landscape) of the tract. Thus, in the short term and mid-term, the Proposed Action would result in noticeable changes to visual resources. In the long term, the effect of the actions anticipated under the Proposed Action and the actions anticipated under No Action would have similar effect on the landscape scene—the creation of more variety and visual appeal.

4.2.3.2.3 BLM Visual Resource Inventory and Visual Resource Management Objectives

Under the Proposed Action, the level of change to the landscape was determined to be moderate to strong, based on the visual resource contrast analysis, and proposed activities were determined to be consistent with objectives. Although surface-mining activities would be apparent on the landscape, they would occur in the short term and would be reclaimed upon completion. Development of centralized and dispersed facilities would occasionally be visible on the landscape from KOPs during the active mining period. Dispersed facilities would be relocated throughout the tract during the active mining period and their disturbances reclaimed. Dispersed and centralized facilities would be entirely removed from the tract at the end of the active mining period and the disturbances reclaimed. Because the level of landscape change resulting from actions proposed under this alternative would be consistent with VRM Class IV objectives, it would not reach a level of significance. See Appendix N for visual contrast ratings.

4.2.3.3 ALTERNATIVE C: REDUCED TRACT ACREAGE AND SEASONAL RESTRICTIONS

Under Alternative C the tract would be modified to exclude Block NW (the block closest to the town of Alton). The modified tract encompasses 3,173 acres, of which 2,280 acres are federal surface and mineral estate and 893 acres are split estate: private surface estate and federal mineral estate.

Under this alternative, 1,662 acres of surface disturbance would occur in the tract. Of this, 1,454 acres would be the result of surface-mining operations. Centralized facilities associated with mining activities in the tract would be in the same area, would occupy the same acreage (36 acres), and would include the same items as the Proposed Action. Impacts from dispersed facilities necessary to conduct mining operations would also be the same as the Proposed Action, except that fewer acres (135 acres) would be required.

Contrasts in landform, line, color, and texture would be the same as described under the Proposed Action but would occur on 321 fewer acres (the acreage of Block NW) than the Proposed Action and over a shorter amount of time (21 years). Additionally, the tract would be modified to exclude 321 acres from mining those areas closest to Alton. This would result in less apparent contrast from KOPs in Alton due to the greater distance between Alton and the nearest disturbance. Due to sage-grouse timing restrictions, no surface-disturbing actions would be allowed between March 15 and July 15 in Block S. To allow work to continue year-round, two simultaneously open pits would be required. At any one time during the life of the mine, active and suspended mining operations would involve up to 240 acres (two pits) or double the level of visual contrast associated with the Proposed Action. Additionally, this would necessitate a 40- to 60-acre permanent EODA. In the long term, disturbances including the EODA would be recontoured and reclaimed to a more natural condition.

KOP 1–3. Actions proposed in the tract under Alternative C that would be visible from KOPs 1, 2, and 3 consist of surface-mining activities, dispersed facilities, and rehabilitation of disturbances. These actions would occur in the middleground, and because of the distance involved, the contrast would not be as apparent as under the Proposed Action.

KOP 4, 6, and 7. Actions proposed in the tract under Alternative C that would be visible from KOPs 4, 6, and 7 consist of surface-mining activities, dispersed facilities, and rehabilitation of disturbances. These actions would have the same effect on the characteristic landscape as described above.

KOP 5. Actions proposed in the tract under Alternative C that would be visible from KOP 5 consist of surface-mining activities, centralized facilities, and dispersed facilities. These actions would have the same effect on the characteristic landscape as described above.

4.2.3.3.1 BLM Visual Resource Inventory and Visual Resource Management Objectives

The level of change to the landscape in the long term under Alternative C is less than that described under the Proposed Action. Surface-mining activities would remain apparent on the landscape, but would occur over less acreage than the Proposed Action and at a greater distance from KOPs in the town of Alton. Just as in the Proposed Action, open pit mines would occur in the short term, but would cover twice the acreage at any one time in the process as the Proposed Action. Unlike the Proposed Action, an additional 40 to 60–acre EODA would be required where more than one pit is excavated. In the short term, the EODA would introduce horizontal and angular lines, a blocky, rectangular form, and a coarser texture to the landform of the landscape. Measures to restore more natural characteristics and to further reduce contrasts with the current landscape are included under this alternative and are the same as under the Proposed Action. These measures would be applied to the EODA as well as other surface disturbances. As under the Proposed Action, development of centralized and dispersed facilities would occasionally be visible on the landscape from KOPs. Likewise, resulting under this alternative, the level of landscape change would be consistent with VRM Class IV objectives, and would not reach a level of significance.

4.2.3.4 ALTERNATIVE K1: REDUCED TRACT ACREAGE

Under Alternative K1, the tract would be modified to exclude Block NW (the block closest to the town of Alton) and Block S (see Map 2.3). Under this alternative, recoverable portions of in-place coal reserves would be mined over approximately 16 years. The modified tract would reduce tract acreage to encompass 2,114 acres, of which 1,227 acres are federal surface and mineral estate and 887 acres are split estate: private surface estate and federal mineral estate.

Under this alternative, 1,005 acres of surface disturbance would occur in the tract in the form of vegetation removal. Of this, 861 acres would be the result of surface-mining operations. Centralized facilities associated with mining activities in the tract would be responsible for 36 acres of surface disturbance, whereas 92 acres would be impacted by dispersed facilities necessary to conduct mining operations. Finally, the relocation of KFO Route 116 in the tract would remove approximately 16 acres of vegetation.

Contrasts in landform, line, color, and texture would be the same as described under the Proposed Action but would occur on 745 fewer acres (the combined acreages of Block NW and Block S) than the Proposed Action and over a shorter amount of time (16 years). Additionally, the tract would be modified to exclude 321 acres from mining in areas closest to Alton. This would result in less apparent contrast from KOPs in Alton due to the greater distance between Alton and the nearest disturbance. Under Alternative K1, there would be a single open pit (approximately 120 acres), and at any one time, there would be approximately 120 acres of open surface-mining pit disturbance and an additional 120 or more acres in some stage of reclamation, the same as in the Proposed Action. Reclamation would be concurrent with mining over the course of the

estimated 16-year mine life and would be followed by an up to 10-year reclamation and revegetation monitoring period, with reclamation activities potentially extended for some pits due to timing restrictions for sage-grouse. Impacts are reported in terms of total acres of disturbance over the life of the mine, but note that this disturbance would not all occur at one time.

KOP 1–3. Actions proposed in the tract under Alternative K1 that would be visible from KOPs 1, 2, and 3 consist of surface-mining activities, dispersed facilities, and rehabilitation of disturbances. These actions would occur in the middleground, and because of the distance involved, the contrast would not be as apparent as under the Proposed Action.

KOP 4, 6, and 7. Actions proposed in the tract under Alternative K1 that would be visible from KOPs 4, 6, and 7 consist of surface-mining activities, dispersed facilities, and rehabilitation of disturbances. These actions would have the same effect on the characteristic landscape as described above.

KOP 5. Actions proposed in the tract under Alternative K1 that would be visible from KOP 5 consist of surface-mining activities, centralized facilities, and dispersed facilities. These actions would have the same effect on the characteristic landscape as described above.

4.2.3.4.1 BLM Visual Resource Inventory and Visual Resource Management Objectives

Similar to Alternative C, the level of change to the landscape in the long term under Alternative K1 would be less than that described under the Proposed Action. Surface-mining activities would remain apparent on the landscape, but would occur over less acreage than the Proposed Action and at a greater distance from KOPs in the town of Alton. As under the Proposed Action, development of centralized and dispersed facilities would occasionally be visible on the landscape from KOPs. Likewise, resulting under this alternative, the level of landscape change would be consistent with VRM Class IV objectives, and would not reach a level of significance.

4.2.4 Nighttime Lighting and the Extent of Skyglow

The analysis of impacts to the natural lightscape is an assessment of changes in brightness of the night sky caused by the Proposed Action and alternatives. A natural lightscape is characterized by the natural rhythm of sun and moon cycles, clean air, and of dark nights unperturbed by artificial lights. Changes to natural lightscapes result from changes in air quality and changes in sources of artificial lighting. See Section 4.17.4.2.5 for a discussion of the effects of nighttime lighting on wildlife.

A computer model developed by Dark Sky Partners and based on the Garstang model for calculating sky brightness arising from artificial lighting was used to assess the impacts caused by the Proposed Action and alternatives on the night skies viewed from Brian Head Peak and Yovimpa Point.

The BLM has no objectives for management of natural lightscapes or dark skies. NPS policy is to preserve the natural lightscapes of parks to the greatest extent possible. The NPS worked directly with Dark Sky Partners to verify all model input parameters, especially atmospheric clarity. It is the practice of the NPS to evaluate impacts based on the best 20% of air quality conditions as recorded during night sky monitoring. The NPS believes that such conditions provide the best opportunity for visitors to experience the view of the starry sky, and therefore that is where their cost-limited scientific efforts are focused.

For each alternative, this impacts analysis assesses whether the changes in artificial lighting and air quality would meet NPS objectives to preserve dark night skies and the natural lightscape surrounding the parks. Actions that result in a long-term reduction in night sky conditions as observed from Brian Head Peak and Yovimpa Point would result in significant impacts to the natural lightscape. The NPS considered points in Zion National Park also, however, due to its proximity to St. George, Utah and Las Vegas, Nevada night skies are brighter at Zion National Park than Bryce Canyon National Park and Cedar Breaks National Monument. In

addition, most of the visitation experience in Zion National Park occurs at lower elevations and in the steep walled canyons of Zion Canyon, where the major park facilities and most popular recreational opportunities are located. Though Zion Canyon takes up only 5% of the landmass of the park, most of visitation occurs within it. This minimizes the amount of potential light pollution visible from the tract and thus the potential impact to the visitor experience. The brightness of light from the tract under this alternative would be greatest on the horizon of the nighttime sky in the direction of the mine. As a person's view moves in an arc from the horizon to vertical overhead, the presence of the light from the tract decreases, as does its effect on the darkness of nighttime skies. Given the depth and steepness of the canyons of Zion National Park, the view of the nighttime sky is near vertical to vertical. That said, most of the park's landmass (95%) consists of table lands: mesas and higher elevation backcountry areas that sit above Zion Canyon's walls (Zion's Kolob and Plateau ranger districts). These areas, though they experience lower visitation with most recreation activities requiring a backcountry permit, would be subject to a higher potential of visible light pollution from the tract as well as from other non-natural sources. Any perceived change in night sky conditions as viewed from within the canyons of Zion National Park would be proportionately less when compared with the existing conditions viewed from table lands and other lands adjacent to and within the park (Moore 2008).

The BLM received comments on the DEIS regarding the need to address impacts to skyglow from mine-generated dust, and impacts to overall sky brightness (not just to a specific sky segment). Following publication of the DEIS, the BLM reconvened the Night Sky Working Group (comprising cooperating agencies such as the NPS) to respond to comments on the DEIS, update the modeling and analysis approach and technical report, and suggest mitigation measures to reduce night sky impacts to the region and Zion National Park, Bryce Canyon National Park, and Cedar Breaks National Monument. The updated analysis in Appendix J includes impacts of mine-generated dust on skyglow as seen from Yovimpa Point, increased skyglow from population growth in the region through the year 2040, and finally a new measure, ASL, was calculated to illustrate the brightness quality of the entire hemisphere of the sky.

4.2.4.1 ALTERNATIVE A: NO ACTION

Under the No Action Alternative, ACD's application to lease the coal included in the tract would not be approved, and the coal included in the tract would not be mined. No impacts to night sky conditions over the tract or over Bryce Canyon National Park would result from coal mining under the No Action Alternative.

Under this alternative, however, existing land uses would continue, including livestock grazing, backcountry driving, hunting, and vegetation treatments. Although it has not been quantified, PM released into the sky in smoke from prescribed fire used to treat vegetation communities would temporarily increase the diffusion of artificial light in the nighttime sky, and result in infrequent and intermittent increases in skyglow. Population growth in the region is anticipated to increase skyglow by approximately 66% by 2040 (see Appendix J). Section 4.19 provides more detail on regional impacts due to projected population growth.

4.2.4.2 ALTERNATIVE B: PROPOSED ACTION

Under the Proposed Action, surface-mining operations would result in 1,993 acres of surface disturbance occurring at different times over the estimated 25-year mine life. Surface-mining operations and motorized travel through the tract would result in artificial nighttime lighting combined with increased airborne PM.

4.2.4.2.1 Artificial Lighting Sources

Three types of artificial lighting sources proposed for use during nighttime operations are discussed in this analysis: 1) portable lighting towers for use at the mine pit during active nighttime mining; 2) fixed light towers to be used for lighting centralized mine facilities; and 3) mobile light sources generated by

vehicles, mining equipment, and flashlights. One to six portable light towers would be located at each active pit. Portable light towers would be diesel powered with approximately four individually shielded metal halide (MH) lamps per tower. Each portable light tower would be approximately 30 feet tall, oriented approximately 30 degrees from the horizontal down toward the ground, and would be moved in accordance with the mining sequence. Four to six fixed-position light poles would be permanently located at the 36-acre centralized mine facilities for the life of the mine. Fixed-position light poles would have a similar height and orientation as the portable light towers but would use fully shielded lamps (Figure 4.2.5). Additionally, mobile equipment lighting would come from headlights, brake lights, flashlights, and other safety lighting on mechanical equipment used during nighttime mining operations.

4.2.4.2.1.1 Lamp Shielding and Aiming

Lamp shielding and aiming reduce uplight, light spill, and light trespass. A fully shielded light fixture is a light fixture constructed in such a manner that all light emitted by the fixture is projected below the horizontal, typically by placing a barrier at the top of the fixture above the lamp (bulb) (Davis 2013) (Figure 4.2.5). Aiming light simply means to position the lamp in such a way that light travels in a specific direction and highlights a targeted object or work surface. In addition, certain lamp types are better at aiming than others. Fully shielding fixtures is considered a type of aiming, because fully shielded fixtures aim the lamp's light toward the ground and below the horizontal.

Figure 4.2.5. Differences in unshielded and fully shielded lamps[2] (Davis 2013).

Three scenarios are used in this analysis to describe potential impacts to sky brightness across a range of nighttime lighting scenarios from Yovimpa Point, which is in Bryce Canyon National Park approximately 21 km from the tract. The current three-scenario approach evolved from the prior analyses' two approaches (referred to as the "typical case" and the "brightest case") to add a third, brighter case (see notes below):

1. Scenario 1 assumes the least lighting with one portable light tower (4 lamps), four fixed-position light towers, and 20 lamps from mobile light sources (this is referred to as the "typical case" in prior analyses).
2. Scenario 2 assumes a mid-range of lighting with three portable light towers (12 lamps), six fixed-position light towers, and 36 lamps from mobile light sources (this is referred to as the "brightest case" in prior analyses).

[2] The intent of the photographs presented in Figure 4.2.5 is to illustrate the general concept of lamp shielding. The reduction in light from fully shielding lamps in the photograph does not represent the amount of light reduction that would result from shielding lamps on the mine tract.

3. Scenario 3 assumes the most lighting with six portable light towers (24 lamps), six fixed-position light towers, and 36 lamps from mobile light sources.

Portable and fixed-position light towers would result in the greatest addition to artificial light under the Proposed Action. Fixed-position lights at the centralized mine facilities would use 250-watt MH lamps producing up to 25,000 lumens each. The fixed lights would be fully shielded, and no light would be emitted upward. The portable lights would use 1,000-watt MH lamps producing 110,000 lumens each and partially shielded. MH lamps are the most commonly used lamp at mine sites. Despite having the highest impact to skyglow as compared to other lamp types in regard to visual astronomical observation, they are ideal for use in mine pits due the color rendition provided, which is critical to safety. MSHA safety regulations require adequate nighttime lighting (see Section 4.2.5). Portable lights are adjustable, allowing them to be aimed in different directions and at different angles relative to the horizon. For the purpose of analysis, Dark Sky Partners assumed that portable lights would typically be aimed at 30 degrees below the horizon, directing 30% of light upward (see Appendix J) for Scenario 1. In contrast, the brighter case scenarios (2 and 3) consider that the portable lights are aimed horizontally more of the time, producing a larger uplight fraction (0.50). Equipment and vehicle lighting would represent a small contribution to artificial lighting.

Each scenario described above characterizes night sky brightness from zenith angles from 80° to 89° to the horizon in the direction of the mine from Yovimpa Point. A zenith angle of 80° corresponds to an altitude of 10° above the horizon, and a zenith angle of 89° corresponds to an altitude of 1° above the horizon. See Table 4.2.6 for a calculation of total lumens and percentage increase in night sky brightness under each scenario and Figure 4.2.6 for a depiction of lumens uplight sources.

Table 4.2.6. Nighttime Lighting Scenarios: Percentage Increase in Sky Brightness

Scenario	Total Initial Lumens from Portable, Mobile, and Fixed Sources	Uplight Lumens Output from Portable*, Mobile†, and Fixed‡ Sources	Downlight Lumens Output from Portable, Mobile, and Fixed Sources	Uplight Reflection Lumens Output	Net Uplight Lumens Output¥	Percentage Increase in Sky Brightness at Zenith Angle of 80° (10° above the horizon)	Percentage Increase in Sky Brightness at Zenith Angle of 89°(1° above the horizon)§
1	740,000	154,000	586,000	87,900	241,900	1%	10%
2	1,830,000	699,600	1,130,400	169,560	869,160	3%	31%
3	3,150,000	1,359,600	1,790,400	268,560	1,628,160	8%	136%

* Uplight fraction for portable light towers is 0.301 (for Scenario 1) or 0.0502 (for Scenarios 2 and 3).

† Uplight fraction for mobile light sources is 0.11.

‡ Uplight lumens for fixed light towers (uplight fraction of 0.00) would be 0 lumens in each scenario.

¥ Net uplight lumens are calculated by adding uplight lumens output and uplight reflection lumens output.

§ Results at extreme zenith angles are increasingly less robust.

The first scenario of lighting conditions would brighten the sky by approximately 1% at a zenith angle of 80° (or an altitude of 10° above the horizon), increasing to 10% at a zenith angle of 89° (1° above the horizon). Lighting Scenario 2 would brighten the sky by approximately 3% at an altitude of 10° above the horizon and 31% at 1° above the horizon. The last and brightest scenario (3) would increase sky brightness by approximately 8% at an altitude of 10° above the horizon and 136% at 1° above the horizon (see Appendix J).

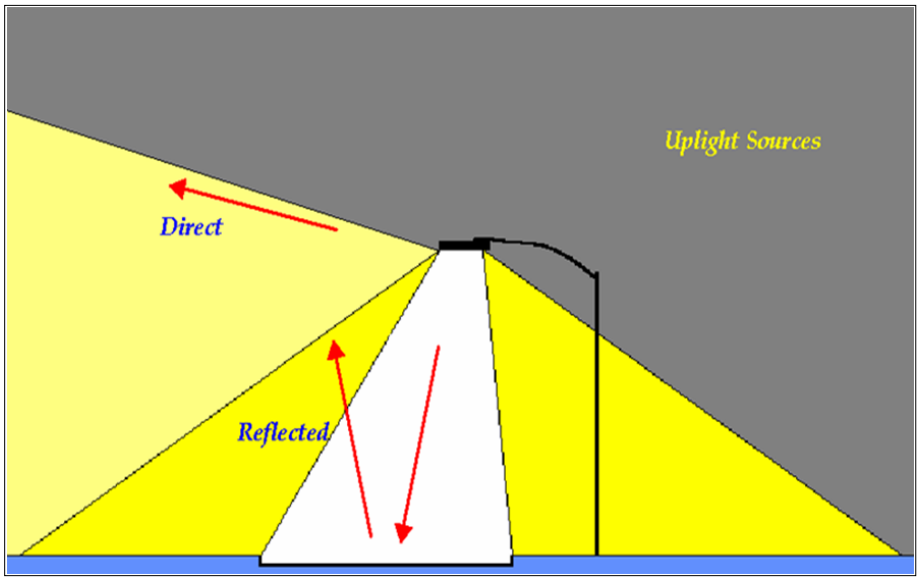

Figure 4.2.6. Uplight sources[3].

4.2.4.2.2 Particulate Matter

PM from surface-mining actions on up to 120 acres at any given time and from motorized travel on dirt surface roads could impact skyglow. Carr (Carr 1989) states that the addition of dust further diffuses artificial lighting through the night sky, resulting in a less bright but more extensive skyglow (Carr 1989).

As a result of comments received on the DEIS, Dark Sky Partners modeled impacts to skyglow as seen from Yovimpa Point from dust expected to be generated by tract operations. The computer code was modified to model mine-generated dust as being a cylinder over the mine pit assumed to be 1 km in radius, 200 meters high, and centered over the mine pit. The model also increased the particulate component of the atmosphere within this cylinder relative to the surrounding atmosphere. For the purposes of including dust, the cylinder was assumed to have a K value of 2 (a K value is the parameter that describes the amount of aerosol [particulates] in the atmosphere). A K value of 2 was chosen to represent increased dust from the mine because it is representative of other mine scenarios. The K value of the surrounding air was set to 0.05, which is representative of the exceptionally clear skies in the region (0.05 is an NPS-measured value and was used in Dark Sky Partners's 2009 model; see Appendix J). The average western air has a K-value ranging from approximately K = 0.3–0.5.

As detailed in the updated report in Appendix J, the addition of dust over the tract would cause a slight decrease in the predicted overall sky brightness, and a slight increase in predicted sky brightness directly above the tract. This is compared to the predicted increase in overall skyglow without dust enhancement over the tract in Dark Sky Partners's original report (see Appendix J). The change in skyglow due to the

[3] Figure 4.2.6 is presented to illustrate various uplight sources conceptually and is not intended to represent the various uplight angles from various mine light sources described in the text.

addition of dust would be very small for all zenith angles, resulting in a predicted reduction in the sky brightness increase at a zenith angle of 89º toward the tract from 10% to 9.7% (a decrease of 0.3%) for lighting Scenario 1, from 31% to 30% (a decrease of 1%) for Scenario 2, and from 64% to 62% (a decrease of 2%) for Scenario 3 (DSP 2014). In terms of impacts to Bryce Canyon, it is expected that the dust over the tract would increase the brightness of the sky above the tract as seen by observers at Yovimpa Point due to increased scattering of light (see Appendix J).

4.2.4.2.3 Average Sky Luminance

ASL was calculated to illustrate the brightness quality of the entire hemisphere of the sky instead of just a particular segment of the sky. The fundamental quantity that the ASL calculates is the luminance of the sky as seen from the observer's location. Luminance is the brightness per unit area of the sky (typically measured in units of nanoLamberts (nL), or mag/arcsec^2). The computer code calculates this luminance on a grid of positions covering the hemisphere of the sky, and a separate calculation then integrates over the grid to find the ASL. For Yovimpa Point calculations, the grid was set with 80 points uniformly spaced in azimuth (0–360 degrees) and 20 points in elevation (0–90 degrees), for a total of 80 × 20 = 1,600 points (see Appendix J). The calculated ASL can be compared with one derived from measurements made by the NPS night sky team as described below. The results are shown in Table 4.2.7.

Table 4.2.7. Average Sky Luminance in NanoLamberts for 2010 Conditions (no mine), Three Cases with Mine Lighting using 2010 Population Numbers, and Two Future (2040) Cases showing both Standard and Optimistic Parameters for 2040 Town Lighting

Scenario and Parameters	Natural Lighting	Mine Lighting	Lighting from Towns	Total Artificial Lighting	Total Present Lighting	Total Percentage Lighting Increase over Present	Total Percentage Lighting Increase over Natural
2010, no mine	71.19	0.00	1.92	1.92	73.11	0.0%	2.7%
2010, ACT Scenario 1	71.19	0.14	1.92	2.06	73.25	0.2%	2.9%
2010, ACT Scenario 2	71.19	0.52	1.92	2.44	73.63	0.7%	3.4%
2010, ACT Scenario 3	71.19	0.99	1.92	2.91	74.10	1.4%	4.1%
2040, ACT Scenario 2, standard parameters	71.19	0.52	4.01	4.53	75.72	3.6%	6.4%
2040, ACT Scenario 2, optimistic parameters	71.19	0.52	2.91	3.43	74.62	2.1%	4.8%
2040, ACT Scenario 3, standard parameters	71.19	0.99	4.01	5.00	76.19	4.2%	7.0%
2040, ACT Scenario 3, optimistic parameters	71.19	0.99	2.91	3.90	75.09	2.7%	5.5%

The NPS estimate of the ASL due to artificial lighting at Yovimpa Point shows significant uncertainty due primarily to uncertainty in the natural skyglow, which varies both temporarily and spatially. Subtracting the natural skyglow model developed by the NPS from their Yovimpa Point observations to find the ASL contribution from towns gives values ranging from 1.1 nL to 5.4 nL, depending on the estimate used for the natural airglow. Hence, the Dark Sky Partners modeled value of 1.92 nL for the 2010 towns' contribution is within the range of the NPS estimate. See Appendix J for more detail.

The Air Resources section of Chapter 4 has been updated in the SDEIS to include elemental carbon (EC) in the calculations related to PM. As discussed in this section, the maximum impacts inside of Bryce Canyon National Park from increases in PM and NO_x associated with potential mine plumes under the Proposed Action would be less than the VISCREEN acceptance criteria for both color change (Delta E) and contrast (see Table 4.3.14).

4.2.4.2.4 Viewshed Analysis and Nighttime Lighting

To address the concern over the potential direct visibility of light fixtures in the tract from Bryce Canyon National Park and Cedar Breaks National Monument, a viewshed analysis was performed in the GIS to determine which parts of the tract are visible from Yovimpa Point and Brian Head Peak, and vice versa.

The results of this analysis show that no part of the tract is directly visible from Yovimpa Point or any part of Bryce Canyon due to intervening terrain, and thus no light fixtures used on the tract would be directly visible from Bryce Canyon.

The analysis shows, however, that a portion of the proposed mining tract is directly visible from Brian Head Peak near Cedar Breaks National Monument and more importantly from portions of the Markagunt Plateau in the northeast portion of the monument itself. Light fixtures used in these portions of the tract could therefore be directly visible from within the monument. The partially shielded, portable fixtures particularly, using 1,000-watt 110,000 lumen lamps, would almost certainly be the brightest artificial light sources visible in the night landscape. Although a precise calculation of the brightness of these lights would require detailed specification of the fixtures' photometric properties, aiming configuration, and other details, an order-of-magnitude calculation yields that the lights would appear significantly brighter than the planet Venus, the brightest object in the night sky after the moon. This calculation assumes lighting Scenario 2 and assumes that the lights are pointing toward Brian Head Peak. Under lighting Scenario 3, impacts would be doubled, because the number of lamps from portable light sources is doubled. However, there would only be a fractional increase in sky brightness over the baseline condition visible from Brian Head Peak. In fact, lighting Scenario 1 is fainter than all other artificial light sources visible from Brian Head Peak and considered in the study. Any impacts to Brian Head Peak and portions of the Markagunt Plateau as a result of portable lighting tower glare would be addressed at the permitting stage through a detailed mine lighting plan.

When portable lights are in place and pointed at Cedar Breaks National Monument, the impact to visitors is likely to be minor to moderate; however, because of the intermittent nature of these lights and their visibility, and the fact that glare would be visible in limited locations, the overall impact to Cedar Breaks National Monument would be negligible (NPS 2009b).

It is also expected that, at times, direct glare would be visible from Brian Head Peak in addition to other locations in the Dixie National Forest. In addition, the effects of direct glare would be reduced through the use of directional lighting and by installing shields on lights.

Additionally, as portable lights are located at pits adjacent to the town of Alton, some residents throughout the town may be impacted by glare from direct lighting. Glare would be reduced through the use of directional lighting and by installing shields on lights. Glare would also be reduced by placing portable lights in the pit disturbance using the change in terrain resulting from mining activity to block any potential direct lighting on the town of Alton.

The study conducted by Dark Sky Partners (included as Appendix J) concludes that the predicted skyglow visible from Yovimpa Point in Bryce Canyon National Park would be less than that produced by several small towns in the general area. The study also concluded that the predicted skyglow visible from Brian Head Peak outside of Cedar Breaks National Monument would be much less than skyglow arising from

St. George and Cedar City, Utah. Although the impacts of the Proposed Action would not reach a level of significance, there is a high value placed on night sky resources at Bryce Canyon. The mitigations listed in Section 4.2.5 are recommended to further reduce impacts to night sky conditions.

4.2.4.3 ALTERNATIVE C: REDUCED TRACT ACREAGE AND SEASONAL RESTRICTIONS

Under Alternative C, centralized facilities associated with mining activities on the tract would be located in the same area, occupy the same acreage (36 acres), and include the same artificial lighting sources as the Proposed Action. Artificial lighting associated with dispersed facilities necessary to conduct mining operations would also be the same as the Proposed Action, except that fewer acres (135 acres) would be required. Impacts to natural lightscapes would be the same as those described under the Proposed Action, except that they would occur over a shorter timeframe of 21 years (the life of the mine under Alternative C).

4.2.4.4 ALTERNATIVE K1: REDUCED TRACT ACREAGE

Under Alternative K1, the tract would be modified to exclude Block NW (the block closest to the town of Alton) and Block S (see Map 2.3). Under this alternative, recoverable portions of in-place coal reserves would be mined over approximately 16 years. The modified tract would reduce tract acreage to encompass 2,114 acres, of which 1, 227 acres are federal surface and mineral estate and 887 acres are split estate: private surface estate and federal mineral estate.

Under Alternative K1, centralized facilities associated with mining activities on the tract would be located in the same area, occupy the same acreage (36 acres), and include the same artificial lighting sources as the Proposed Action. Artificial lighting associated with dispersed facilities necessary to conduct mining operations would also be the same as the Proposed Action, except that fewer acres (92 acres) would be required. Impacts to night skies would be the same as the Proposed Action, except that they would occur over a shorter timeframe of 16 years (the life of the mine under Alternative K1).

4.2.5 Potential Mitigation Measures

Table 2.6.1 in Section 2.6.1.9 describes a number of BMPs and design features that are required and included as part of the action alternatives for the Alton Coal Tract, including the requirement that a detailed nighttime lighting plan be prepared as part of the mine permitting stage. The design features and BMPs are environmental protection measures, actions, or practices that are part of the Proposed Action and all action alternatives and would be implemented by the lessee. Potential mitigation measures are additional means, measures, or practices not incorporated into the Proposed Action or alternatives as design features (or BMPs) that would further reduce or eliminate impacts. In considering mitigation measures for aesthetic resources, it should be noted that measures to reduce dust are included as design features in the air resources Section 4.3.1, and are therefore not discussed below.

4.2.5.1 POTENTIAL SOUNDSCAPE MITIGATION MEASURES

The following soundscape mitigation measures are discretionary, and if prescribed as conditions of the ROD (in the form of stipulations on the lease), they would further reduce impacts to aesthetic resources:

- Reduce nighttime hours of operation in certain areas of the mine; a 10-dBA penalty is added to operation that occurs between 10:00 p.m. and 7:00 a.m.
- Use equipment with lower sound power levels than the ones that were modeled.
- Build a noise attenuating wall.
- Use the noisiest equipment in areas where natural topographic buffers, distance from sensitive noise areas, and/or noise attenuating walls can be used to lower the overall noise levels.

- Use smaller blast charges in mining operations than the maximum levels used to produce the numbers in Table 4.2.5.
- Conduct mine blasting at greater distances from the town of Alton.
- Conduct pre-blast surveys to identify buildings potentially vulnerable to airblast and/or vibration.
- Conduct noise and vibration blast monitoring at vulnerable buildings and sensitive resource areas, including within Bryce Canyon National Park.

4.2.5.2 POTENTIAL VISUAL RESOURCE MITIGATION MEASURES

Though it would not reduce visual impacts of mining, the following visual resource mitigation measure would promote greater public understanding of mining and minerals development and would therefore serve a compensatory purpose:

- To promote public understanding, place interpretive signs at overlooks along USFS (Dixie National Forest) trails that describe the mining and rehabilitation activities.

4.2.5.3 POTENTIAL NIGHT SKY MITIGATION MEASURES

Potential light pollution mitigation recommendations are summarized below following a detailed discussion of a variety of mitigation approaches and MSHA safety requirements in regard to adequate mine lighting. Potential mitigation measures include specifying lamp types and using operational controls (such as dimmers, timers, motion sensors, and directional lighting) to promote efficient lighting usage at facilities.

4.2.5.3.1 MSHA Safety Regulations

Table 4.2.8 and Section 4.2.1 outline MSHA safety regulations with regard to mine lighting. Any mitigation recommendations must be consistent with identified lighting needs and regulations. The key phrase in these regulations, "Illumination sufficient to provide safe working conditions" implies that a) conditions need to be bright enough to work safely; b) lamp types used in work areas must emit a full spectrum of light necessary for color rendition, which is necessary for safety; and c) lights must be in operable working condition with an adequate backup system, so that there is always lighting available.

Table 4.2.8. MSHA Mine Lighting Safety Regulations

Statute/Reference	Detail
30 CFR 56.17001 (MSHA) Illumination of surface working areas	Illumination sufficient to provide safe working conditions shall be provided in and on all surface structures, paths, walkways, stairways, switch panels, loading and dumping sites, and work areas.
30 CFR 77.207 (MSHA) Illumination	Illumination sufficient to provide safe working conditions shall be provided in and on all surface structures, paths, walkways, stairways, switch panels, loading and dumping sites, and working areas.

4.2.5.3.2 Lamp Types

Six lamp types under consideration for use in the mining context are low-pressure sodium (LPS), narrow band amber light–emitting diode (ALED), high-pressure sodium (HPS), filtered white light–emitting diode (FLED), white light–emitting diode (wLED), and MH. Three of these are considered "traditional" mine lighting lamp types (LPS, HPS, and MH) and are considered high-intensity discharge (HID) lamps, whereas the LED family has only in recent years been developed for outdoor lighting application. Sources such as LPS, HPS, and MH are the most common type of outdoor lighting. This is because they have dominated outdoor lighting for many decades, are inexpensive, and efficiently produce abundant light (Monrad Engineering 2012). However, Monrad considers the HID family of lamps to be inferior to more

modern LED lamp types (Monrad Engineering 2012). See Section 4.2.5.3.2 for a discussion of these lamp types in relation to operational controls.

The impacts of the six lamp sources on the visual character of the night in general and on visual astronomical observation in particular—as are relevant in the Bryce Canyon National Park region— depend on the relative visibility of skyglow caused by the various lamp sources. Ranked from lowest to highest impact, the six lamp sources and their contribution to visual skyglow relative to LPS are shown in Table 4.2.9.

Table 4.2.9. Lamp Type Contribution to Skyglow

Lamp Type	Skyglow Brightness Measure Relative to LPS*	Relative Contribution to Skyglow as it impacts Visual Astronomical Observation
LPS	1.0	Lowest
ALED	1.0	
HPS	2.6	
FLED	3.7	
wLED	4.4–8.0†	
MH	6.4‡	Highest

* Skyglow impact ratios presented above are based on scotopic brightness as viewed near the light source; at distances over several kilometers the ratios decrease, and depend on many factors including distance, aerosol load, and viewing angles.

† Values shown are for wLED with correlated color temperature of 2400K and 5100K.

‡ Value is for MH with correlated color temperature of 4100K.

Source: Luginbuhl et al. (2013; 2013).

In cases where color rending is not critical to the task, the environmentally preferred options become the amber sources, LPS, and ALED. These lighting sources produce the least light pollution because they emit only yellow wavelengths, causing the lowest skyglow brightness when observed by the human eye at the low luminance of the night sky. That said, with these sources, the color spectrum is reduced to only one wavelength or a very limited spread of wavelengths, and the ability of the human eye to perceive color differences is lost. Mine areas where LPS or ALED lamps might be employed exclusively are those areas where color rendition is not critical to the task or safety, such as employee parking, storage, and central facilities outdoor lighting.

In areas of the mine where color rendition is needed, lamp types that produce a wider color spectrum should be used as all or a portion of the lighting to provide color rendition (Boynton et al. 1989). These lamp types include HPS, MH, wLED, and FLED. HPS is the lamp type with the second lowest skyglow impact at 2.6 times LPS, and though it is a yellow-rich source, it provides substantial color rendition. MH and wLED lamps (MH are the most commonly used lamp at mine sites) result in the highest impact to skyglow at 4.4–8.0 times that of LPS and 1.7–3.1 times that of HPS. FLEDs cause an intermediate skyglow that appears 3.7 times brighter than LPS and 1.4 times brighter than HPS, yet notably less skyglow than conventional wLEDs and MH. Even in applications where color rendition is needed, consideration should be given to producing as much light as possible (taking into account safety requirements) using amber sources (LPS, ALED) with a mix of 10% or more of the light provided by wide-spectrum sources such as HPS, FLED, MH or wLED (Boynton et al. 1989). Such a mixed-source design can provide the needed color perception while minimizing environmental impact.

If insect attraction and other biological disturbance are of primary concern, LPS and ALED are preferred over HPS and FLED, and FLED is preferred over wLED and MH. FLEDs are an advantageous option when good color rendering is necessary for safety or task purposes.

4.2.5.3.3 Operational Controls

One of the easiest ways to reduce unwanted nighttime light pollution is to use adaptive lighting controls to dim or extinguish lighting when not needed, and to provide 'instant on' capabilities for emergency or operational lighting. HPS, MH and LPS, however, do not perform well when dimmed below maximum output and generally require warm up and cool down periods between uses (sometimes taking several minutes to restart), and may cause unsafe working conditions as a result. In contrast, LEDs can be easily turned on and off, do not present start or restart delays, and perform well when dimmed. Therefore, LEDs (ALED, FLED, or wLED) are preferred where lighting needs require dimming lights, extinguishing lights when not needed, or 'instant on' capabilities for emergency or operational lighting (Monrad Engineering 2012).

4.2.5.3.4 Potential Night Sky Mitigation Measures

The following night sky mitigation measures would further reduce impacts to aesthetic resources:

- In areas of the mine where there is a need for color rendition, use the minimum amount of white-spectrum lamps such as FLED or HPS lamps rather than MH lamps.
- In areas of the mine where color rendition is not important, use LPS or ALED lamps.

  In the event that MH lamps are used, lamps should be 3400K or less correlated color temperature (warm-white).
- Place motion sensors on outdoor lighting fixtures for dimming or extinguishing capabilities while not in use.
- Keep partially shielded portable light fixtures in the mine pit below the ground surface, and aim them approximately 30º or more below the horizon and away from Bryce Canyon National Park, Cedar Breaks National Monument, and Brian Head Peak.
- Operate no more than six portable light towers at one open pit at any given time.
- Paint or stain mine-related buildings to produce flat-toned, nonreflective surfaces, which would have minor, beneficial impacts on dark skies by reducing the potential for building related reflected night lighting.

4.2.6 Unavoidable Adverse Impacts

The Proposed Action and alternatives would result in unavoidable adverse impacts to aesthetic resources even following implementation of protective measures and the mitigation measures described above.

Although BMPs and required mitigation measures would result in a reduced increase in ambient noise levels relative to noise-sensitive receptors, increased ambient noise levels from truck traffic, blasting, and other heavy machinery would still occur for the duration of mining activities. The changes to landform, vegetation, and structures on the landscape from pit disturbances and construction of facilities would be evident in the natural landscape of the tract and surrounding lands, even with mitigation. Following reclamation, the landform would be restored to a near-natural condition, centralized and dispersed facilities would be removed, and a more varied vegetation pattern would be rehabilitated. Reclamation would restore the existing landscape following mining. Even with mitigation, the addition of artificial lighting in the tract and the added airborne PM (dust) would result in greater light pollution and skyglow over the tract and surrounding lands.

4.2.7 Short-term Uses versus Long-term Productivity

As discussed throughout this section, there would be a short-term loss of the aesthetic resources in the tract over the 25-year mine life under the Proposed Action, the 21-year mine life under Alternative C, and over the 16- year mine life under Alternative K1. Effective implementation of required BMPs and protective measures described in Chapter 2, as well as prescribed mitigation measures identified in Chapter 4, would prevent these short-term uses from substantially impacting the long-term quality of aesthetic resources. Even with mitigation, increased levels of noise and decreased darkness of nighttime skies would result.

4.2.8 Irreversible and Irretrievable Commitments of Resources

The BMPs and protective measures detailed in Chapter 2 require the reclamation of disturbed areas following completion of mining operations under either action alternative. Because surface disturbances (including the EODA under Alternative C) would be recontoured and vegetation resources would be reclaimed, there would be no anticipated, irreversible impacts on visual resources associated with the actions proposed for the tract. Additionally, because noise and light pollution would only occur for the duration of the mining operations, there would be no irreversible impacts on soundscapes and lightscapes. There would, however, be irretrievable impacts associated with surface-disturbing activities proposed throughout the tract. The changes in landscape, soundscapes, and lightscapes that would result are an irretrievable loss of these aesthetic resources until mining operations are completed and successful reclamation takes place.

4.3 Air Resources

The analysis area for air resources consists of an approximately 150-km area surrounding the Alton Coal Tract (see Map 3.5). It is also referred to as the *dispersion model domain*. A series of technical analyses was performed to assess potential impacts on ambient air quality in the air analysis area from mining on the tract and transportation of coal along the reasonably foreseeable transportation route; these analyses have been expanded and updated in the SDEIS to address the addition of Alternative K1 and responses to public comments on the DEIS. The SDEIS air analyses are based on the assumption of an overburden removal of no more than approximately 200 feet, which is specified as a design feature as described in Section 1.1 and Table 2.6.1. The following are addressed quantitatively or qualitatively in these analyses:

- Mine construction–related emissions
- Mine operation–related emissions
- Impacts to attainment of the NAAQS for the tract
- PSD review
- AQRV: visibility impacts to the Class I areas, acid deposition, flora, and fauna
- General conformity

The analyses were based on a conceptual mine design, operating assumptions, and a set of design features to be implemented by the lessee. Although the analyses are intended to be conservative to accommodate foreseeable emissions under various mining scenarios, a detailed mine plan has not yet been developed. An approved, detailed mine plan would be subject to state permitting requirements and to appropriate dispersion modeling at that time, as well as to detailed operation and mitigation measures. Technical aspects of the air resources analysis are addressed in more detail in the *Air Resources Impact Assessment Technical Report for the Alton Coal Lease by Application* (included in Appendix K) and the *Supplement to Air Resources Impact Assessment Technical Report for the Alton Coal Lease by Application* (included in Appendix K).

4.3.1 Design Features

As described in Section 2.6.1.9, design features are environmental protection measures, actions, or practices that are part of the Proposed Action and all action alternatives and would be implemented by the lessee. For air resources, design features or emission controls included in the emission inventory calculations consist of the following:

- Watering or using a combination of chemical suppressants and watering to reduce fugitive dust from unpaved roads and disturbed areas (dust control efficiencies are in Table 4.3.1, below.)
- Watering before predicted high-wind events to reduce windblown dust from portions of the tract, overburden storage piles, and coal storage piles
- Enclosing most coal transfer points and processing activities during coal production to reduce fugitive dust emissions (dust control efficiencies are in Table 4.3.1, below.)
- Using ultra-low sulfur diesel fuel (15 ppm) for nonroad vehicles and generators
- Using generators and nonroad diesel engines that meet Tier 4 emissions standards
- Using post-combustion controls on nonroad vehicles

The use of chemical suppressants can affect air quality characteristics in several ways. Dust suppressants that adhere to soil particles can be re-entrained into the air with strong winds, potentially adding contaminants to the air in addition to PM. Dust suppressants have little efficacy at suppressing small respirable dust; they may be harmful because smaller dust particles (less than 10 μm) can be inhaled directly into the lungs. In addition, some dust suppressants may contain VOCs that can be dispersed into the air

when the product is applied (which is a particular concern in the formation of O_3). These potential impacts vary greatly due to physical and chemical differences from site to site, dust suppressant composition, and application techniques (EPA and UNLV 2004).

The design features discussed above, as well as project design assumptions for emission calculations, are summarized in Table 4.3.1.

Table 4.3.1. Design Features and Project Design Assumptions for Emission Calculations for the Alton Coal Tract

Feature	Parameter	Units
Reasonable Maximum Year of Mining Activities		
Construction duration	6	Months
Construction acreage disturbed	6	Acres/month
Topsoil thickness	12	Inches
Topsoil density	3,000	Pounds per cubic yard
One-way topsoil haul distance	0.85	Mile
Topsoil haul road control efficiency	70	%
Scraper capacity	22	Cubic yards
Scraper empty weight	36	Tons
Scraper travel (on haul roads)	4,473	Trips per year
Topsoil haul road silt content (scrapers)	16	%
Topsoil/overburden/coal haul road silt content	4.8	%
Topsoil front-end loader capacity	12	Cubic yards
Topsoil haul truck capacity	100	Tons
Topsoil haul truck empty weight	80.4	Tons
Topsoil haul truck travel	1,476	Trips per year
Overburden thickness	200	Feet
Overburden hauled	13,117,440	Tons
Overburden density	2,562	Pounds per cubic yard
Overburden moisture	7.9	%
Overburden silt content	7	%
Average annual wind speed	7	mph
Average annual daytime wind speed	8.1	mph
One-way overburden haul distance	0.75	Mile
Overburden haul road control efficiency	85	%
Overburden haul truck capacity	420	Tons
Overburden haul truck empty weight	307	Tons
Number of overburden haul trucks	2	–
Overburden haul truck loading/unloading	3.6	Trips per hour
Annual acres disturbed (Proposed Action)	61	Acres per year
Annual acres disturbed (Alternative C)	61	Acres per year

Table 4.3.1. Design Features and Project Design Assumptions for Emission Calculations for the Alton Coal Tract

Feature	Parameter	Units
Annual acres disturbed (Alternative K1)	61	Acres per year
Effective control efficiency on new disturbance	90	%
Coal thickness	16	Feet
Coal density	2,300	Pounds per cubic yard
Coal moisture	10.4	%
Coal silt content	8.6	%
Coal haul truck capacity (at mining operation)	100	Tons
Coal haul truck empty weight	80.4	Tons
One-way coal haul distance (on-site)	1	Mile
Coal haul road control efficiency	85	%
Coal loading into mine trucks	2	MMTPY
Coal dumping (at crusher)	2	MMTPY
Coal crushing/screening/conveying	2	MMTPY
Coal processing control efficiency	95	%
Coal storage	150,000	Tons
Coal storage surface area	170,000	Square feet
Coal storage control efficiency	90	%
One-way coal haul distance (off-site)	110	Miles
On-road haul truck capacity	43.3	Tons
On-road haul truck empty weight	20.95	Tons
Coal loading into over-the-road trucks	2	MMTPY
Coal loading into over-the-road trucks control efficiency	95	%
Coal dumping (at railhead)	2	MMTPY
Coal storage control efficiency (loadout)	90	%
Coal loading (trains)	2	MMTPY
Coal loading into trains control efficiency	95	%
Access road length	2.5	Miles
Access road silt content	4.8	%
Access road control efficiency	85	%
Average vehicle weight (employees)	2.5	Tons
Number of employees	160	–
Employee round-trip distance	60	Miles
Number of graders	2	–
Grader speed	3	mph
Grader operating hours	10	Hours per day
Grader control efficiency	55	%
Number of water trucks	2	–

Table 4.3.1. Design Features and Project Design Assumptions for Emission Calculations for the Alton Coal Tract

Feature	Parameter	Units
Water truck capacity	10,000	Gallons
Number of blasts	62	Blasts per year
Area per blast	1,000	Square meters
Number of bulldozers	5	–
Number of front-end loaders	1	–
Number of service vehicles	10	–
Service vehicles travel	20	Miles per day
Service vehicles weight	4	Tons
Service vehicles control efficiency	85	%
Electric power shovel	36	Cubic yards
Generating power capacity (facility)	2,000	Kilowatts
Generating power capacity (underground mining)	3,000	Kilowatts
Hydraulic backhoe	1	–
Paved road silt loading	0.2	Grams/square meter
Employee vehicle weight	2	Tons
Ammonium nitrate/fuel oil use	0.6	Pounds per cubic yard
Overburden blasted	1,000,000	Cubic yards
Diesel fuel density	7.05	Pounds per gallon
Diesel fuel sulfur content	15	ppm
Operating hours	8,760	Hours per year
Construction Phase		
Duration	6	Months
Acreage	36	Acres
Acres per month	6	Acres
Total suspended particulate emission factor	1.2	Tons per acre-month

The following design features would be reflected in lease stipulations to address impacts to air quality and AQRVs (each design feature is also identified with the applicable pollutant it would address):

1. Limit surface mining to no more than approximately 200 feet of overburden removal (NO_2, PM, SO_2, visibility).
2. Install fencing to restrict public access to active mining areas (1-hour NO_2).
3. Require blasting provisions for wind speed, direction, and variability, plus provisions for public notifications/alerts during blasting events (1-hour NO_2, PM).
4. Require diesel oxidation catalysts on heavy equipment (PM, HAPs, visibility, VOCs, CO).
5. Implement a dust control plan (PM).
6. Conduct continuous ambient air monitoring for PM_{10}, $PM_{2.5}$, NO_2, and visibility according to the adaptive management strategy.
7. Ensure that all controls used in the 200-foot overburden removal scenario demonstrate compliance with the NAAQS, including Tier 4 engines, dust control, etc. (PM, NO_2, SO_2).

The dust control plan described in design feature 5 would include at a minimum the following provisions:

- Appropriate watering and/or surfactant application
- Appropriate wind-fencing and/or other wind barriers to prevent windblown dust as needed
- Speed limits for vehicle traffic on-site
- Stabilization of stockpiles (overburden, coal, and/or topsoil) to prevent wind erosion
- Track-out provisions, including street-sweeping, grizzlies, and/or washing trucks before entering the roadway
- Covering and/or securing truck beds and other conveying devices to prevent fugitive dust emissions

Ambient air monitoring as required by design feature 6 would be used to demonstrate the effectiveness of these design features and validate the air modeling done for the DEIS and SDEIS analyses. Monitoring would be conducted according to the adaptive management strategy described below. If monitoring shows concentrations above the applicable NAAQS or indicates AQRV degradation, it would trigger the implementation of additional measures as defined in the adaptive management strategy to further decrease emissions.

Based on an agreement with the EPA, design features are established in lieu of modeling for 1-hour NO_2 and 1-hour SO_2. The particular design features that apply to NO_2 and SO_2 are noted above. The use of ultra-low sulfur diesel fuel for nonroad vehicles and generators and the use of nonroad diesel engines and generators that meet Tier 4 emissions standards are also SO_2 design features.

4.3.1.1 ADAPTIVE MANAGEMENT STRATEGY

The leaseholder commits to developing a project-specific adaptive management strategy for air resources. This adaptive management strategy, as outlined here, has been designed to detect and address monitored air quality and AQRV degradation that can reasonably be attributed to emissions originating from mine activities on the tract. The adaptive management strategy would consist of the following three elements to be implemented in the order listed:

1. Conduct targeted air monitoring to address potential impacts to air quality or AQRVs in Bryce Canyon National Park and the town of Alton.
2. Based on monitoring, refine air quality analyses and/or modeling assessments as needed to determine whether any monitored air quality or AQRV deterioration is reasonably attributable to mine operations.
3. Implement additional environmental protection and mitigation measures as needed based on monitoring and source attribution.

The **first element** of this strategy, targeted project-specific air monitoring, would be funded and implemented by the leaseholder with oversight by the BLM (and in consultation with NPS) upon issuance of the lease, with monitoring operations beginning at least one year before mining activities start on the tract based on the timing of the permitting process. Air monitoring would consist of the following:

- The installation of equipment at a location near the south end of Bryce Canyon National Park and at an intermediate site between the tract and the park. The location of the in-park site would be designed to better address potential Bryce Canyon National Park impacts than the current, existing monitoring site. The intermediate site would address decreasing gradients in observed impacts between the tract and Bryce Canyon National Park, identifying potential issues and the need for additional evaluation.

- Use of a meter capable of continuous visibility measurements (coarse and fine particle scattering) (e.g., Optec nephelometer), an instrument capable of continuous absorption and scattering measurements from fine particulate mass (e.g., DTM PAX), and an instrument to record meteorological measurements such as wind direction, wind speed, and relative humidity at the in-park site.
- Use of a continuous visibility meter, as well as meteorological monitoring equipment, at the intermediate site.
- Solar power sources or other supplemental power options.
- The incorporation of existing equipment into the air monitoring, including the filter-based PM_{10} samplers at the Coal Hollow Mine. In addition, the existing Coal Hollow monitoring site between the Coal Hollow Mine and the town of Alton would be used to monitor and characterize possible NO_2 (and other) impacts to the residents of Alton.
- A four-year sampling period (to be extended if monitoring sites have recorded an exceedance of the NAAQS [not due to a natural event] or if impacts to Bryce Canyon National Park or the town of Alton have been clearly identified from mine operations)[4,5].
- The storage of data on-site with periodic offloading for transfer to a central facility for processing and database entry.
- Optical measurements related to visibility (dust, PM) collected on a shorter period than the 24-hour filter samples taken by the IMPROVE monitoring site.

Monitors would be operated to UDAQ specifications, and the monitoring data would be made publicly available. Existing NPS monitoring equipment, consisting of a night sky visibility camera and a daytime visibility camera, could also be incorporated into the adaptive management strategy. The process by which data are examined, processed, and transmitted to the appropriate parties (data tracking) would be fully defined in an interagency memorandum of understanding (MOU) to be developed after the ROD. The actual data tracking procedures may need to be adjusted or revised as monitoring information becomes available, but at a minimum should incorporate either annual or biannual periodic in-depth data assessments to evaluate overall trends and conditions, as well as data flagging. The adaptive management strategy would include a commitment to funding a third-party contractor to be responsible for the data analysis and tracking procedures, as defined by the BLM and NPS in consultation with the BLM Utah Air Resources Technical Advisory Group (ARTAG). The lessee would be responsible for funding the tracking component, in addition to the remaining elements of the adaptive management strategy.

If monitoring shows impacts to air quality and/or AQRVs at Bryce Canyon National Park or the town of Alton that can reasonably be attributed to emissions from mining operations, the BLM and NPS would review the data and develop an analysis plan to definitively determine the source(s) of the monitored impacts. The plan may include additional monitoring and/or modeling, emission inventory analysis, and/or other investigative techniques to be decided by the BLM and NPS in consultation with ARTAG. This is the second element of the strategy.

[4] The primary concern for Bryce Canyon National Park is AQRV (visibility) impacts and the primary concern for the town of Alton is NAAQS exceedances.

[5] DOGM coal rules (R645-301-420 through R645-301-425) state that all surface coal mining and reclamation activities with projected production rates exceeding 1,000,000 tons of coal per year must have an air pollution control plan with "an air quality monitoring program to provide sufficient data to evaluate the effectiveness of the fugitive dust control practices" to comply with federal and Utah air quality standards. Therefore, monitoring will be required by DOGM for the tract anytime the production exceeds 1,000,000 tons per year (projected to be annually for the life of the mine). The four years of monitoring specified in the adaptive management strategy include elements not required by DOGM (e.g., NO_2) and would be timed to capture the maximum impact. The timing would be determined during the permitting process when the specifics of the mining activities are known.

To implement the **second element** of the strategy, quantifiable trigger points would be identified that define the potential for unacceptable impacts. This would include the identification of routine data analyses that indicate potential impacts from tract activities, such as wind roses and spatial gradients. Thresholds that account for the potential magnitudes, frequency, and duration of these impacts would also be defined. For monitoring sites in Bryce Canyon National Park, FLAG 2010 guidance (USFS et al. 2010) would be used to determine appropriate thresholds. Although desirable to define the analyses and trigger points ahead of time, it is likely that modifications to the protocols would be needed after data have been collected and analyzed. Refinements would be mutually agreed upon by all parties. The second element of the strategy would also identify the acceptable level of source attribution analysis if the defined thresholds are exceeded, while maintaining the ability to implement additional measures quickly if necessary. This could include analyses using air dispersion, back trajectory, and Eulerian chemical transport models integrated in a weight of evidence analysis. Additional monitoring might also be required to quantify source impacts.

If the refined air quality analysis conducted in response to the monitored air quality impacts shows the tract contributing to degraded air quality and/or AQRVs at Bryce Canyon National Park or the town of Alton (including any exceedances of the NAAQS), the mine operator would be required to adopt additional measures as soon as possible but within no more than one year of the determination depending on the required measure (the **third element** of the strategy). Additional measures may include the following actions:

- Provisions to reduce NO_2 from blasting related to the sizing of shots, quality of explosive materials, minimum elapsed time between blasts, and measures that could be employed to reduce the need for blasting altogether (1-hour NO_2)
- Heavy-duty vehicle controls, including NO_x combustion controls, limitation on the total number of vehicles in operation simultaneously, use of electrically driven equipment if available, and reduction of on-road emissions by obtaining lower-emitting engines than the county average (PM_{10}, $PM_{2.5}$, NO_x, HAPs)
- Dump height provisions, road paving (depending on the type of road in service), and/or fogging systems (PM_{10}, $PM_{2.5}$)
- Construction of buildings and/or silos to store coal, topsoil, and/or overburden (PM_{10}, $PM_{2.5}$)
- Restriction on simultaneously open pits as applicable (PM_{10}, $PM_{2.5}$)

Additional measures would be selected based on the nature of the monitored impacts, the effectiveness of the proposed measures to address monitored impacts, the feasibility of implementing the proposed measures, and final approval by the BLM in consultation with the NPS and ARTAG. The cost for these measures would be the sole responsibility of the successful bidder, and would be included as a design feature.

Because the exact mining sequence and particulars of the mining operation are unknown at this time (the leasing process), not all of the fine points of the adaptive management plan are delineated here. The successful lessee would submit detailed mining plans as part of the permitting process (which includes air quality permitting and related dispersion modeling) and additional details of the adaptive management strategy would be cooperatively determined at that time.

Potential mitigation measures are defined as additional means, measures, or practices *not* incorporated into the Proposed Action or alternatives as design features that would further reduce or eliminate impacts (see Section 2.6.1.9). Potential mitigation measures for air resources are described in Section 4.3.5 and would be considered as possible terms and conditions of the ROD (in the form of stipulations on the lease), if an action alternative is selected.

4.3.2 Emission Inventory

Air emissions are quantified to determine the relationship between emissions released into the atmosphere from various sources and the ambient concentrations that result. An emissions inventory is a listing, by source, of the amount of air pollutants discharged into the atmosphere per unit of time. Ambient concentration refers to the mass of a pollutant per unit volume in the atmosphere. It is commonly expressed in units of micrograms per cubic meter ($\mu g/m^3$). Tract-related air quality impacts can be predicted using the emissions calculated in an emissions inventory as inputs to a dispersion model. Dispersion model outputs are predicted concentrations of air pollutants in the atmosphere at receptors (locations where the dispersion model estimates pollution concentrations).

Adverse impacts to air quality generated by construction and mining activities in general would largely be due to the dispersion of small-diameter dust particles from the action of prevailing winds, the turbulence caused by moving machinery and trucks, or both. These dust emissions are typically called “fugitive dust” or PM. Other impacts include exhaust emissions from diesel engines (such as loaders and haul trucks) and from diesel-powered generators.

Initial construction activities for the tract would include development of an access road, site preparation for fixed (i.e., centralized) facilities (e.g., crushers, conveyors, generators, and office and maintenance buildings), development of the main haul road, delivery of materials and equipment to the mine, and other construction-vehicle activity. It is assumed that 36 acres would be disturbed for construction activities on the tract; approximately 6 acres would be disturbed each month for six months.

Pollutant emissions sources during mining activities (coal production) on the tract would include PM emissions and fuel-combustion emissions. Both surface and underground mining were considered in this analysis. Surface mining up to approximately 200 feet of overburden removal was considered for the Proposed Action, Alternative C, and Alternative K1. Emissions were calculated for 24 hours per day, seven days per week, and 52 weeks per year. The total number of operating days per year was assumed to be 365.

Emission estimates that would be associated with construction and mining activities and diesel-powered generators are provided in this section. Pollutants considered are $PM_{10,}$ $PM_{2.5}$, NO_x, VOCs, CO, SO_2, CO_2, and HAPs. On-site emission sources on the tract would include

- construction activities;
- topsoil removal and replacement;
- overburden removal and replacement;
- topsoil, overburden, haul truck, service vehicle, and employee travel on unpaved roads;
- wind erosion of disturbed areas and coal and overburden piles;
- coal loading, handling, and processing;
- bulldozer and grading activities;
- blasting, mobile source gaseous exhaust; and
- diesel-powered generators.

Off-site emission sources would include

- haul truck and employee travel on paved roads;
- motor vehicle exhaust;
- coal handling and train loading; and
- wind erosion of coal piles.

On-road motor vehicle emissions were calculated using 2005 Kane County mobile source (Mobile 6) emission factors from the UDAQ. A more recent mobile source emission estimation program, the Motor Vehicle Emission Simulation (MOVES), has been developed by the EPA to replace the Mobile model. However, UDAQ does not have MOVES model results for Kane County (UDAQ 2012). Based on a preliminary comparison of MOVES2010 to MOBILE6.2 by the EPA, the Mobile 6 modeling completed for the Alton Coal Tract air quality analysis may overestimate VOC emissions and underestimate NO_x and $PM_{2.5}$ (see Section 2.1.1 of the *Supplement to Air Resources Impact Assessment Technical Report for the Alton Coal Lease by Application* in Appendix K).

4.3.2.1 ALTERNATIVE A: NO ACTION

Alternative A would result in no increases in air emissions associated with the tract. Emissions associated with growth or other developments would likely increase over time.

4.3.2.2 ALTERNATIVE B: PROPOSED ACTION

Construction and operation of the tract under the Proposed Action would result in both temporary and ongoing increases in emissions to the atmosphere. Two topsoil removal options exist for this alternative: 1) topsoil removal and replacement with scrapers, and 2) topsoil removal and replacement with a bulldozer, front-end loader, and trucks. A 200-foot overburden thickness removal scenario was evaluated. Following completion of surface mining, underground mining would occur for two or more years. Emissions are divided into five distinct groups: 1) emissions from construction; 2) on-site emissions with scrapers for topsoil removal and replacement; 3) on-site emissions with topsoil removal using a bulldozer, front-end loader, and trucks; 4) off-site emissions; and 5) emissions from underground mining. The construction phase would occur first, and the underground mining would occur last. Off-site emissions would occur for the two on-site options and during the underground mining phase. Estimated pollutant emissions from the five groups for the 200-foot overburden removal scenario under the Proposed Action are shown in Table 4.3.2.

Table 4.3.2. Estimated Pollutant Emissions (TPY), 200-foot Overburden Removal Scenario, Proposed Action

Pollutant	Construction	On-site Scrapers	On-site Front-end Loader/Trucks	Off-site	Underground Mining	Total
PM_{10}	13	154	146	1,079	99	1,491
$PM_{2.5}$	1.3	25.0	25.0	43.0	16.0	110.3
NO_x	–	223	229	171	73	696
VOCs	–	35	35	18	26	114
CO	–	354	352	186	249	1,141
SO_2	–	0.58	0.58	0.19	0.38	1.73
CO_2	–	35,307	36,822	18,423	40,561	131,113
Benzene	–	0.07	0.07	–	0.26	0.40
Toluene	–	0.03	0.03	–	0.09	0.15
Xylenes	–	0.02	0.02	–	0.06	0.10
Formaldehyde	–	0.01	0.01	–	0.03	0.05
Acetaldehyde	–	0.00	0.00	–	0.01	0.01
Acrolein	–	0.00	0.00	–	0.00	0.00

During underground mining, coal haul truck use and coal loading would be the same as during surface-mining operations. Generating capacity requirements would be greater for underground mining (an additional 3,000 kilowatts of power would be required). When underground mining begins, emissions would decrease for PM, NO_x, VOC, CO, and SO_2. CO_2 and HAP emissions would increase.

4.3.2.3 ALTERNATIVE C: REDUCED TRACT ACREAGE AND SEASONAL RESTRICTIONS

As under the Proposed Action, construction operations and mining of the tract under Alternative C would result in both temporary and ongoing emission increases to the atmosphere. Pollutant emissions as a result of topsoil removal options, the 200-foot overburden thickness removal scenario, and other components of mining the tract were evaluated for Alternative C in the same way as for the Proposed Action. Because there would be two open pits under Alternative C, fugitive dust emissions were doubled in the emissions inventory compared to the Proposed Action. This provided a better estimate of increased emissions resulting from the operational requirements of Alternative C (seasonal restrictions to address sage-grouse concerns). Estimated pollutant emissions from the five groups for the 200-foot overburden removal scenario under Alternative C are shown in Table 4.3.3.

Table 4.3.3. Estimated Pollutant Emissions (TPY), 200-foot Overburden Removal Scenario, Alternative C

Pollutant	Construction	On-site Scrapers	On-site Front-end Loader/Trucks	Off-site	Underground Mining	Total
PM_{10}	13	163	156	1,079	108	1,519
$PM_{2.5}$	1.3	27.0	26.0	43.0	18.0	115.3
NO_x	–	223	229	171	73	696
VOCs	–	35	35	18	26	114
CO	–	354	352	186	249	1,141
SO_2	–	0.58	0.58	0.19	0.38	1.73
CO_2	–	35,307	36,822	18,423	40,561	131,113
Benzene	–	0.07	0.07	–	0.26	0.40
Toluene	–	0.03	0.03	–	0.09	0.15
Xylenes	–	0.02	0.02	–	0.06	0.10
Formaldehyde	–	0.01	0.01	–	0.03	0.05
Acetaldehyde	–	0.00	0.00	–	0.01	0.01
Acrolein	–	0.00	0.00	–	0.00	0.00

HAP emissions (see the bottom 6 rows of Tables 4.3.2 and 4.3.3) from generators do not vary between alternatives because the same amount of combustion would occur under all alternatives. The difference in HAP emissions between alternatives for scrapers and front-end loaders/trucks is too small to register as a change in the emissions tables.

4.3.2.4 ALTERNATIVE K1: REDUCED TRACT ACREAGE

As under the Proposed Action, construction operations and mining of the tract under Alternative K1 would result in both temporary and ongoing emission increases to the atmosphere. Pollutant emissions as a result of topsoil removal options, the 200-foot overburden thickness removal scenario, and other components of mining the tract were evaluated for Alternative K1 in the same way as for the Proposed Action. Estimated pollutant emissions under Alternative K1 are identical to those under the Proposed Action (see Table 4.3.2).

4.3.3 Near-field Air Resources Impacts

The near-field analysis for the tract comprises a 50 × 50–km area with the tract in the center (the near-field dispersion model domain, see Map 3.5). The near-field analysis was conducted to assess impacts to public health and welfare and to estimate potential impacts to lakes and viewsheds in nearby (near-field) national parks.

In particular, the near-field, ambient, air resources impact assessment was performed to quantify maximum-modeled pollutant impacts near the tract. To demonstrate that air quality standards and AQRVs would be protected, the following are required: the development of short-term (hourly and daily) and long-term (annual) emission rates of regulated pollutants, application of regulatory-approved models to quantify predicted concentrations of regulated pollutants, and a comparison of predicted concentrations and relevant background concentrations with applicable standards.

The EPA's guideline model, AERMOD, was the refined air dispersion model used to assess near-field impacts and to verify compliance with the applicable NAAQS in the ambient airshed that encloses the tract. The modeling analysis focused on the reasonable, maximum development year (i.e., the maximum emission year) for the mine. Using this anticipated, maximum, potential emission year, the AERMOD dispersion model was used to analyze potential near-field impacts of PM_{10}, $PM_{2.5}$, NO_2, CO, and SO_2.

The modeling results reported in the SDEIS are presented in a different form than those in the DEIS, per EPA request. Compliance with the respective NO_2 and SO_2 annual NAAQS was based on the highest modeled value (highest first-high [H1H]) for each year of the four-year meteorological dataset added to the respective background concentrations. Compliance with the respective short-term NAAQS (24-hour, 8-hour, 3-hour, and 1-hour) for CO and SO_2 was based on the highest second-high (H2H) modeled concentration for each year of the four-year meteorological period added to the respective background concentrations. Regulatory changes to the NAAQS NO_2 and SO_2 standards occurred during the DEIS tract analysis. Due to the timing of these regulatory changes in relation to the tract analysis, assessment of the new 1-hour NO_2 and SO_2 standards was not incorporated in the DEIS. However, specific design features for 1-hour NO_2 and SO_2 in lieu of modeling have been added to Section 4.3.1 of the SDEIS.

Compliance demonstrations with the 24-hour $PM_{2.5}$ standard used the 98th percentile 24-hour concentration (highest eighth-high [H8H]) for each year of the four-year meteorological dataset. Three-year H8H average concentrations were calculated for each alternative. Compliance with the annual $PM_{2.5}$ standard was based on the H1H concentration for each year of the four-year meteorological dataset; three-year annual average concentrations were calculated for each alternative. Compliance with the 24-hour PM_{10} standard was verified with the H2H modeled concentration for each year of the four-year meteorological dataset; three-year H2H averages were calculated for each alternative. Modeled concentrations for all criteria pollutants were rounded to match the form of the appropriate NAAQS.

For the SDEIS, a near-field ambient air quality impact assessment was performed for Alternative K1 to quantify maximum-modeled pollutant impacts near the tract at the boundary of the two blocks removed as part of Alternative K1, and within the two blocks that would be removed under Alternative K1. For the purposes of modeling, Alternative K1 is considered the same as the Proposed Action except that it has a modified boundary. This approach was used because the emissions would be the same under Alternative K1 and the Proposed Action. The receptors included in the Proposed Action and Alternative C modeling are presented in Figure 4.3.1. For the Alternative K1 analysis, only the receptors that are new (those within the area between the Proposed Action boundary and the Alternative K1 boundary) were included in the modeling. These receptors are shown in Figure 4.3.2.

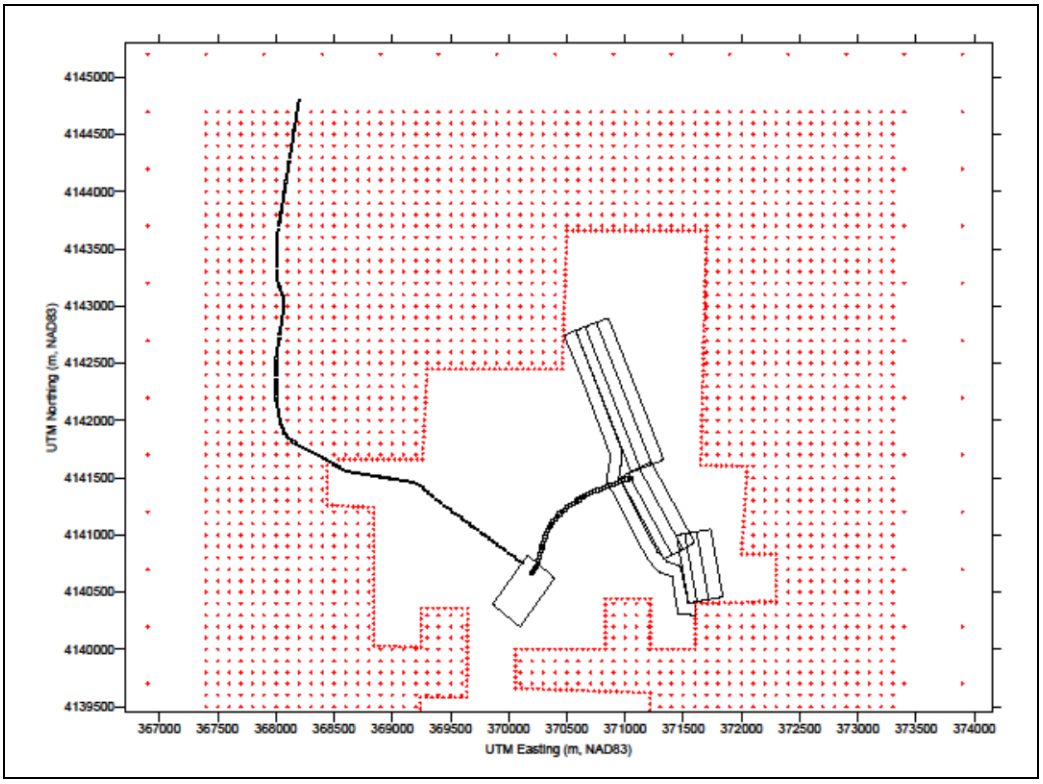

Figure 4.3.1. Proposed Action and Alternative C modeling receptors for the maximum development year (200-foot overburden) (see Appendix K).

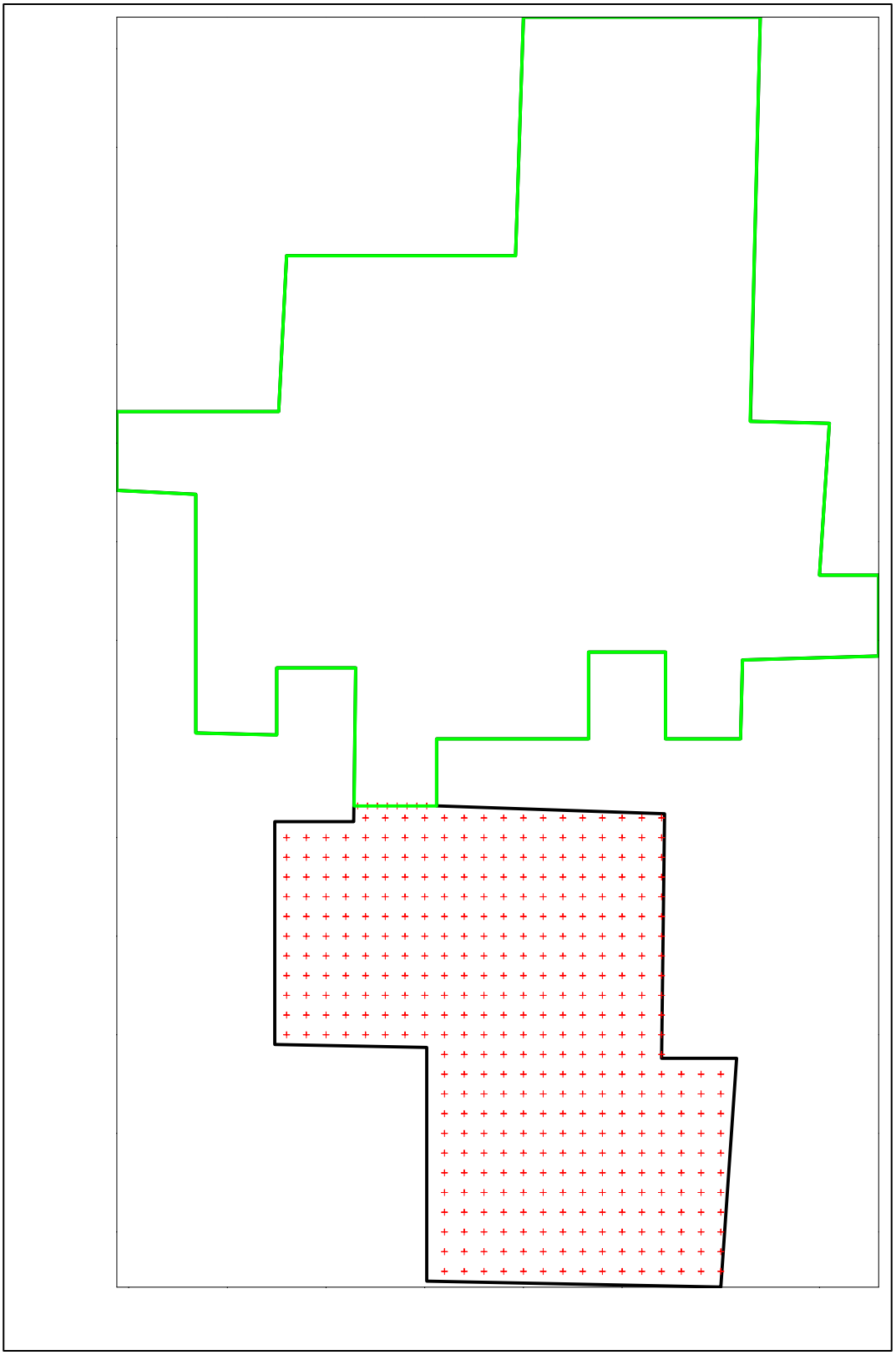

Figure 4.3.2. Alternative K1 modeling receptors (green line = effective new boundary; black line = previous boundary) (see Appendix K).

4.3.3.1 PM_{10} AERMOD RESULTS

Modeled PM_{10} concentrations associated with the maximum development year are summarized here. The 200-foot overburden removal scenario was modeled for compliance with the NAAQS under each action alternative. The 24-hour NAAQS is not to be exceeded more than once per year on average over three years. The H2H concentrations are presented in Table 4.3.4 for each year of the four-year meteorological period. The model results have been rounded to the form of the standard.

Table 4.3.4. PM_{10} Modeling Results (highest second-high)

Alternative	Model Year	Averaging Period	Modeled PM_{10} ($\mu g/m^3$)	Background PM_{10} ($\mu g/m^3$)	Total PM_{10} ($\mu g/m^3$)	Rounded PM_{10} ($\mu g/m^{3)}$	NAAQS ($\mu g/m^3$)
Proposed Action	2005	24-hour H2H	77.6	72	149.6	150	150
	2006	24-hour H2H	84.5	72	156.5	**160**	150
	2007	24-hour H2H	80.2	72	152.2	150	150
	2008	24-hour H2H	85.7	72	157.7	**160**	150
	2005–2007	Average	80.8	72	152.8	150	150
	2006–2008	Average	83.5	72	155.5	**160**	150
	2005–2008	Average	82.0	72	154.0	150	150
Alternative C	2005	24-hour H2H	77.7	72	149.7	150	150
	2006	24-hour H2H	84.9	72	156.9	**160**	150
	2007	24-hour H2H	80.5	72	152.5	150	150
	2008	24-hour H2H	85.9	72	157.9	**160**	150
	2005–2007	Average	81.0	72	153.0	150	150
	2006–2008	Average	83.8	72	155.8	**160**	150
	2005–2008	Average	82.3	72	154.3	150	150
Alternative K1*	2005	24-hour H2H	33.8	72	105.8	110	150
	2006	24-hour H2H	42.4	72	114.4	110	150
	2007	24-hour H2H	41.2	72	113.2	110	150
	2008	24-hour H2H	37.2	72	109.2	110	150
	2005–2007	Average	39.1	72	111.1	110	150
	2006–2008	Average	40.3	72	112.3	110	150
	2005–2008	Average	38.7	72	110.7	110	150

* Additional receptors only.

Note: A number in bold is a modeled exceedance of the NAAQS.

The results for Alternative K1 (additional receptors) comply with the NAAQS at all modeled receptors. Results for the Proposed Action and Alternative C do not show modeled compliance with the NAAQS for the 2006–2008 averaging period. Results for the Proposed Action and Alternative C do show modeled compliance with the NAAQS for the 2005–2007 averaging period and over the four-year 2005–2008 meteorological dataset.

Compliance with the 24-hour PM_{10} standard can also be verified against the highest fifth-high (H5H) modeled concentrations over the four-year period. The H5H was originally recommended by UDAQ because only four years of meteorological data were available for modeling (rather than the H6H

associated with five years of meteorological data). The form of the standard is not to be exceeded more than once per year on average over three years; therefore, the form allows one exceedance per year on average. With four years of meteorological data, the fifth exceedance would violate the NAAQS. Because the model results show that there is one exceedance on average per meteorological year, the H5H value does not exceed the standard.

Modeled exceedances are at the northwest side of the tract boundary near the boundary line. The public would only be exposed to lower concentrations of PM_{10}, because concentrations drop off quickly further away from the tract boundary.

Modeling is based on the maximum development year of a conceptual mine plan; a detailed mine plan would be developed during the permitting process from which actual air emissions would be modeled to obtain an air permit. As indicated above, a single exceedance does not necessarily indicate a violation of the standard because the standard states that the 24-hour PM_{10} should not be exceeded more than once per year on average over three years. In summary, modeling for the tract indicates that the potential exists for a short-term PM_{10} exceedance; however, the likelihood is low for a NAAQS violation based on the conservativeness of the modeling (see the following PM_{10} background value discussion) and the implementation of the adaptive management strategy.

Quarterly PM_{10} monitoring is ongoing at three monitors at or near the existing Coal Hollow Mine adjacent to the tract. The air monitoring program at the mine officially began in March 2011. Table 4.3.5 describes highest 24-hour mean PM_{10} results from quarterly monitoring reports beginning in the first quarter of 2011.

Table 4.3.5. Highest 24-hour Mean PM_{10} Concentrations Measured at Coal Hollow Mine

Monitoring Period	Measured PM_{10} Concentrations ($\mu g/m^3$)*			NAAQS ($\mu g/m^3$)
	Monitor 962A (background)	Monitor 963B (compliance)	Monitor 964C (co-located)	
1st Quarter, 2011	3.5	12.7	11.7	150
2nd Quarter, 2011	21.9	71.3	68.5	150
3rd Quarter, 2011	32.4	53.3	55.9	150
4th Quarter, 2011	n/a	n/a	n/a	150
1st Quarter, 2012	17.1	74.5	78.5	150
2nd Quarter, 2012	19.6	255.3†	233.7†	150
3rd Quarter, 2012	23.4	107.1	155.3	150
4th Quarter, 2012	12.1	66.3	104.6	150
1st Quarter, 2013	9.0	81.3	39.9	150
2nd Quarter, 2013	29.4	115.2	129.0	150

Source: UDEQ (2013), UDAQ (2012).

n/a = not available

* Measurements were collected during a 24-hour period and represent the average PM_{10} concentration during the midnight-to-midnight data-collection cycle. Only the highest 24-hour mean PM_{10} concentrations measured during each quarter are listed in the table. Monthly mean values are significantly lower.

† The monitoring report (ACD 2012) notes that NAAQS exceedances were because May and June had no measureable precipitation (as documented by an on-site meteorological station). Coal Hollow Mine brought in an additional water truck in early June and reapplied dust suppressant to the haulage and access roads to extend the capabilities of the water trucks in other areas of the mine for dust suppression. Additionally, the mine is installing an additional storage tank to store dust suppressant to be used as needed in problematic areas.

Background PM_{10} concentrations monitored near Coal Hollow Mine range from 3.5 to 32.4 µg/m^3, well below the background concentration of 72 µg/m^3 assumed for the PM_{10} modeling analysis (see Table 4.3.4). With the exception of four of the quarterly monitoring periods (2nd, 3rd, and 4th Quarter, 2012 and 2nd Quarter, 2013 data), all monitored PM_{10} concentrations at Coal Hollow Mine are below the 2005–2008 average modeled result of 82.3 µg/m^3 for Alternative C, which is the maximum emission rate case. Compared to the Coal Hollow Mine data, PM_{10} results from the tract modeling analysis are conservative. If the maximum background concentration at Coal Hollow Mine (measured significantly lower than [less than half of] 72 µg/m^3) is added to the highest modeled PM_{10} emissions, no NAAQS exceedances would occur.

One of the design features that would be reflected in the lease stipulations for the tract would be the implementation of a dust control plan (see Section 4.3.1) to prevent elevated emissions in circumstances such as those that caused the PM_{10} exceedances at Coal Hollow Mine in the 2nd Quarter of 2012.

4.3.3.2 $PM_{2.5}$ AERMOD RESULTS

Modeled $PM_{2.5}$ concentrations associated with the maximum development year are summarized in Table 4.3.6. The 200-foot overburden removal scenario was modeled for compliance with the NAAQS under each action alternative. The form of the annual NAAQS is the annual mean, averaged over three years. The H1H for each year of the four years in the meteorological period is presented in the table. For comparison to the NAAQS, the three-year average of the H1H annual values was calculated for the years 2005–2007 and 2006–2008. These values are compared to the standard of 12.0 µg/m^3. The form of the 24-hour NAAQS is the 98th percentile concentration averaged over three years. The H8H modeled value represents the 98th percentile. The H8H 24-hour value for each of the four years in the meteorological period is presented in Table 4.3.6. For comparison to the NAAQS, the three-year average of the H8H annual values was calculated for the years 2005–2007 and 2006–2008. These values are compared to the standard of 35 µg/m^3. The model results have been rounded to the form of the standard.

Table 4.3.6. $PM_{2.5}$ Modeling Results

Alternative	Model Year	Averaging Period	Modeled $PM_{2.5}$ (µg/m^3)	Background $PM_{2.5}$† (µg/m^3)	Total $PM_{2.5}$ (µg/m^3)	NAAQS (µg/m^3)
Proposed Action	2005	24-hour	11.8	9.5	21	35
		Annual	4.2	2.8	7.0	12.0
	2006	24-hour	14.2	9.5	24	35
		Annual	4.4	2.8	7.2	12.0
	2007	24-hour	13.4	9.5	23	35
		Annual	4.7	2.8	8.0	12.0
	2008	24-hour	14.1	9.5	24	35
		Annual	4.2	2.8	7.2	12.0
	2005–2007 average	24-hour	13.1	9.5	23	35
		Annual	4.4	2.8	7.2	12.0
	2006–2008 average	24-hour	13.9	9.5	23	35
		Annual	4.4	2.8	7.2	12.0

Table 4.3.6. $PM_{2.5}$ Modeling Results

Alternative	Model Year	Averaging Period	Modeled $PM_{2.5}$ ($\mu g/m^3$)	Background $PM_{2.5}$[†] ($\mu g/m^3$)	Total $PM_{2.5}$ ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)
Alternative C	2005	24-hour	12.9	9.5	22	35
		Annual	4.5	2.8	7.3	12.0
	2006	24-hour	15.5	9.5	25	35
		Annual	4.8	2.8	7.6	12.0
	2007	24-hour	14.5	9.5	24	35
		Annual	5.1	2.8	7.9	12.0
	2008	24-hour	15.4	9.5	25	35
		Annual	4.6	2.8	7.4	12.0
	2005–2007 average	24-hour	14.3	9.5	24	35
		Annual	4.8	2.8	7.6	12.0
	2006–2008 average	24-hour	15.1	9.5	25	35
		Annual	4.8	2.8	7.6	12.0
Alternative K1[*]	2005	24-hour	4.8	9.5	14	35
		Annual	1.2	2.8	4.0	12.0
	2006	24-hour	5.7	9.5	15	35
		Annual	1.5	2.8	4.3	12.0
	2007	24-hour	4.8	9.5	14	35
		Annual	1.5	2.8	4.3	12.0
	2008	24-hour	5.2	9.5	15	35
		Annual	1.8	2.8	4.6	12.0
	2005–2007 average	24-hour	5.1	9.5	15	35
		Annual	1.4	2.8	4.2	12.0
	2006–2008 average	24-hour	5.2	9.5	15	35
		Annual	1.6	2.8	4.4	12.0

[*] Additional receptors only.

[†] 2.8 $\mu g/m^3$ is the three-year (2006–2008) annual average $PM_{2.5}$ concentration for Bryce Canyon National Park; 9.5 $\mu g/m^3$ is the three-year average 98th percentile 24-hour value for Bryce Canyon National Park.

The 200-foot overburden removal scenario for all action alternatives complies with the NAAQS for modeled concentrations of $PM_{2.5}$ at all modeled receptors.

4.3.3.3 NITROGEN DIOXIDE AERMOD RESULTS

The maximum-modeled NO_2 annual concentrations associated with the maximum development year are summarized in Table 4.3.7 for each year of the four-year meteorological period. These values are compared to the standard of 100 $\mu g/m^3$. Based on the promulgation date for the 1-hour NO_2 standard (January 22, 2010), no 1-hour modeling was performed. However, in lieu of modeling, specific design features for 1-hour NO_2, including air monitoring and pollution controls, have been added to Section 4.3.1 of the SDEIS.

The 200-foot overburden removal scenario was modeled for compliance with the annual NAAQS. The estimated NO_2 emissions for the Proposed Action and Alternative C are the same. A 75% O_3 correction was applied to all modeled annual NO_2 modeling results. This correction was performed in accordance

with EPA's Ambient Ratio Method of estimating ambient annual NO_2 concentrations from modeled NO_x emissions. The intent is to account for the interaction of ambient O_3 with emissions of NO_x, which can chemically interact to form NO_2. The model results have been rounded to the form of the standard.

Table 4.3.7. Annual Maximum Nitrogen Dioxide Modeling Results (highest first-high)

Alternative	Model Year	Modeled NO_2 ($\mu g/m^3$)	Background NO_2 ($\mu g/m^3$)	Total NO_2 ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)
Proposed Action and Alternative C	2005	27.8	17	45	100
	2006	29.6	17	47	100
	2007	31.7	17	49	100
	2008	30.2	17	47	100
Alternative K1*	2005	9.1	17	26	100
	2006	11.3	17	28	100
	2007	11.8	17	29	100
	2008	13.5	17	31	100

* Additional receptors only.

Note: As a result of incorporating design features in lieu of modeling, this table does not include values for 1-hour NO_2.

The 200-foot overburden removal scenario under all action alternatives complies with the annual NAAQS for modeled concentrations of NO_2 at all modeled receptors.

4.3.3.4 CARBON MONOXIDE AERMOD RESULTS

The modeled CO concentrations associated with the maximum development year are summarized in Table 4.3.8 for each of the four years of the meteorological period. The 200-foot overburden removal scenario was modeled for compliance with the NAAQS. The 1-hour and 8-hour CO standards are not to be exceeded more than once per year. The results in Table 4.3.8 represent the H2H modeled concentration over the four-year meteorological period to meet the form of the standard. The estimated CO emissions for the Proposed Action and Alternative C are the same. Separate model runs were not necessary for the 200-foot overburden removal depth scenario. The model results have been rounded to the form of the standard.

Table 4.3.8. Carbon Monoxide Modeling Results (highest second-high)

Alternative	Model Year	Averaging Period	Modeled CO ($\mu g/m^3$)	Background CO ($\mu g/m^3$)	Total CO ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)
Proposed Action and Alternative C	2005	1-hour	2,283	1,150	3,433	40,000
		8-hour	582	1,150	1,732	10,000
	2006	1-hour	2,567	1,150	3,717	40,000
		8-hour	485	1,150	1,635	10,000
	2007	1-hour	2,639	1,150	3,789	40,000
		8-hour	519	1,150	1,669	10,000
	2008	1-hour	2,416	1,150	3,566	40,000
		8-hour	486	1,150	1,636	10,000

Table 4.3.8. Carbon Monoxide Modeling Results (highest second-high)

Alternative	Model Year	Averaging Period	Modeled CO (µg/m^3)	Background CO (µg/m^3)	Total CO (µg/m^3)	NAAQS (µg/m^3)
Alternative K1*	2005	1-hour	846	1,150	1,996	40,000
		8-hour	239	1,150	1,389	10,000
	2006	1-hour	1,009	1,150	2,159	40,000
		8-hour	224	1,150	1,374	10,000
	2007	1-hour	874	1,150	2,024	40,000
		8-hour	211	1,150	1,361	10,000
	2008	1-hour	934	1,150	2,084	40,000
		8-hour	245	1,150	1,395	10,000

* Additional receptors only.

The 200-foot overburden removal scenario under all action alternatives complies with the 1-hour and 8-hour NAAQS at all modeled receptors.

4.3.3.5 SULFUR DIOXIDE AERMOD RESULTS

Modeled SO_2 concentrations associated with the maximum development year are summarized in Table 4.3.9. The 3-hour and 24-hour SO_2 standards are not to be exceeded more than once per year. The results in Table 4.3.9 represent the H2H 3-hour and 24-hour modeled concentrations over each year of the four-year meteorological period. The annual modeled concentration is the H1H concentration over each year of the four-year meteorological period. The model results have been rounded to the form of the standard. Though potential SO_2 emissions associated with mining activities would be nominal, modeling was completed to quantify potential concentrations. Based on the recent promulgation date for the 1-hour SO_2 standard (June 2, 2010), no 1-hour modeling was performed. However, specific design features for 1-hour SO_2 in lieu of modeling have been added to Section 4.3.1 of the SDEIS.

Table 4.3.9. Sulfur Dioxide Modeling Results

Alternative	Model Year	Averaging Period	Modeled SO_2 (µg/m^3)	Background SO_2 (µg/m^3)	Total SO_2 (µg/m^3)	NAAQS (µg/m^3)
Proposed Action and Alternative C	2005	3-hour	1.49	20	21	1,300
		24-hour†	0.35	10	10	365
		Annual†	0.09	5	5	80
	2006	3-hour	1.51	20	22	1,300
		24-hour†	0.41	10	10	365
		Annual†	0.09	5	5	80
	2007	3-hour	1.64	20	22	1,300
		24-hour†	0.41	10	10	365
		Annual†	0.10	5	5	80
	2008	3-hour	1.47	20	21	1,300
		24-hour†	0.47	10	10	365
		Annual†	0.09	5	5	80

Table 4.3.9. Sulfur Dioxide Modeling Results

Alternative	Model Year	Averaging Period	Modeled SO_2 ($\mu g/m^3$)	Background SO_2 ($\mu g/m^3$)	Total SO_2 ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)
Alternative K1*	2005	3-hour	0.69	20	21	1,300
		24-hour†	0.17	10	10	365
		Annual†	0.03	5	5	80
	2006	3-hour	0.71	20	21	1,300
		24-hour†	0.17	10	10	365
		Annual†	0.03	5	5	80
	2007	3-hour	0.65	20	21	1,300
		24-hour†	0.16	10	10	365
		Annual†	0.03	5	5	80
	2008	3-hour	0.69	20	21	1,300
		24-hour†	0.17	10	10	365
		Annual†	0.04	5	5	80

* Additional receptors only.
† NAAQS revoked June 2, 2010.
Note: As a result of incorporating design features in lieu of modeling, this table does not include values for 1-hour SO_2.

The 200-foot overburden removal scenario under all action alternatives complies with the 3-hour, 24-hour, and annual NAAQS at all modeled receptors.

4.3.3.6 COAL HAUL ROAD IMPACTS

The reasonably foreseeable haul roads in the tract and the access road were included in the tract modeling. The entire reasonably foreseeable off-site coal haul road could not be incorporated into the model because of model limitations; however, impacts associated with the reasonably foreseeable off-site coal haul road were assessed using two methods:

- The long haul road was incorporated in the near-field modeling by attaching 39 volume sources depicting a segment of the long haul road starting from the intersection of the access road and the long haul road.
- A 1-km segment of the theoretical road, using emissions determined in the inventory, was modeled using receptors spaced at 25-m intervals out to 250 m from the edge of the road to assess potential impacts in areas far removed from the tract.

Additional detail regarding coal haul road modeling can be found in Appendix K. The modeled PM_{10}, $PM_{2.5}$, NO_2, and CO impacts associated with the coal haul road truck traffic do not contribute to off-site NAAQS compliance concerns. The apportioned modeled emission rates from each 50-m spaced volume source along the 1-km road are the same for all coal removal scenarios and are as follows:

- 0.00914 gram/second (g/s) PM10
- 0.000365 g/s PM2.5
- 0.001449 g/s NO2
- 0.001582 g/s CO

Table 4.3.10 lists the maximum-modeled concentrations for each pollutant and the applicable averaging period, all of which comply with the NAAQS.

Table 4.3.10. Off-site Coal Haul Road Only (representative segment) Maximum-Modeling Results

Pollutant	Modeled Years	Averaging Period	Modeled (µg/m^3)	Background (µg/m^3)	Total (µg/m^3)	NAAQS (µg/m^3)
PM_{10}	2005–2008	24-hour	55.1	72	127	150
$PM_{2.5}$	2005–2008	24-hour	1.8	9.5	11	35
		Annual	0.7	2.8	3.5	12.0
NO_2	2005–2008	Annual	3.2	17	20	100
CO	2005–2008	1-hour	53	1,150	1,203	40,000
		8-hour	17	1,150	1,167	10,000

Note: All maximum-modeled values occur when source receptors are at the same elevation.

4.3.3.7 HAZARDOUS AIR POLLUTANTS IMPACT ASSESSMENT

HAPs can cause various adverse health effects, as described in Section 3.3.2.1.1. They are not part of the NAAQS, but high levels at the tract boundary could indicate the need for further analysis, mitigation strategies, or both. Therefore, HAPs have been included in the emission inventory and were modeled in the AERMOD near-field analysis. The modeled concentrations were compared with known health exposure levels as a means of assessing potential impacts.

The only source of HAPs in the emissions inventory that can be quantified would be the generators needed to conduct mining operations. HAP emissions from the generators would be the same under all action alternatives because combustion would be the same. No adverse impacts from the tract HAP sources are anticipated based on the comparison between modeled concentrations and threshold health exposure levels (Tables 4.3.11 and 4.3.12).

Table 4.3.11. Hazardous Air Pollutants AERMOD Modeling Results (noncarcinogenic)

Pollutant	Model Years	Averaging Period	Receptor Location		Modeled (µg/m^3)	Threshold (µg/m^3)
			UTM East	UTM North		
Benzene	2005–2008	1-hour	371800	4140300	0.440	1,300 (REL)
		24-hour	368400	4142500	0.046	53 (TSL)
		Annual	370060	4140000	0.003	30 (RfC)
Toluene	2005–2008	1-hour	371800	4140300	0.160	37,000 (REL)
		24-hour	368400	4142500	0.017	2,512 (TSL)
		Annual	370060	4140000	0.001	5,000 (RfC)
Xylenes	2005–2008	1-hour	371800	4140300	0.110	22,000 (REL)
		24-hour	368400	4142500	0.011	14,473 (TSL)
		Annual	370060	4140000	0.001	100 (RfC)
Formaldehyde	2005–2008	1-hour	371800	4140300	0.045	37 (TSL)
		Annual	370060	4140000	0.0003	9.8 (RfC)

REL = recommended exposure limit; TSL = toxic screening level; RfC = reference concentration.

Table 4.3.12. Hazardous Air Pollutants AERMOD Modeling Results (carcinogenic)

Analysis	HAP Constituent	Carcinogenic Annual RfC (Risk Factor)* 1/(µg/m^3)	Exposure Adjustment Factor	Modeled (µg/m^3)	Calculated Risk	Significance Criterion
MLE	Benzene	7.80E-06	0.0949	0.003	2.2E-09	1.00E-06
MLE	Formaldehyde	5.50E-09	0.0949	0.0003	1.6E-13	1.00E-06
MEI	Benzene	7.80E-06	0.33	0.003	7.7E-09	1.00E-06
MEI	Formaldehyde	5.50E-09	0.33	0.0003	5.4E-13	1.00E-06

RfC = reference concentration; MLE = most likely exposure; MEI = maximally exposed individual.

* Data from EPA Air Toxics Database, Table 1 (EPA 2007).

HAP emissions from mobile sources and nonroad equipment were not quantified in the emission inventory due to the lack of appropriate emission factors. Mobile source emission factors obtained from the UDAQ do not include HAPs. The diesel-powered mining equipment emission factors obtained from the *Federal Register* (69:39219) also do not include HAP emission factors for these types of equipment or sources (EPA 2004). AP-42 and *Federal Register* PM emission factors (see "Table 7 of § 1039.102" in *Federal Register* 69:39219) from fugitive dust and combustion include diesel emissions; however, the emission factors do not speciate the constituents of the particular matter (e.g., diesel). Therefore, diesel, heavy metal impacts, or other specific components, cannot be separated out from the PM emissions. For the diesel-powered generators, emission factors for six of the current 187 listed HAPs are provided in Chapter 3.3 of the *Compilation of Air Pollutant Emission Factors* (EPA 1995). These six compounds are included in the emission inventory for the generators. However, these factors are not appropriate for mobile and nonroad sources.

Qualitatively, a comparison of diesel fuel usage for mobile and nonroad sources with that of the generators can be made to assess HAP impacts. Diesel fuel usage for the mobile and nonroad sources (i.e., area sources) is estimated to be 2,093,192 gallons; diesel fuel usage for the generators (i.e., point sources) is estimated to be 1,214,136 gallons. Total diesel fuel usage is approximately 1.7 times the generator fuel usage (see Appendix K). Modeled HAP impacts from the generators were more than two orders of magnitude below the risk thresholds and significance criterion (130 to 1,852,000). Because total diesel fuel usage is 1.7 times the usage for generators, it is unlikely that HAPs impacts would exceed any risk threshold or significance criterion.

4.3.3.8 NEAR-FIELD CLASS I AND CLASS II INCREMENTS

Under federal and state PSD regulations, increases in ambient air concentrations in Class I areas are limited by PSD Class I increments. Specifically, emissions associated with a particular development may increase ambient concentrations above baseline levels only within those specific increments developed for SO_2, PM_{10}, and NO_2. Modeling results for the maximum development year are presented in Table 4.3.13. For this air resources assessment, modeled concentrations are compared to the PSD increments. These comparisons are made for informational purposes only, and the analyses described herein are not intended to be, nor should they be, interpreted as a regulatory increment consumption analysis. This analysis was only performed for Alternative C because impacts from the other alternatives would be equal to or less than those presented here.

Table 4.3.13. Near-field Class I (Bryce Canyon National Park) and Class II (Grand Staircase-Escalante National Monument) Results for the Maximum Emission Rate Case (200-foot overburden removal, Alternative C)

Pollutant	Averaging Period	Class I Analysis Results		Class II Analysis Results	
		Cumulative Concentration ($\mu g/m^3$)	Class I Increment ($\mu g/m^3$)	Cumulative Concentration ($\mu g/m^3$)	Class II Increment ($\mu g/m^3$)
PM_{10}	Annual	0.01	4	0.33	17
	24-hour	0.25	8	2.34	30
SO_2	Annual	0.00	2	0.00	20
	24-hour	0.00	5	0.02	91
	3-hour	0.01	25	0.15	512
NO_x	Annual	0.04	2.5	1.73	25
$PM_{2.5}$	Annual	0.00	n/a	0.08	n/a
	24-hour	0.05	n/a	0.91	n/a
CO	8-hour	6.0	n/a	67	n/a
	1-hour	48	n/a	497	n/a

Because modeling results displayed in Table 4.3.13 show values far below the relevant increments, results are only presented for the maximum emission rate case (200-foot overburden removal, Alternative C); impacts from the other alternatives would be equal to or less than those presented here. Modeled concentrations are well below both the Class I and Class II increments. Even though there are no increments for $PM_{2.5}$ or CO, results are presented in Table 4.3.13 to convey a general impression of impact levels.

4.3.3.9 NEAR-FIELD VISCREEN ANALYSIS

VISCREEN was used to assess potential visibility impacts in the near-field modeling domain at Bryce Canyon National Park. The model indicates whether a plume from a source may be visible from a given vantage point. The primary pollutants of concern that may impact visibility in the near-field are PM (PM_{10} and $PM_{2.5}$), NO_x, and soot (EC). The conservative Level-2 VISCREEN visual impacts category was used to assess visibility impacts inside of Bryce Canyon National Park. The results are summarized in Table 4.3.14. This analysis was only performed for Alternative C because Alternative C represents the maximum emission rate case.

Only the sources associated with the surface-mining operation were modeled because the underground and surface mining operations would occur sequentially, rather than concurrently. Off-site sources are located too far from the mining operations for inclusion in this analysis.

Table 4.3.14. Visual Impacts Inside of Bryce Canyon National Park, 200-foot Overburden Removal Results for Alternative C

Background	Theta	Azimuth	Distance from Alton (km)	Alpha	Delta E		Contrast	
					Criteria	Plume	Criteria	Plume
Sky	10	157	35	11	5.35	0.420	0.13	0.009
Sky	140	157	35	11	3.70	0.108	0.13	-0.003
Terrain	10	84	18	84	5.44	1.205	0.28	0.005
Terrain	140	84	18	84	4.03	0.035	0.28	0.000

Note: Theta, azimuth, alpha, and delta E are VISCREEN modeling terms. *Theta* is the scattering angle or angle between direct solar radiation and the line of sight. *Azimuth* is an angular measurement in a spherical coordinate system, measured in degrees. *Alpha* is defined as the angle (in degrees) between a line of sight and the plume centerline. *Delta E* is the color difference parameter used to characterize the perceptibility of a plume on the basis of the color difference between the plume and a viewing background such as the sky or a cloud. *Contrast* is the relative difference in the intensity between the plume and its background (EPA 1992).

These results demonstrate that the maximum impacts inside of Bryce Canyon National Park from a potential tract plume under the Alternative C 200-foot overburden removal scenario would be less than the VISCREEN acceptance criteria for both color change (delta E) and contrast. Impacts from the Proposed Action and Alternative K1 would be equal to or less than those presented in Table 4.3.14.

4.3.4 Far-field Analysis

The purpose of the far-field analysis is to quantify potential air resources impacts to both ambient air concentrations and AQRVs from air pollutant emissions of NO_x, CO, SO_2, PM_{10}, and $PM_{2.5}$ that are expected to result from mining operations on the tract. Ambient air quality impacts beyond the tract and throughout the modeling domain were analyzed, as were AQRVs at Class I areas and selected Class II areas.

The analyses were performed using the EPA-approved CALMET/CALPUFF/CALPOST modeling system to predict direct and indirect impacts to air resources at far-field PSD Class I areas and selected Class II areas. The term *CALPUFF* is generally used to represent the entire modeling system, including the pre- and post-processors.

Since the modeling analyses were completed for the DEIS, a revised FLAG guidance document has been released (USFS et al. 2010). The FLAG 2010 guidance was in draft form at the time the analysis was performed for the DEIS and was not used by the BLM because of the potential for it to be modified (the DEIS used FLAG 2000 guidance). Differences between FLAG 2000 and FLAG 2010 are presented in Table 4.3.15.

Table 4.3.15. Comparison of FLAG 2000 vs. FLAG 2010

Element	FLAG 2000	FLAG 2010	Implications for Alton Analysis
Annual emissions/distance (Q/D) screening criteria	None	≤ 10: sum of NO_x plus SO_2 emissions (TPY) divided by distance (km) from Class I area (page 18)	NO_x plus SO_2 emissions are less than 500 TPY. No visibility analyses required beyond 50 km.
Background visibility conditions	Based on annual average natural, using National Acid Deposition Program estimates	Based on annual average natural, or 20% best natural, using EPA data from Regional Haze Rule development (page xi)	New FLAG 2010 data are more refined than National Acid Deposition Program data.
Relative humidity adjustment factor f(RH)	Hour-by-hour (with RH capped at 98%)	Monthly average (with RH capped at 95%) (page x)	Using the FLAG 2010 monthly average with RH capped at 95% is less conservative.
First-level screening model	CALPUFF or CALPUFF-lite	< 50 km AERMOD, > 50 km CALPUFF (page xii)	AERMOD used < 50 km, CALPUFF used > 50.
Visibility assessment criteria	Maximum-modeled value	< 50 km calculate hourly estimates of changes in visibility, as characterized by the change in the color difference index (ΔE) and plume contrast (C) (page xiii), > 50 km calculate 98th percentile modeled value at any receptor (page 23)	VISCREEN was used < 50 km, using the 98th percentile eliminates the first seven highest concentrations at each receptor.
Deposition analysis thresholds/concern thresholds	None	Provided for nitrogen and sulfur deposition	Q/D screening criteria were not exceeded.
Adverse impact determination criteria	"Likely to Object" if 10% threshold exceeded; regulatory factors implicitly considered	Adverse impact determination process more explicit; considers regulatory and other factors	No visibility or deposition analysis is required based on Q/D.

Note: Data from this table are from Appendix K.

4.3.4.1 CLASS I AND CLASS II INCREMENTS

Under federal and state PSD regulations, increases in ambient air concentrations in Class I areas are limited by PSD Class I increments. Specifically, emissions associated with a particular development may increase ambient concentrations above baseline levels only within those specific increments developed for SO_2, PM_{10}, and NO_2. The modeling results for the maximum development year are presented in Table 4.3.16. For this air resources assessment, modeled concentrations are compared to the PSD increments. These comparisons are made for informational purposes only, and the analyses described herein are not intended to be, nor should they be, interpreted as a regulatory increment consumption analysis.

Table 4.3.16. Far-field Class I and Class II Results for the Maximum Emission Rate Case (200-foot overburden removal, Alternative C)

Pollutant	Averaging Period	Class I Analysis Results		Class II Analysis Results	
		Cumulative Concentration ($\mu g/m^3$)	Class I Increment ($\mu g/m^3$)	Cumulative Concentration ($\mu g/m^3$)	Class II Increment ($\mu g/m^3$)
PM_{10}	Annual	0.14	4	0.03	17
	24-hour	1.06	8	0.24	30
SO_2	Annual	0.00	2	0.00	20
	24-hour	0.02	5	0.01	91
	3-hour	0.06	25	0.07	512
NO_x	Annual	0.01	2.5	0.00	25
$PM_{2.5}$	Annual	0.01	n/a	0.00	n/a
	24-hour	0.04	n/a	0.02	n/a
CO	8-hour	25	n/a	52	n/a
	1-hour	108	n/a	118	n/a

Modeled concentrations are well below both the Class I and Class II increments. Even though there are no increments for $PM_{2.5}$ or CO, results are presented in Table 4.3.16 to convey a general impression of impact levels. Impacts from the Proposed Action and Alternative K1 would be equal to or less than those presented in Table 4.3.16.

4.3.4.2 VISIBILITY

Atmospheric light extinction relative to background conditions is used to measure regional haze. This analysis has been updated for the SDEIS and included the FLAG 2010 background visibility data (in response to comments). CALPOST was used to estimate change in light extinction from CALPUFF model concentration results.

The FLAG document provides guidance for evaluating visibility. A threshold change in light extinction of 5% or more (0.5 deciview) is considered to contribute to regional haze visibility impairment, and a threshold change of 10% or more (1.0 deciview) causes visibility impairment.

The far-field visibility results were updated to include EC effects from tract emissions and recomputation of the nitric acid/nitrate (HNO_3/NO_3) partition. To estimate the EC of the fine particulate, exhaust emissions were calculated for each stationary, mobile, and nonroad combustion source. On average, 26% of the calculated $PM_{2.5}$ emissions were estimated to be from combustion. It was assumed that 80% of the exhaust emissions were EC (NPS 2013d).

Visibility results for the Alton Coal Tract only are presented in Tables 4.3.17 and 4.3.18 for the Proposed Action and Tables 4.3.19 and 4.3.20 for Alternative C. Results summarize the CALPOST visibility calculation Method 6 and FLAG 2010 Method 8 processing. Visibility results for Alternative K1 would be equal to or less than those of the Proposed Action.

Table 4.3.17. Tract-only Visibility Impacts, Method 6, Proposed Action, 200-foot Overburden Removal (with EC and HNO_3/NO_3 partitioning)

Method 6*	**Proposed Action, 200-foot Overburden**		
Class I/Class II Area	**No. of Days > 5%†**	**No. of Days > 10%†**	**Maximum Change (%)**
Capitol Reef National Park	0	0	1.3 (in 2002)
Grand Canyon National Park	0	0	3.0 (in 2001)
Zion National Park	3 (in 2002)	0	5.9 (in 2002)
Grand Staircase-Escalante National Monument	0	0	2.8 (in 2003)

* Method 2 results can be found in the *Supplement to Air Resources Impact Assessment Technical Report for the Alton Coal Lease by Application* in Appendix K. Method 6 results are shown here because they indicate the overall highest impact. One individual maximum change % for Method 2 is slightly higher at Grand Staircase-Escalante National Monument.

† No. of days > 5% is approximately equivalent to a change of 0.5 deciview and no. of days > 10% is approximately equivalent to a change of 1.0 deciview.

Table 4.3.18. Tract-only Visibility Impacts, Method 8, Proposed Action, 200-foot Overburden Removal (with EC and HNO_3/NO_3 partitioning)

Method 8	**Proposed Action, 200-foot Overburden**		
Class I/Class II Area	**2001 Change (%) 8th-high**	**2002 Change (%) 8th-high**	**2003 Change (%) 8th-high**
Capitol Reef National Park	0.67	0.73	0.64
Grand Canyon National Park	0.93	1.04	0.95
Zion National Park	3.13	4.00	3.19
Grand Staircase-Escalante National Monument	1.30	1.50	1.40

Under the Proposed Action, Zion National Park has three extinction changes that exceed 5% for Method 6. There are no extinction changes that exceed 10% in any of the areas (maximum change of 5.9% at Zion National Park). The greatest percentage change for Method 8 is 4.0% at Zion National Park. Results for Alternative K1 would be equal to or less than those presented for the Proposed Action. The greatest percentage change for Method 8 is 4.0% at Zion National Park.

Table 4.3.19. Tract-only Visibility Impacts, Method 6, Alternative C, 200-foot Overburden Removal (with EC and HNO_3/NO_3 partitioning)

Method 6*	**Alternative C, 200-foot Overburden**		
Class I/Class II Area	**No. of Days > 5%†**	**No. of Days > 10%†**	**Maximum Change (%)**
Capitol Reef National Park	0	0	1.3 (in 2002)
Grand Canyon National Park	0	0	3.1 (in 2001)
Zion National Park	3 (in 2002)	0	5.9 (in 2002)
Grand Staircase-Escalante National Monument	0	0	2.8 (in 2003)

* Method 2 results can be found in the *Supplement to Air Resources Impact Assessment Technical Report for the Alton Coal Lease by Application* in Appendix K. Method 6 results are shown here because they indicate the overall highest impact. One individual maximum change % for Method 2 is slightly higher at Grand Staircase-Escalante National Monument.

† No. of days > 5% is approximately equivalent to a change of 0.5 deciview and no. of days > 10% is approximately equivalent to a change of 1.0 deciview.

Table 4.3.20. Tract-only Visibility Impacts, Method 8, Alternative C, 200-foot Overburden Removal (with EC and HNO_3/NO_3 partitioning)

Method 8	**Alternative C, 200-foot Overburden**		
Class I/Class II Area	**2001 Change (%) 8th-high**	**2002 Change (%) 8th-high**	**2003 Change (%) 8th-high**
Capitol Reef National Park	0.68	0.74	0.65
Grand Canyon National Park	0.94	1.05	0.96
Zion National Park	3.13	4.00	3.19
Grand Staircase-Escalante National Monument	1.32	1.53	1.43

Under Alternative C, Zion National Park has three extinction changes that exceed 5% for Method 6. There are no extinction changes exceeding 10% in any of the areas (maximum change of 5.9% at Zion National Park). The greatest percentage change for Method 8 is 4.0 % at Zion National Park.

FLAG 2000 guidance was used for the visibility analysis in the DEIS. Under FLAG 2010 guidance, no visibility analyses are required for receptors more than 50 km from the tract, because the sum of NO_x and SO_2 emissions for the tract is less than 500 TPY (i.e., 230 TPY). Bryce Canyon National Park is entirely within 50 km of the tract, and the visibility analysis for Bryce Canyon National Park used the VISCREEN model to evaluate color difference index (ΔE) and plume contrast (C). This analysis (see Section 4.3.3.9) is consistent with the FLAG 2010 guidance.

A portion of Zion National Park is within 50 km of the tract, and a portion of Zion National Park is outside 50 km. No visibility analyses are required for the portion outside 50 km (NO_x plus SO_2 emissions are less than 500 TPY). A VISCREEN-type analysis would be appropriate for the portion within 50 km. For illustrative purposes, the visibility results obtained using the FLAG 2000 guidance in the DEIS were compared to similar results calculated using the FLAG 2010 guidance.

EPA released a new version of CALPOST (V6.221 Level 080724) in 2008. The draft guidance that became FLAG 2010 is used in the Method 8 CALPOST algorithms to calculate visibility impacts. Model-predicted 2002 cumulative concentrations for the Proposed Action and the 200-foot overburden removal scenario were used with FLAG 2010 background visibility data for this analysis, along with CALPUFF-predicted concentrations. The highest visibility impact is selected for FLAG 2000, whereas the eighth-highest impact is selected for FLAG 2010. The comparison between the two methodologies is presented in Table 4.3.21.

Table 4.3.21. FLAG Guidance Documents: Visibility Impact Comparison

Class I Area, Guidance Document, Method	Change (%)
Zion National Park, FLAG 2000, Maximum	5.38
Zion National Park, FLAG 2010, 98th percentile	3.94

Based on the comparison presented in Table 4.3.21, the percentage change predicted using the FLAG 2010 guidance (98th percentile change, using the same CALPUFF concentrations) is lower than that predicted using the FLAG 2000 guidance (maximum change).

4.3.4.3 DEPOSITION

Maximum predicted sulfur and nitrogen deposition impacts were estimated for the 200-foot overburden removal scenario in the Proposed Action. Predicted, direct tract-related impacts were compared to the deposition analysis thresholds (DATs) for nitrogen and sulfur in western Class I parks and refuges.

The DATs were developed by the NPS and the USFWS to provide a quantitative method with which to evaluate deposition in Class I areas. A DAT is the additional amount of nitrogen or sulfur deposition within a Class I area (or within a federal land management area) below which estimated impacts from a proposed new or modified source are considered negligible. If a source's predicted contribution to deposition is less than the applicable DAT, the impacts are considered insignificant. If the impacts are equal to or greater than the DAT, the federal land manager would make a project-specific assessment of whether the projected increase in deposition would likely result in an "adverse impact" on resources considering existing AQRV conditions, the magnitude of the expected increase, and other factors (USFS et al. 2011).

Deposition analysis results are presented in Table 4.3.22. Nitrogen and sulfur emissions for the Proposed Action and Alternative C are identical; nitrogen and sulfur emissions for Alternative K1 would be equal to or less than those reported in Table 4.3.22.

Table 4.3.22. Maximum Predicted Nitrogen and Sulfur Deposition Results for the Proposed Action and Alternative C, 200-foot Overburden Removal

Location	Overburden Thickness (feet)	Alternative	Alton Coal Tract			
			Maximum Dry and Wet Annual Sulfur Deposition (kg/ha/year)	Sulfur DAT for Western Class I Parks and Refuges (kg/ha/year)	Maximum Dry and Wet Annual Nitrogen Deposition (kg/ha/year)	Nitrogen DAT for Western Class I Parks and Refuges (kg/ha/year)
Bryce Canyon National Park	200	Proposed Action, Alternative C	0.0001	0.005	0.0124	0.005
Capitol Reef National Park	200	Proposed Action, Alternative C	0.0000	0.005	0.0004	0.005
Grand Staircase-Escalante National Monument	200	Proposed Action, Alternative C	0.0000	0.005	0.0013	0.005
Grand Canyon National Park	200	Proposed Action, Alternative C	0.0000	0.005	0.0003	0.005
Zion National Park	200	Proposed Action, Alternative C	0.0000	0.005	0.0038	0.005
Navajo Lake	200	Alternative C	0.0000	0.005	0.0021	0.005

Impacts for sulfur deposition are below the DAT in all cases; impacts for nitrogen deposition are below the DAT in all cases except for Bryce Canyon National Park. The nitrogen deposition value for Bryce Canyon National Park exceeds the DAT.

Increased deposition may have a negative impact on AQRVs sensitive to nitrogen or sulfur deposition, including lakes, streams, soils, vegetation, and wildlife (USFS et al. 2011). Documented effects of nitrogen and sulfur deposition include acidification of lakes, streams, and soils; leaching of nutrients from soils; injury to high-elevation spruce forests; changes in terrestrial and aquatic species composition and abundance; changes in nutrient cycling; and unnatural fertilization of terrestrial ecosystems (USFS et al. 2010). Each ecosystem and its AQRVs respond somewhat differently to deposition (USFS et al. 2010). The modeled exceedance of the nitrogen deposition value indicates that the NPS would make a project-specific assessment as described earlier in this section.

4.3.4.4 ACID NEUTRALIZING CAPACITY

CALPUFF was used to predict annual deposition fluxes of sulfur and nitrogen at Navajo Lake for the maximum emission rate case (200-foot overburden removal scenario, Alternative C). Because no data on lake chemistry at Navajo Lake were available, no estimates of acid neutralizing capacity change in Navajo Lake were performed. However, maximum-modeled annual sulfur and nitrogen deposition values for Navajo Lake are 0.0000 and 0.0021 kg/ha per year, respectively. Both of these values are well below the DATs of 0.005 kg/ha per year for sulfur and nitrogen. Though acid neutralizing capacity change ultimately depends on the specific water body, Leydecker et al.'s (1999) study of high-altitude Sierra Nevada lakes found that even with depressed acid neutralizing capacity as a result of modeled snowmelt NO_3 and sulfate deposition rates up to 150% above baseline conditions, no lakes experienced chronic acidification.

4.3.4.5 GREENHOUSE GASES

The primary GHGs are CO_2, CH_4, N_2O, and fluorinated gases (hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride) (EPA 2013e). In 2011, United States GHG emissions were 84% CO_2, 9% CH_4, and 7% N_2O and fluorinated gases (EPA 2013e). The action alternatives would produce GHG emissions from the combustion of fuel by vehicles and equipment, and the release of CH_4 contained in the coal. The end user combustion of the coal (off-site) would also result in CO_2 emissions. This analysis focuses on CO_2 and CH_4 because together these gases account for most of the GHG emissions (93%).

Research on how emissions of GHGs influence global climate change and associated effects has focused on the overall impact of emissions from regional or global aggregate sources. This approach is required primarily because GHG emissions from single sources are small relative to aggregate emissions. The climate change research community has not yet developed tools specifically intended for evaluating or quantifying end-point impacts attributable to the emissions of GHGs from a single source. The current tools for simulating climate change generally focus on global- and regional-scale modeling. Global- and regional-scale models lack the capability to represent many important small-scale processes. As a result, confidence in regional- and subregional-scale projections is lower than at the global scale. Therefore, limited scientific capability exists to assess, detect, or measure the relationship between emissions of GHGs from a specific single source and any localized impacts.

Globally, approximately 31,780 million metric tons of CO_2 were added to the atmosphere through the combustion of fossil fuels in 2010 (EPA 2013c). The CO_2 emissions for the Proposed Action or Alternative C would be 58,984 tons (53,510 metric tons). This total includes all on-site emissions, as well as off-site emissions from employee travel, haul truck traffic, cars and light duty trucks, and heavy duty diesel vehicles. This represents approximately 0.0002% of the 2010 global emissions. CO_2 emissions from Alternative K1 would be equal to or less than those reported for the Proposed Action and Alternative C.

Annual coal production from the tract would be approximately 2 million tons. The annual worldwide primary coal production based on 2011 data is approximately 8.46 billion tons (EIA 2013). The coal produced from the tract would therefore be expected to account for approximately 0.024% of total worldwide annual production. Because heat content varies by coal produced, there is not a direct relationship to emissions produced. The percentage of emissions from burning the coal removed from the tract would be approximately the same magnitude as the production relationship. Because site-specific data are not available, EPA's default emission factor of 4,810 pounds per ton of subbituminous coal (EPA 1998) was used to approximate annual CO_2 emissions from combusting the 2 million tons of coal that would be produced from the tract. Based on this emission factor, the end user(s) of the coal produced from the tract would emit 4.8 million tons of CO_2 per year (4.4 million metric tons). This represents 0.014% of the total CO_2 emissions from 2010 global fossil fuel combustion. Annual estimated CO_2 emissions from mining operations on the tract (0.05 million metric tons) are small relative to the amount of estimated CO_2 emissions from end user annual combustion of the coal (4.4 million metric tons). The total of these two sources of annual CO_2 emissions (4.45 million metric tons) is approximately 0.014% of 2010 global emissions from fossil fuel combustion (see Table 4.3.23).

Globally, approximately 588.6 million metric tons of carbon dioxide equivalent (CO_2e) are emitted annually from coal mining (EPA 2012h). Based on an estimate of 0.1 cubic cm per gram (cm^3/g) of CH_4 in the Smirl Coal Zone in the Alton Coal Field (Duel et al. 1988), estimated annual CO_2e emissions from the tract are 5,653,546 tons or 5,128,870 metric tons (assuming 100% of the CH_4 in the coal is released). This value represents approximately 0.87% of global emissions from coal mining.

Table 4.3.23. Carbon Dioxide Emission Comparisons

Comparison	Global	Alton Coal Tract (mining operations)	End User Annual Combustion of Coal Produced from the Tract	Total Emissions related to Alton Coal Tract
CO_2 emissions from fossil fuel combustion, MMTPY	31,780	0.05 (0.0002% of global emissions)	4.4 (0.014% of global emissions)	4.45 (0.014% of global emissions)
CO_2e emissions from coal mining, MMTPY	588.6	5.13 (0.87% of global emissions)	n/a	5.13 (0.87% of global emissions)
Annual coal production, million tons	8,460	2 (0.024% of global production)	n/a	n/a

4.3.5 Potential Mitigation Measures

Section 4.3.1 describes the design features for the Alton Coal Tract. The design features are environmental protection measures, actions, or practices that are part of the Proposed Action and all action alternatives and would be implemented by the lessee. Potential mitigation measures are additional means, measures, or practices *not* incorporated into the Proposed Action or alternatives as design features that would further reduce or eliminate impacts. These air resources mitigation measures would be considered as possible terms and conditions of the ROD (in the form of stipulations on the lease), if an action alternative is selected.

If the BLM's decision is to offer the tract for competitive leasing under any one of the action alternatives, the successful lessee would be required to obtain an air permit from the UDAQ. This air permit (and other permits that would be required prior to conducting mining operations on the tract) would be based on detailed mine plans (as described in Chapter 2, the analyses in this EIS are based on conceptual mine plans using conservative estimates and assumptions).

The following mitigation measures could be applied to reduce GHG emissions, as appropriate and economically feasible:

- Reduce engine idling or implement a "no idling" policy during construction and mining operations.
- Use biodiesel fuel in construction equipment and vehicles (typically blends of biodiesel and petroleum fuels can be used in diesel engines without any need for engine modifications).
- Use biodiesel fuel in operations equipment and vehicles.

4.3.6 Unavoidable Adverse Impacts

Unavoidable adverse impacts to air resources from mining and transporting coal under any of the three action alternatives would consist of increases in concentrations of criteria pollutants and HAPs. As a consequence of increased concentrations of criteria pollutants, some decrease in AQRVs would occur but would be within threshold values based on current regulations and guidance, with the exception of the nitrogen deposition value for Bryce Canyon National Park, which exceeds the DAT. Though pollutant concentrations would increase under the alternatives modeled, values show compliance with all the NAAQS, except for the 2006–2008 averaging period for the PM_{10} 24-hour standard under the Proposed Action and Alternative C 200-foot overburden removal scenario.

Multiple design features (control measures) have been incorporated into the analysis. Potential mitigation measures identified in Section 4.3.5 would further reduce GHG emissions and associated impacts. The adaptive management strategy would detect and address monitored air quality and AQRV degradation caused by mining activities on the tract, and would implement additional environmental protection and mitigation measures as needed.

4.3.7 Short-term Uses versus Long-term Productivity

The short-term use of the tract for mining operations would result in impacts to air resources in the analysis area for the duration of the mining operations. However, upon mine closure and reclamation, these impacts would be eliminated and would therefore not impact the long-term productivity of the air resource.

4.3.8 Irreversible and Irretrievable Commitments of Resource

The irreversible commitment of a resource means that, once committed, the resource is permanently lost to other uses. This type of commitment generally applies to nonrenewable resources (e.g., minerals, geologic features, or cultural resources) or to resources that are only renewable over a very long period of time (e.g., soil productivity or perhaps old-growth forest). Irretrievable commitments of resources, on the other hand, are regained following cessation of the activity and reclamation. There would be no irreversible commitments of air resources from mining the tract. All air resource impacts described would be irretrievable because air quality would cease to be impacted by mining operations following cessation of mining activities.

4.4 Cultural Resources

Inventories to identify and evaluate cultural resources in the Alton Coal Tract were conducted by Montgomery Archaeological Consultants, Inc. on behalf of ACD (Stavish 2007, 2008b) and by the BLM (Zweifel 2007). These inventories resulted in the identification of 132 prehistoric, historic, and multicomponent sites (a multicomponent site is one that contains both prehistoric and historic archaeological materials). Of these 132 sites, 107 are eligible for the NRHP (Table 4.4.1).

Table 4.4.1. Summary of Archaeological Site Types in the Tract

Cultural Association	Eligible	Not Eligible	Total
Historic	0	6	6
Multicomponent	7	0	7
Prehistoric	100	19	119
Total	**107**	**25**	**132**

In addition to these archaeological sites, other cultural resources that may be affected by the Proposed Action and alternatives include the Panguitch Historic District, which is listed on the NRHP, and Utah Heritage Highway 89 with its associated Mormon Pioneer Heritage Area. Finally, the Proposed Action and alternatives may affect TCPs identified by Native American groups during consultation with the BLM.

Impacts to these cultural resources under the Proposed Action and alternatives are analyzed here. Impacts for the Proposed Action, Alternative C, and Alternative K1 are considered by type of disturbance: surface mining, underground mining, construction of centralized facilities, KFO Route 116 relocation, short haul route, construction of dispersed facilities, increased human presence, other indirect effects, and coal truck traffic. It should be noted that not all 132 sites would be disturbed by each of the individual mining activities. Therefore, the following impact sections disclose the number of sites impacted by each activity. Methods and assumptions for the analysis are described next.

4.4.1 Regulatory Framework

According to the KFO RMP, the identification, preservation, and protection of significant cultural resources are necessary to ensure their appropriate uses for future generations (BLM 2008b). FLPMA Sections 1039I, 201(a), and (c); the National Historic Preservation Act (NHPA) Sections 106 and 110(a); and Archaeological Resources Protection Act Section 14(a) provide the regulatory framework that ensures cultural resource protection.

Prior to any mining disturbance, consultation with the SHPO would occur to evaluate the NRHP eligibility of cultural properties and to evaluate the effects of mining on historic properties as stipulated in the PA developed for the tract. Cultural properties determined eligible for the NRHP would be avoided; if avoidance is not be possible, a data recovery plan would be implemented prior to disturbance also as stipulated in the tract's PA.

Design features with regard to cultural resources include the following:

- Conducting Class I and III surveys to identify cultural properties on all state and federal lands and on private lands affected by federal undertakings
- Consulting with the SHPO to evaluate eligibility of cultural properties for the NRHP
- Consulting with the SHPO to evaluate effects of mining on historic properties

- Avoiding or recovering data from significant cultural properties identified by surveys, according to the approved cultural resources mitigation plan
- Notifying appropriate federal personnel if historic or prehistoric materials are uncovered during mining operations
- Instructing employees on the importance of cultural resources and the regulatory obligations to protect those resources
- Consulting with Native American tribes that have known interests in this area of leasing action and requesting assistance with identification of potentially significant religious or cultural sites
- Avoiding or recovering data from significant cultural properties identified by surveys, according to the approved HPTP
- Complying with the Native American Graves Protection and Repatriation Act

4.4.1.1 CULTURAL RESOURCES PROGRAMMATIC AGREEMENT

In December 2011, BLM initiated a formal consultation process with relevant federal agencies, Indian tribes, Utah's SHPO, representatives of local governments, interested members of the public, and the applicant to develop a PA in accordance with the NHPA Section 106 implementing regulations (36 CFR 800.14). The PA specifies how BLM will consider the effects of the undertaking on historic properties and includes detailed discussions of the APE, measures to identify and mitigate adverse effects to historic properties, and mechanisms for maintaining involvement of Indian tribes and the interested public. The PA is currently being circulated for signatures, and the text of the agreement is included in its entirety as Appendix M. Key stipulations of the PA include the following:

- Ongoing consultation with Indian tribes regarding historic properties of religious and cultural significance
- Defining the APE for the purposes of NHPA Section 106 consultation to include the entire lease area and a buffer extending 1 mile from the external boundaries of the lease area; the reasonably foreseeable haul route along US-89, SR-20, I-15, and a buffer extending 500 feet on each side of the reasonably foreseeable haul route highway centerlines; the Panguitch Historic District; the town of Alton, Utah; and the town of Hatch, Utah
- Requiring a Class I cultural resources inventory that summarizes known cultural resources inside the APE
- Requiring a Class III cultural resources inventory in all portions of the APE where activities would result in new ground disturbance
- Requiring a reconnaissance-level survey to document and evaluate historic buildings in all portions of the APE that have not been subject to survey for historic buildings within ten years prior to the execution of the PA
- Specifying the reporting requirements of Class I, Class III, and reconnaissance-level survey surveys
- Requiring that an HPTP that addresses adverse effects to NRHP-listed or eligible historic properties be developed and implemented before mining activities start
- Requiring that a Native American Graves Protection and Repatriation Act plan of action be developed and included as part of the HPTP
- Requiring that cultural resources monitoring and inadvertent discoveries plans be developed and included as part of the HPTP
- Requiring BLM and OSM to invite tribes and consulting parties to a meeting to review the implementation of the PA every five years throughout the life of the project

4.4.2 Impact Indicators and Thresholds

Impacts to cultural resources are analyzed by evaluating the extent to which NRHP-eligible properties would be affected directly or indirectly by any of the actions included in each alternative. The criteria used to assess adverse effects to NRHP-eligible properties are set forth in 36 CFR 800.5. An adverse effect consists of any impact that may alter one or more of the characteristics of a historic property that make the property eligible for the NRHP. Characteristics that must be considered with regard to NRHP criteria include the integrity of the property's setting, feeling, location, design, materials, workmanship, and association. In addition, consideration must also be given to effects that may alter the property's eligibility under any of the four NRHP Criteria (A to D). Criterion A refers to a property's association with events that have made a significant contribution to the broad patterns of our history. Criterion B refers to a property's association with the lives of persons significant in our past. Criterion C refers to properties that embody the distinctive characteristic of type, period, or method of construction, or that represent the work of a master, possess high artistic values, or represent a significant and distinguishable entity whose components may lack individual distinction. Criterion D refers to properties that have yielded or may be likely to yield information important in prehistory or history. Most of the 132 sites that would likely be adversely affected under either action alternative are eligible under Criterion D.

Direct effects consist of any physical destruction or damage to all or part of the property, such as the creation of roads or trails through the resource, the selling or leasing of the land where the resource is located, development that would alter the physical landscape of the resource, and any other types of human activity that could affect the physical integrity of the landscape where the resource is located. Direct effects may also result from activities in areas adjacent to the resource, such as when the creation of a road, trail, or recreational facility denudes vegetation in the area or changes water drainage patterns and causes erosion of the resource.

Some of the more substantial indirect effects on cultural resources typically result from increased human activity in the area, which can increase the risk of vandalism, looting, or unintentional destruction of a property. Prehistoric sites are especially vulnerable to these effects. Other types of indirect effects can impact a property's integrity of setting, feeling, or association, rather than its physical integrity. These characteristics can be affected by visual intrusions such as buildings and transmission lines, by alteration of the surrounding landscape, or by atmospheric intrusions such as dust clouds or smog. They can also be affected by substantial changes to the audible environment; such changes can result from increased vehicle or air traffic, the operation of heavy machinery, blasting, or elimination of the natural sounds that would have created the historical audible environment.

Finally, cumulative impacts are those that occur when the effects of an action are added to or interact with the effects of other past, present, and RFFAs, regardless of who is responsible for such actions. Cumulative impacts may result from individually minor, but collectively significant actions occurring over a period of time. For example, if cultural resources are being affected by development in areas adjacent to or nearby an area that is the subject of an action, then that action may contribute to a larger pattern of impacts in the region. Sites of specific types or from specific time periods may not have great individual significance, but if several such sites are being impacted by a variety of developments, they may become a rare and a much more valuable resource.

In this general framework, the effects of the Proposed Action and the alternatives on cultural resources are analyzed by considering these specific impact indicators:

- For archaeological sites and/or TCPs located in the tract, the number of sites completely or partially physically destroyed (e.g., by surface-mining activities or construction of facilities)
- For archaeological sites and/or TCPs located in the tract that are not physically destroyed, the loss of integrity, as defined above due to other direct and indirect effects

- For the Panguitch Historic District, Utah Heritage Highway 89 and the associated Mormon Pioneer Heritage Area, and Native American sacred sites or other TCPs not located in the tract, the loss of integrity of setting, feeling, and association

The first of these indicators can be analyzed quantitatively using data on cultural resource sites identified in the tract. The remaining two, which involve loss of integrity, must be analyzed qualitatively.

4.4.3 Analysis Assumptions

This analysis assumes that impacts to sites in areas of surface disturbance would be mitigated following procedures outlined in a HPTP created especially for the tract as stipulated in the PA. It also assumes that impacts to sites that have not yet been identified but that may be encountered during the course of mining or construction activities (e.g., deeply buried sites without surface manifestations that allowed them to be identified during inventory) would be mitigated through monitoring procedures similar to those described in the data recovery plan. The PA developed for the tract stipulates that a cultural resources monitoring plan and discovery plan will be included in the HPTP (see Appendix M).

4.4.4 Alternative A: No Action

Under the No Action Alternative, ACD's application to lease the coal included in the tract under the Proposed Action or Alternative C would not be approved, the tract would not be offered for competitive lease sale, and the coal included in the tract would not be mined. As such, no coal mining activities or infrastructure development would occur under the No Action Alternative, and therefore no archaeological sites or other cultural resources would be directly affected by these activities. Likewise, no cultural resources located either inside or outside of the tract would be indirectly affected by increased vandalism, looting, or unintentional damage resulting from increased access associated with mining activities from the action alternatives, nor would the integrity of setting, feeling, or association of such resources be affected. Under the No Action Alternative, current land uses such as recreation, livestock grazing, and vegetation treatments may impact archaeological sites or cultural resources in the tract.

Management of cultural resources on BLM-administered lands in the tract would continue at the discretion of the BLM under the KFO RMP. The objectives of the RMP with regard to cultural resources are 1) to identify, preserve, and protect significant cultural resources and ensure that they are available for appropriate uses by present and future generations, 2) to seek to reduce imminent threats and resolve potential conflicts by ensuring that all authorizations for land use and resource use comply with NHPA Section 106, 3) to provide opportunities for scientific and educational uses of cultural resources, 4) to provide opportunities for traditional (Native American) uses of cultural resources, and 5) to ensure compliance with the Native American Graves Protection and Repatriation Act (BLM 2008b).

4.4.5 Alternative B: Proposed Action

Under the Proposed Action, the tract would be offered for lease at a sealed-bid, competitive lease sale, subject to lease stipulations for the tract. The boundaries of the tract under the Proposed Action (see Map 1.2) would be reasonably consistent with the tract reconfiguration completed by the BLM after ACD's original LBA submittal (see Map 2.7). Approximately 1,993 acres of surface disturbance (surface mining and infrastructure development) would occur in the tract under the Proposed Action. In addition, underground mining would occur on 717 acres of land in the tract.

4.4.5.1 EFFECTS OF SURFACE-MINING ACTIVITIES ON CULTURAL RESOURCES

Of the 1,993 acres of surface disturbance that would occur in the tract under the Proposed Action, 1,750 acres would be the direct result of surface mining (pit disturbance) (see Map 1.2). There are 92 known archaeological sites located either partially or wholly in the areas that would be surface mined; of these, 75 are eligible for the NRHP. These sites, or portions of them, would be destroyed by the surface-mining process. As described in the PA, these sites would undergo archaeological testing and, if warranted, data recovery (i.e., excavation as well as other methods of collecting data) before being disturbed by surface mining. Thus, the loss of archaeological sites to surface mining would be offset to some degree by the acquisition of new information about the area's history and prehistory.

It is also possible that an unknown number of previously unidentified sites would be encountered during surface mining and may thus be affected. Implementation of a monitoring plan would mitigate impacts to NRHP-eligible sites and allow for the possibility of conducting data recovery at them.

4.4.5.2 EFFECTS OF UNDERGROUND MINING ACTIVITIES ON CULTURAL RESOURCES

Under the Proposed Action, underground mining would result in subsidence on 613 surface acres of the tract. An additional 166 surface acres outside the tract boundary but within the angle of influence would be disturbed by subsidence due to underground mining (see the Geology and Minerals section for more information on subsidence and angle of influence). Under the 200-foot overburden removal scenario, four sites occur within the 613 surface acres susceptible to subsidence from underground mining activity. One site is eligible for the NRHP.

The specific method of underground mining that would be used is not yet known, but regardless of the method, any surface disturbance associated with underground mining would occur in the pit disturbance areas discussed in the previous section (e.g., accessing subsurface coal from a high wall exposed in a pit). Thus, compared to archaeological sites located in surface-mining areas, the impacts to sites located on the surface in the underground mining area would be relatively low. The main effect that underground mining may have on archaeological sites would occur through subsidence. Until a detailed mining plan is developed, the extent of subsidence that would occur cannot be estimated. However, the integrity of sites could possibly be diminished as a result. In particular, subsidence could alter spatial and stratigraphic relationships among artifacts and other materials, reducing their potential to provide archaeologically important information. Subsidence might also cause architectural damage to prehistoric or historic structures, although it is unlikely that such structures exist in the underground mining area because no archaeological sites were identified in this area, and sites with structures are generally the most visible type of archaeological site.

4.4.5.3 EFFECTS OF CENTRALIZED FACILITY CONSTRUCTION ON CULTURAL RESOURCES

Under the Proposed Action, centralized facilities associated with mining activities in the tract would be located on approximately 36 acres of BLM-administered land in the tract's no-coal zone (areas outside of pit disturbance boundaries) (see Map 1.2). There are four archaeological sites located either partially or wholly in the centralized facility area; all four of these sites are eligible for the NRHP.

These sites would likely be destroyed by facilities construction. These sites would undergo archaeological testing and, if warranted, data recovery before construction begins. Thus, as with archaeological sites lost to surface mining, the loss of these sites would be offset to some degree by the acquisition of new information about the area's history and prehistory.

In the surface-mining areas, it is possible that some unknown number of previously unidentified sites would be encountered during construction of centralized facilities. Implementation of a monitoring plan would mitigate impacts to NRHP-eligible sites discovered in this way and would allow for the possibility of conducting data recovery.

4.4.5.4 EFFECTS OF KANAB FIELD OFFICE ROUTE 116 RELOCATION ON CULTURAL RESOURCES

Based on a series of assumptions discussed in Section 4.1.3, relocation of KFO Route 116 under the Proposed Action would affect as many as four archaeological sites, two of which are eligible for the NRHP. These sites are located within potential ROWs for the relocated road and would be partially or completely destroyed by road construction. However, it might be possible to mitigate impacts to these sites during final road design by locating the road and associated construction areas to avoid them. If avoidance is not possible, these sites would undergo archaeological testing and, if warranted, data recovery before road construction begins, and their loss would be offset to some degree by the acquisition of new information about the area's history and prehistory.

4.4.5.5 EFFECTS OF DISPERSED FACILITY CONSTRUCTION ON CULTURAL RESOURCES

Dispersed facilities would be constructed under the Proposed Action on an estimated 160 acres; these 160 acres would be located within the 1,183 acres of the tract's no-coal zone outside of the 36-acre centralized facility area. There are 45 archaeological sites located either partially or wholly in the area available for dispersed facility construction, 35 of which are eligible for the NRHP. It is unlikely that it would be possible to avoid all archaeological sites in the construction of dispersed facilities, but because the locations of dispersed facilities are not yet known, it is not possible to determine the exact number of sites that would be impacted by them. However, it can be assumed that impacts to archaeological sites from dispersed facilities would be proportionate to the percentage of the area available for dispersed facilities that would actually be occupied by them (13.5%). Applying this percentage to the number of known archaeological sites in the area available for dispersed facilities, it is likely that approximately six archaeological sites would be impacted by dispersed facilities, and that approximately five of these would be eligible for the NRHP.

As with sites located in the surface-mining and centralized facilities areas, those impacted by construction of dispersed facilities would likely be partially or completely destroyed. However, these sites would undergo archaeological testing and, if warranted, data recovery before construction begins, and the loss of these sites would be offset to some degree by the acquisition of new information about the area's history and prehistory.

In addition, it is possible that some unknown number of previously unidentified sites would be encountered during construction of dispersed facilities, and may thus be affected. Implementation of a monitoring plan would minimize or mitigate impacts to NRHP-eligible sites discovered during construction by allowing facilities to be moved to avoid them, or by allowing for the possibility of conducting data recovery at them.

4.4.5.6 INDIRECT EFFECTS OF INCREASED HUMAN ACTIVITY IN THE TRACT ON CULTURAL RESOURCES

Under the Proposed Action, an estimated 160 employees would work at the mine, with operations occurring 24 hours a day, six days a week, over a projected mine life of 25 years. This increased human presence would have an unquantifiable but potentially great impact on the integrity of NRHP-eligible archaeological sites in the tract that occur on the surface but are not directly affected by pit disturbance or facilities construction. In particular, it could increase vandalism, looting, or unintentional destruction of archaeological sites during the course of mine operations.

As noted in the previous section, there are 45 archaeological sites, 35 of which are eligible for the NRHP, located either partially or wholly in the tract's no-coal zone outside of the centralized facility area. All these sites could be affected by vandalism, looting, or unintentional destruction to a much greater degree than would be the case under the No Action Alternative, although the magnitude of such impacts cannot be estimated precisely.

4.4.5.7 OTHER INDIRECT EFFECTS ON CULTURAL RESOURCES IN THE TRACT

As noted in the Native American Consultation section, natural landscape features (e.g., springs and creeks), resource harvesting and processing areas, and archaeological sites are significant to the Native American tribes in the region for cultural and spiritual reasons (Zweifel 2008). As such, visual, auditory, and other atmospheric impacts from surface-mining activity under the Proposed Action may substantially degrade the integrity of setting, feeling, and association of TCPs that are not directly affected by pit disturbance or facilities construction. These are not impacts that can be quantified, but they would be a major concern for consulting tribes.

4.4.5.8 EFFECTS OF COAL TRUCK TRAFFIC ON CULTURAL RESOURCES

As discussed in the Cultural Resources along the Coal Haul Transportation Route section, the reasonably foreseeable coal haul transportation route under the Proposed Action (see Map 2.5) would pass through the NRHP-listed Panguitch Historic District and would follow Utah Heritage Highway 89 (see Map 3.7), which is part of the Mormon Pioneer Heritage Area. The coal haul transportation route that is used for analysis purposes is the most reasonably foreseeable route, but it is impossible to predict the exact route that a successful bidder might choose. The Panguitch Historic District is significant under NRHP Criterion A for its association with the early settlement of Panguitch and with the subsequent economic development of the area, and it is significant under Criterion C for its intact concentration of historic buildings. The Mormon Pioneer Heritage Area was established in recognition of the role that Mormon settlement played in the Euro-American colonization of the West, and its purpose includes fostering conservation and interpretation of cultural and natural resources, as well as economic development related to the region's heritage.

Under the Proposed Action, it is projected that 153 coal truck round-trips per day would occur six days per week over a projected mine life of 25 years. A traffic analysis conducted for this EIS indicates that the portion of US-89 that corresponds to the coal haul transportation route presently experiences average traffic volumes ranging in various locations from approximately 3,600 to 4,100 vehicles per day, of which between 720 and 900 vehicles per day are heavy trucks (Fehr & Peers Transportation Consultants 2013). Projected total traffic volumes for the year 2020 on US-89 (without the addition of coal trucks) range from 4,400 to 5,850 vehicles per day (Fehr & Peers Transportation Consultants 2013). The coal truck traffic that would result from the Proposed Action would be an incremental addition to the existing and projected future traffic volumes. Compared to present levels, it would represent an increase in truck traffic volume of approximately 17%–21%, six days per week. Possible impacts to cultural resources from this incremental increase in truck traffic could include physical damage to historic buildings from traffic-generated vibrations, as well an alteration of the integrity of setting, feeling, and association of the Panguitch Historic District and the Utah Heritage Highway 89/Mormon Pioneer Heritage Area.

The California Department of Transportation has presented a technical advisory on transportation-related vibrations (CALTRANS 2002). The results in this advisory suggest that neither existing truck traffic nor the addition of further coal truck traffic should physically affect historic buildings. This technical advisory suggests that a peak particle velocity (i.e., velocity of soil particles) of 5.0 millimeters/second (mm/s) is the threshold at which there is a risk of architectural damage (i.e., damage to finish materials) to "normal dwellings," such as houses with plastered walls and ceilings. The advisory further suggests that minor structural damage would not occur until peak particle velocities of 10–15 mm/s are reached. Finally, the advisory recommends that "ruins and ancient monuments" not be subjected to peak particle velocities of greater than 2.0 mm/s. In contrast to these threshold levels, the advisory reports that the highest measured traffic-generated vibrations from heavy trucks, measured on freeway shoulders at a distance of 5 m (16 feet, five inches) from the center line of the nearest lane, have never exceeded 2.0 mm/s. Vibration velocity declines exponentially with distance from the source, and because buildings along the coal transportation route are located much farther than 5.0 mm/s m from the center line of the closest traffic lane, it is unlikely that buildings along the route would ever experience vibrations that even approach the recommended maximum for "ruins and ancient monuments," much less the threshold at which architectural damage to "normal dwellings" might occur. Vibration velocity does depend on the road surface, and vibrations could be further minimized by filling potholes and cracks (CALTRANS 2002).

Although it is unlikely that the additional truck traffic would result in physical damage to historic buildings along the coal haul transportation route, there is perhaps a greater chance that it could adversely affect the integrity of setting, feeling, and association of the Panguitch Historic District, the Utah Heritage Highway 89/Mormon Pioneer Heritage Area, or both. In particular, the increased traffic could result in increases in noise, air pollutants, and traffic congestion in downtown Panguitch and along US-89, thereby adversely affecting the historic feeling of the area for residents and visitors; such impacts are considered in greater detail in the aesthetic resources, air resources, and traffic sections of this document. Portions of US-89 along the coal haul transportation route currently experience heavy truck traffic of between 720 and 900 vehicles per day. As such, heavy truck traffic is part of the experience of the Panguitch Historic District and the Utah Heritage Highway 89, and the additional volume of 153 trucks per day would represent only an incremental increase against this baseline. In addition, mining is one of the historic uses of the region that was considered in establishing the region as a heritage area, and from this perspective coal truck traffic is not inconsistent with the heritage of the area.

4.4.5.9 SUMMARY OF EFFECTS ON CULTURAL RESOURCES UNDER THE PROPOSED ACTION

Under the Proposed Action, 75 NRHP-eligible archaeological sites would be completely or partially destroyed by surface mining on 1,750 acres, and four NRHP-eligible archaeological sites would be completely or partially destroyed by construction of centralized facilities on 36 acres. As many as two NRHP-eligible archaeological sites would be impacted by the relocation of KFO Route 116, and an estimated five NRHP-eligible sites would be impacted by the construction of dispersed facilities on 160 acres out of 1,183 acres available for dispersed facility construction. The complete or partial destruction of archaeological sites under the Proposed Action are impacts that would not occur under the No Action Alternative because the No Action Alternative would not result in mining the tract. However, it is uncertain how many sites would be completely or partially destroyed when considering impacts from the current land uses discussed in the No Action Alternative.

Mitigation for the loss of eligible archaeological sites would be the information about regional prehistory and history that would be gained from archaeological testing and data recovery to be conducted as stipulated in the PA. An unknown number of archaeological sites not identified during the cultural resources inventory for the tract (e.g., buried sites without surface manifestations) might be impacted by

pit disturbance, construction of centralized or dispersed facilities, or KFO Route 116 relocation, but such impacts would be mitigated by avoidance if possible (in the case of KFO Route 116) or through monitoring and possibly data recovery (if selected to be added to the sample of sites for data recovery). At present, one NRHP-eligible archaeological site has been identified within the 613 surface acres that are susceptible to subsidence from underground mining that would occur under the 200-foot overburden removal scenario, and the specific method of underground mining to be adopted is unknown. Thus, the effects of subsidence on archaeological sites cannot be evaluated quantitatively, although there is some chance that they could occur.

Sites that are not directly impacted by surface mining or facilities construction would be subject to a greater degree of threat for vandalism, looting, or unintentional destruction due to an increased human presence in the area. Native American TCPs, which include natural features as well as archaeological sites, would be subject to adverse effects to their integrity of setting, feeling, and association due to visual, auditory, and other atmospheric impacts from mining activity. Although not quantifiable, these impacts would be a major concern for the tribes that would be consulted.

The incremental increase in truck traffic through the Panguitch Historic District and along the Utah Heritage Highway 89 that would occur under the Proposed Action would likely not cause physical damage to historic buildings along the route. However, it likely would have some adverse effect on the integrity of setting, feeling, and association of these resources.

4.4.6 Alternative C: Reduced Tract Acreage and Seasonal Restrictions

Under Alternative C, total projected surface disturbance would occur on 1,662 acres. The number of archaeological sites impacted by surface mining would be 83, of which 69 are eligible for the NRHP (compared to 75 NRHP-eligible sites affected by surface mining under the Proposed Action). Based on assumptions described for Alternative C in Section 4.1, the number of sites affected by the relocation of KFO Route 116 would be reduced from a maximum of four to a maximum of three, of which two are eligible for the NRHP (the same maximum number of NRHP-eligible sites affected by road relocation under the Proposed Action). The number of sites that would be located either partially or wholly in the area available for construction of dispersed facilities under Alternative C would be reduced from 45 to 43, of which 34 (rather than 35) are eligible for the NRHP. Applying the same percentage used to estimate impacts from dispersed facilities under the Proposed Action (13.5%), it can be estimated that the number of sites affected by dispersed facilities would not differ appreciably from the Proposed Action—that is, six sites would be affected, including five that are NRHP eligible. Impacts from underground mining and centralized facility construction would be the same as those described for the Proposed Action. Effects of increased human activity in the tract (e.g., increased threat of looting through increased access), other indirect effects (e.g., effects on the setting and feeling of TCPs), and effects from coal truck traffic would be reduced in proportion to a reduction in mine life from 25 to 21 years. Impacts from surface mining, facilities construction, and road relocation activities to sites not previously identified during cultural resource inventories would be reduced roughly in proportion to the reduction in total surface disturbance from 1,993 acres to 1,662 acres. Alternative C would increase the complete or partial destruction of archaeological sites on the tract compared to the No Action Alternative because no mining would occur on the tract under No Action. However, it is not known how many sites would be completely or partially destroyed when considering impacts from the current land uses discussed for the No Action Alternative.

4.4.7 Alternative K1: Reduced Tract Acreage

Under Alternative K1, total projected surface disturbance would occur on 1,012 acres. The number of archaeological sites impacted by surface mining would be 40, of which 29 are eligible for the NRHP (compared to 75 NRHP-eligible sites affected by surface mining under the Proposed Action). Based on assumptions described for Alternative K1 in Section 4.1, three sites would be affected by the relocation of KFO Route 116, of which two sites are NRHP-eligible. The number of sites that would be located either partially or wholly in the area available for construction of dispersed facilities under Alternative K1 would be 38. Applying the same percentage used to estimate impacts from dispersed facilities under the Proposed Action (13.5%), it can be estimated that five sites would be affected by dispersed facilities, of which four are NRHP-eligible. Impacts from underground mining and centralized facility construction would be the same as those described for the Proposed Action. Effects of increased human activity in the tract (e.g., increased threat of looting through increased access), other indirect effects (e.g., effects on the setting and feeling of TCPs), and effects from coal truck traffic would be reduced in proportion to a reduction in mine life from 25 to 16 years. Impacts from surface mining, facilities construction, and road relocation activities to sites not previously identified during cultural resource inventories would be reduced roughly in proportion to the reduction in total surface disturbance from 1,993 acres to 1,012 acres. Alternative K1 would increase the complete or partial destruction of archaeological sites on the tract compared to the No Action Alternative because no mining would occur on the tract under No Action. However, it is not known how many sites would be completely or partially destroyed when considering impacts from the current land uses discussed for the No Action Alternative.

4.4.8 Potential Mitigation Measures

Mitigation measures would consist of a combination of avoidance, monitoring, and conducting archaeological testing and, if warranted, data recovery at sites that would be affected by the Proposed Action as stipulated in the tract's PA. The PA stipulates that an HPTP that addresses adverse effects to NRHP-eligible properties would be prepared before mining activities start. Effects to prehistoric and historic archaeological sites, historic architecture, and TCPs would all be considered in the HPTP. Mitigation of adverse effects to prehistoric or historic archaeological properties would be conducted in phases. Phase I mitigation would include archaeological testing of NRHP-eligible and unevaluated sites to determine the potential for each site to provide necessary information to address relevant local and regional research issues. Phase II mitigation would involve data recovery excavation at those sites identified during Phase I mitigation to contain data relevant to local and regional research issues. Also as stipulated in the PA, the HPTP would include a Native American Graves Protection and Repatriation Act plan of action, an inadvertent discoveries plan, and a monitoring plan.

Employee education regarding the treatment of cultural resources and the restriction on access to inactive mining areas could also be included as a potential mitigation measure when managing cultural resources.

4.4.9 Unavoidable Adverse Impacts

Unavoidable impacts, or impacts that exist even after mitigation measures have been taken, would principally manifest through the destruction of all cultural resources in areas targeted for surface mine pit disturbance. For previously identified sites that are included in the sample of sites to be excavated, even though impacts would be mitigated through the collection of information about the prehistory and history of the area, materials from those sites would forever be removed from their original context. Unavoidable damage to cultural resources could also occur if resources not identified during surveys are affected during ground disturbance, despite the implementation of a monitoring plan for mitigation purposes. Unavoidable loss of cultural resources due to nonrecognition, lack of information and documentation, increased erosion, and inadvertent damage or use could also occur.

4.4.10 Short-Term Uses versus Long-Term Productivity

Cultural resources that are wholly eliminated due to short-term uses such as scientific data recovery efforts and data recovery supporting surface-disturbing activities would no longer be available for further study. Therefore, the long-term productivity of the resources (e.g., their ability to provide additional data) is also reduced. Short-term uses comprising the actual mining of coal would have the combined effect of destroying sites as well as increasing threats (such as looting) to sites outside of the actual disturbance areas through increased traffic and public access. Those sites not affected by looting during the active life of the mine may still have some reduced long-term productivity through continued looting or inadvertent destruction as a result of increased access to the region. Natural forces such as erosion would also continue to affect cultural resources, and it is likely that these resources would suffer deterioration and loss of data as a result.

4.4.11 Irreversible and Irretrievable Commitments of Resources

The implementation of laws that protect cultural resources would provide mitigation of impacts from permitted activities. However, the development of a surface coal mine would impact a large number of sites. Such a large number of NRHP-eligible sites would make mitigation through full data recovery an impractical solution for every resource, and a testing strategy in advance of data recovery would consequently be implemented, as stipulated in the PA. For sites that are excavated, even though data would be recovered through scientific research, excavation and subsequent destruction through mining activities would result in an irreversible commitment of resources.

Several irretrievable commitments of resources would also occur. During the active lifetime of the mine, cultural resources not otherwise impacted by direct mining effects would be under increasing threat of looting for a period of time. In addition, cultural resources in the tract would not be available to Native Americans for traditional uses or to scholars for research purposes for a period of time. The loss of integrity of setting and feeling that the Panguitch Historic District and the Utah Heritage Highway 89/Mormon Pioneer Heritage Area would experience during transportation of coal to markets would also constitute an irretrievable commitment of resources. Because these impacts would be temporary, lasting only for the life of the mine, they would be irretrievable rather than irreversible.

4.5 Fire Management

This section discusses the impacts of the Proposed Action and alternatives as described in Chapter 2 on FRCC acreages in the Alton Coal Tract. Impacts would vary by alternative and would depend on specific actions that could directly or indirectly reduce or contribute to fuels loading or increase or decrease the risks of wildland fire.

4.5.1 Regulatory Framework

Although no specific regulations or additional design features are in place for fire activities, the successful bidder would follow internal protocol and BLM BMPs to reduce and mitigate fire risk.

4.5.2 Impact Indicators and Thresholds

Acres of surface disturbance in vegetation communities in each FRCC would be used as the primary indicator of impacts from implementation of the alternatives. Surface disturbance would mainly be incurred by minerals development and by the construction of facilities and roads as planned under the action alternatives.

FRCCs are categories that describe the degree of departure of vegetation communities from the central tendency of reference ecosystems (see Section 3.5.3.1 in Chapter 3). Central tendency is a composite estimate of fuel composition, fire severity and frequency, and other characteristics of an ecosystem. There are three FRCC categories: FRCC 1 consists of areas having no to low departure from reference communities, FRCC 2 consists of areas with moderate departure, and FRCC 3 consists of areas with high departure (Hann et al. 2001). These departures are largely caused by changes to vegetation structure and composition through improper grazing, fire suppression, and exotic annual weed invasion. In the tract, 99.7% of all the vegetation types (excluding open water and acres of roads) are in FRCC 2 and FRCC 3 (see Map 3.9).

A secondary indicator of impacts to fire regimes in the tract would be the construction and presence of new roads. Because of the potential for vehicle traffic to start wildfires, increased travel in the tract could lead to a greater risk of human-caused wildfires. Also, increased machinery operation during construction of facilities could lead to a greater wildfire risk. Acres of land designated for facilities construction would also be a secondary indicator of impacts to fire regimes in the tract.

4.5.3 Analysis Assumptions

Lightning accounts for 78% of all fires in the KFO area. Human activity such as careless smoking, vehicle exhaust, sparks from machinery or vehicles, escaped agricultural burning, and unattended campfires accounts for the remaining 22% (BLM 2004). However, alterations to vegetation community structure and composition that create conditions for frequent wildfires are, to some extent, all a result of human activity. Regardless of the initial cause of the fire, wildfires in unreclaimed disturbed areas (i.e., FRCC 2 and 3) tend to occur more frequently and cause more damage than wildfires in natural or reference conditions (BLM 2004). For the purposes of this analysis, vegetation disturbance and FRCC rating would be considered the most important factors in determining wildfire risk, although risk due to new road and facilities construction is also discussed.

For this analysis, it is assumed that post-operational revegetation would be successful and that revegetated vegetation communities would be less susceptible to wildfires than they are currently. Under both of the action alternatives, approximately 43% of pinyon-juniper communities in the tract would be cleared for mine or facilities construction (see Section 4.15). Because all pinyon-juniper communities in the tract are

considered to be a result of invasive plant encroachment, these areas would not be restored to current vegetation community structures post-operation but would be revegetated with sagebrush and perennial grassland species. Permanent removal of 43% of the vegetation in these communities would greatly reduce the overall fuel load in the tract. It is possible that the FRCC rating would be improved following revegetation, and the risk of catastrophic wildfires in the tract would be reduced in the long term.

It is also assumed that revegetated areas would only be subject to minimal, long-term invasive, annual weed species encroachment. This assumption is based on agency objectives for reclamation and on the relatively small amounts of invasive annual weed species observed in past revegetation projects in the area (Reese 2008).

Preventive standard operating procedure (SOPs) would be followed during all mine operations to minimize risk of equipment-started fires.

4.5.4 Actions that Would Cause Change to Existing Fire Conditions

Clearing of vegetation for mines, roads, and facilities would create a short-term reduction in fuel loading and fire frequency. There would be less risk of wildfires prior to reclamation, when these areas are not occupied with vegetation. These cleared areas would also act as firebreaks between vegetated areas. Increased vehicle traffic to and from mining operations would result in an increased risk of vehicle-caused ignitions that could start wildfires. However, new roads would also provide better access for firefighters in the case of a wildfire.

Because 99.7% of land in the tract is classified as FRCC 3, restoration of native vegetation communities would be expected to improve vegetation community quality and fire regime classifications. If the revegetation of vegetation communities at the completion of mining activities is successful, it could shift the lands' FRCC rating from high to low levels of departure from central tendencies of reference ecosystems.

All action alternatives analyzed would be compliant with the *Southern Utah Support Area Fire Management Plan* (BLM 2005c). Thus, leasing the tract, mining activities on the tract, and coal hauling along the reasonably foreseeable coal haul transportation route would not affect the BLM's ability to conduct prescribed burning to reduce threats of wildfire.

Impacts of actions under each alternative are discussed in the following sections.

4.5.4.1 ALTERNATIVE A: NO ACTION

Under the No Action Alternative, ACD's application to lease the coal included in the tract under the Proposed Action or Alternative C would not be approved, the tract would not be offered for competitive lease sale, and the coal included in the tract would not be mined.

No coal-mining activities or infrastructure development would occur under the No Action Alternative on the tract. Likewise, no acres of vegetation communities would be disturbed by these activities, and no change in the FRCC rating would result. Furthermore, no acres in the tract would be revegetated or have the potential to decrease in FRCC rating as a function of mining.

Management of vegetation on BLM-administered lands in the tract would continue at the discretion of the BLM under the KFO RMP. These treatments are generally used to restore sagebrush grasslands that have been invaded by pinyon-juniper woodland for ecosystem restoration and watershed health. In the short term, vegetation treatments could increase the risk of invasion by noxious weeds and invasive species by vegetation removal and ground disturbance. Under the No Action Alternative, the removal of pinyon-juniper woodlands would reduce fuel loads in the tract. However, the approximate percentage of tract to be treated under the No Action Alternative in the short and long term is not known at this time.

Implementing general treatment design features such as 1) using prescribed burning in lieu of mechanical treatment when deemed suitable, 2) evaluating treatment sites for soil suitability and stability prior to manipulation, and 3) excluding livestock from all treatment areas until seedlings are established would help facilitate reestablishment of vegetation communities. Using desired species of grasses, forbs, and browse in the rehabilitation and reseeding of treated areas would facilitate vegetation reestablishment and avoid creating single-species communities.

Vegetation treatments, if successful, would have long-term benefits to the ecology of the area by removing undesired species, increasing species diversity and age class of certain communities, improving vegetation composition and structure, increasing overall vegetation cover, and improving FRCC rating. This could result in healthier woodlands, upland communities, and riparian areas that are more capable of retaining moisture and nutrients and resisting disease, invasive species, drought, fire, and other natural disturbances and/or stressors.

4.5.4.2 ALTERNATIVE B: PROPOSED ACTION

Under the Proposed Action, the tract would be offered for lease at a sealed-bid, competitive lease sale subject to standard and special lease stipulations developed for the tract. The boundaries of the tract under the Proposed Action (see Map 1.2) would be reasonably consistent with the tract reconfiguration completed by the BLM after ACD's original LBA submittal (see Map 2.7).

4.5.4.2.1 Vegetation Removal

Approximately 1,733 acres of surface disturbance in vegetation communities would result from surface-mining operations (pit disturbance) under the Proposed Action. Centralized facilities associated with mining activities on the tract would remove approximately 36 acres of vegetation on BLM-administered land in the tract's no-coal zone (areas outside of pit disturbance boundaries) (see Map 1.2). Other dispersed facilities would result in approximately 160 acres of vegetation removal. Relocation of KFO Route 116 in the tract would also remove approximately 47 acres of vegetation. This leads to approximately 1,975 acres of vegetation removed due to mining and facilities construction. This is 55% of the vegetation in the tract.

Under the management objectives described in Chapter 2, this entire acreage (1,975 acres) would be revegetated with suitable native and non-native species. Invasive annual grasses such as cheatgrass would be suppressed. This could lead to an improved FRCC rating on these revegetated areas due to the suppression of cheatgrass and the return of the vegetation community to one with a fire regime of less frequent and lower intensity fires.

Under the Proposed Action, as well as all other action alternatives, Block Sa (186.2 acres) would not be mined and the lessee would apply pre-mining vegetation treatments to the block. The proposed vegetation treatments would break up continuous fuels and reduce the risk of wildfire entering sensitive sagebrush areas. These enhancements would help create a variety of age classes of sagebrush and would reduce the potential for high-intensity fire. Removing and/or thinning pinyon-juniper in a mosaic pattern would also break up continuous fuels and reduce the risk of a high-intensity wildfire. Because there is a greater risk of conversion of shrublands to annual grasslands under a high-intensity fire, managed vegetation treatments would reduce the likelihood of cheatgrass invasion and help native grasses and forbs persist long term.

4.5.4.2.2 Wildfire Risk Due to Increased Access to Tract and Construction of Facilities

Under the Proposed Action, approximately 6.5 miles of new roads would be constructed due to the relocation of KFO Route 116. This increase in new road, when compared to the No Action Alternative, would result in an increased risk of human-caused wildfires from construction activities.

The construction of centralized and dispersed facilities on 196 acres under the Proposed Action could lead to an increased risk of human-caused wildfires from construction activities in undisturbed vegetation on and adjacent to the tract as compared with the No Action Alternative, where no facilities would be constructed.

The Western Utah RWPP does not consider the town of Alton as a state-identified community at risk of wildfire. However, the RWPP does identify WUI areas immediately west of the town, along the length of US-89, as well as the Spencer Bench, Spencer Cliff Estates, and Stout Canyon area. The RWPP risk assessment identifies a high wildfire risk in these areas (FCAOG 2007b), which include portions of the coal haul transportation route.

4.5.4.2.3 Wildfire Risk Due to Increased Vehicle Trips

Increased movement to and from the tract by construction equipment and coal haul trucks would increase the risk of fuel leakage and/or sparking that could lead to wildfires in the tract and adjacent transportation corridors. An estimated 153 coal haul vehicle round-trips per day are expected under the Proposed Action.

The number of projected employee vehicle trips is expected to increase under this alternative as compared to the No Action Alternative. These trips would also lead to increased wildfire risk due to fuel leakages and sparking.

The risk of spontaneous combustion of coal in haul trucks, coal storage piles, refuse piles, and exposed coal faces would also increase as a result of mining activities. Under the DOGM's coal-mine permitting application requirements (Rule R645-301), the successful bidder would be required to follow all regulations regarding fire prevention and response.

4.5.4.3 ALTERNATIVE C: REDUCED TRACT ACREAGE AND SEASONAL RESTRICTIONS

Under Alternative C, the tract would be modified to exclude Block NW of the tract near the town of Alton (see Map 2.2). Furthermore, certain mining activities in Block S would be subject to seasonal restrictions to reduce impacts to the local sage-grouse population. The boundaries of the modified tract would be reasonably consistent with the configuration shown in Map 2.2.

4.5.4.3.1 Vegetation Removal

Approximately 1,443 acres of surface disturbance in vegetation communities would result from surface-mining operations (pit disturbance) under Alternative C. Centralized facilities associated with mining activities on the tract would remove approximately 36 acres of vegetation on BLM-administered land (see Map 2.2). Other dispersed facilities would result in approximately 135 acres of vegetation removal. Relocation of KFO Route 116 in the tract would also remove approximately 36 acres of vegetation. This leads to 1,650 acres of vegetation that would be removed due to mining and facilities construction. This is 52% of the vegetation in the tract.

Under the management objectives described in Chapter 2, this entire acreage (1,650 acres) would be revegetated with suitable native and non-native species. Invasive annual grasses such as cheatgrass would be suppressed. This could lead to an improved FRCC rating on these revegetated areas due to the suppression of cheatgrass and the return of the vegetation community to one with a fire regime of less frequent and lower intensity fires.

4.5.4.3.2 Wildfire Risk Due to Increased Access to Tract and Construction of Facilities

Under Alternative C, approximately 4.6 miles of new roads would be constructed due to the relocation of KFO Route 116. This increase in new roads, when compared to the No Action Alternative, would result in an increased risk of human-caused wildfires from construction activities.

The construction of centralized and dispersed facilities on 171 acres under Alternative C would lead to an increased risk of human-caused wildfires from construction activities in undisturbed vegetation on and adjacent to the tract when compared to the No Action Alternative, where no facilities would be constructed.

4.5.4.3.3 Wildfire Risk Due to Increased Vehicle Trips

Increased movement to and from the tract by construction equipment and coal haul trucks would increase the risk of fuel leakage and/or sparking that could lead to wildfires in the tract and adjacent transportation corridors. An estimated 153 coal haul vehicle round-trips per day are expected under Alternative C.

The number of projected employee vehicle trips would be greater than under the No Action Alternative and the same as the Proposed Action; however, the number of trips would last for 21 years as opposed to 25 under the Proposed Action. These trips would also lead to increased wildfire risk due to fuel leakages and sparking.

4.5.4.4 ALTERNATIVE K1: REDUCED TRACT ACREAGE

Under Alternative K1, the tract would be modified to exclude Block NW of the tract near the town of Alton and Block S (see Map 2.3).

4.5.4.4.1 Vegetation Removal

Approximately 861 acres of surface disturbance in vegetation communities would result from surface-mining operations (pit disturbance) under Alternative K1. Centralized facilities associated with mining activities on the tract would remove approximately 36 acres of vegetation on BLM-administered land (see Map 2.3). Other dispersed facilities would result in approximately 92 acres of vegetation removal. Relocation of KFO Route 116 in the tract would also remove approximately 16 acres of vegetation. This leads to 1,005 acres of vegetation that would be removed due to mining and facilities construction. This is 48% of the vegetation in the tract.

Under the management objectives described in Chapter 2, this entire acreage (1,005 acres) would be revegetated with suitable native and non-native species. Invasive annual grasses such as cheatgrass would be suppressed. This could lead to an improved FRCC rating on these revegetated areas due to the suppression of cheatgrass and the return of the vegetation community to one with a fire regime of less frequent and lower intensity fires.

4.5.4.4.2 Wildfire Risk Due to Increased Access to Tract and Construction of Facilities

Under Alternative K1, approximately 2 miles of new roads would be constructed due to the relocation of KFO Route 116. This increase in new roads, when compared to the No Action Alternative, would result in an increased risk of human-caused wildfires from construction activities.

The construction of centralized and dispersed facilities on 128 acres under Alternative K1 would lead to an increased risk of human-caused wildfires from construction activities in undisturbed vegetation on and adjacent to the tract when compared to the No Action Alternative, where no facilities would be constructed.

4.5.4.4.3 Wildfire Risk Due to Increased Vehicle Trips

Increased movement to and from the tract by construction equipment and coal haul trucks would increase the risk of fuel leakage and/or sparking that could lead to wildfires in the tract and adjacent transportation corridors. An estimated 153 coal haul vehicle round-trips per day are expected under Alternative K1.

The number of projected employee vehicle trips would be greater than under the No Action Alternative and the same as the Proposed Action; however, the number of trips would last for 16 years as opposed to 25 under the Proposed Action. These trips would also lead to increased wildfire risk due to fuel leakages and sparking.

4.5.5 Potential Mitigation Measures

No potential mitigation measures are proposed for fire management.

4.5.6 Unavoidable Adverse Impacts

The risk of wildfire ignition would be an unavoidable impact under the Proposed Action, Alternative C, and Alternative K1. Restoration of native vegetation communities would be expected to improve vegetation community quality and fire regime classifications.

4.5.7 Short-term Uses versus Long-term Productivity

In the short term, areas cleared of vegetation for construction of mined areas, facilities, or roads would be removed from FRCC rating. These areas would serve as firebreaks in the event of wildfires in adjacent areas. At the completion of mining activities, these areas would be revegetated under the mitigation measures set out in Chapter 2. Revegetation has the potential to improve the tract's FRCC ratings. In the long term, the revegetation of 1,975 acres of land (55.6%) under the Proposed Action, 1,650 acres of land (52.2%) under Alternative C, and 1,005 acres of land under Alternative K1 would remove a large area of land from this high FRCC rating and therefore help this area move toward a more natural fire regime.

4.5.8 Irreversible and Irretrievable Commitments of Resources

The protective measures detailed in Chapter 2 require the reclamation of disturbed areas following the completion of mining. Because vegetation resources would be restored or rehabilitated after the proposed disturbance and/or development, there would be no anticipated irreversible impacts on native vegetation resources or fire regimes associated with the management decisions proposed for the tract. However, there would be irretrievable impacts associated with the surface-disturbing activities proposed throughout the planning area. Any native, fire-resistant vegetation that would be removed or disturbed would be an irretrievable loss until successful restoration took place.

4.6 Geology and Minerals

The analysis area for geology and minerals is primarily the Alton Coal Tract under all action alternatives. However, the area north and northeast of the tract's underground mining portion of mining block C, extending 405 feet beyond the tract boundaries (an area of approximately 166 acres outside the tract boundary), is also included (Map 4.5). This area is within what is known as the "angle of draw" or "angle of influence" (hereafter referred to as the angle of influence) for the underground mine portion of the tract. The angle of influence defines the extent of the surface area affected by ground movement that occurs as a result of removing coal from an underground mine where overlying rock layers are no longer supported by underlying coal removed during mining. Above the mine workings of an underground mine, rock movements occur vertically and at angles projected away from the mined-out area (Pennsylvania Department of Environmental Protection 2008). The angle of influence varies from approximately 8°–45° depending on the coal field (Bell et al. 2006). This analysis assumes that the angle of influence in this portion of the Alton Coal Field is a maximum of approximately 30°. This is the angle of influence presumed by the DOGM to be the maximum angle in the permitting process unless the permit applicant can demonstrate, and the DOGM can determine, that a site-specific angle of influence would be more appropriate (DOGM 2008). Assuming 1) a 30° angle of influence (as stated), 2) that the overburden depth at the tract boundary is approximately 700 feet, and 3) that the land surface extending beyond the tract boundary is flat, approximately 405 feet of land surface (or approximately 166 total acres) beyond the north and northeastern edge of the tract (as mentioned above) would be affected by underground mining operations in the tract (see Figure 4.6.1 for an illustration of the angle of influence and an explanation of calculations).

4.6.1 Regulatory Framework

4.6.1.1 FEDERAL REGULATIONS

- The MLA authorizes and governs the leasing of public lands for developing coal, petroleum, natural gas, and other hydrocarbons, phosphates, and sodium in the United States.
- The Materials Act of 1947 authorizes the United States government to sell minerals to common varieties of sand, stone, gravel, pumice, pumicite, cinders, and clay.
- FLPMA requires that public lands be managed in a manner that will protect scientific, environmental, air and atmospheric, and water resource values. It also requires land use plans to be in compliance with applicable pollution control laws, including state and federal air, water, and other pollution standards.

4.6.1.2 STATE REGULATIONS

- The Coal Mining Reclamation Act of 1979: Utah Rule R645 provides provisions pertaining to the effects of coal mining and reclamation operations and pertaining to coal exploration.
- Coal Mining and Reclamation; UAC 40-10 assures that surface coal mine operations are conducted to protect the environment, that reclamation of mine lands occurs promptly, and that mining operations are not conducted where reclamation is not economically or technologically feasible.
- The DOGM requires the identification of unsuitable overburden materials and selectively placing, mixing chemically, or mixing physically this material to minimize adverse effects to vegetation or groundwater.
- The DOGM requires analysis before mining to detect unsuitable overburden.
- The DOGM requires that topography be restored to AOC.

4.6.2 Alternative A: No Action

Under the No Action Alternative, the BLM would not issue a lease for coal in the Alton Coal Tract. Therefore, the geomorphological surface features, subsurface stratigraphy, and chemical and physical characteristics of the area would not change as a function of coal mining. The current land uses in the tract, which consist of recreation, livestock grazing, and vegetation treatments, would continue in a similar manner to current conditions. Their impacts to the area's geomorphology would remain similar to current conditions. The BLM's current management of burnt shale, gravel, fluid materials, and locatable minerals in and adjacent to the Alton Coal Tract would also remain unchanged as a function of coal mining.

4.6.3 Alternative B: Proposed Action

Under the Proposed Action, the BLM would hold a competitive lease sale for some 49 million tons of coal in the Alton Coal Tract. Under this alternative, the tract includes approximately 3,576 surface acres, roughly 1,296 acres of which are private surface and 2,280 acres of which are federal surface. All coal resources contained in the tract are federally owned. Approximately 1,132 acres of the tract under the Proposed Action do not contain coal (the tract's no-coal zone). Under the Proposed Action, approximately 1,993 surface acres would be disturbed. Of this total acreage, approximately 1,750 acres would be disturbed from pit disturbance (active mining operations), 36 acres would be disturbed for centralized facilities, 160 acres would be disturbed for dispersed facilities, and 47 acres would be disturbed to temporarily relocate KFO Route 116. Additionally, subsidence disturbance could occur over approximately 613 acres of the underground mining area and approximately 166 acres outside the tract boundary but within the assumed angle of influence.

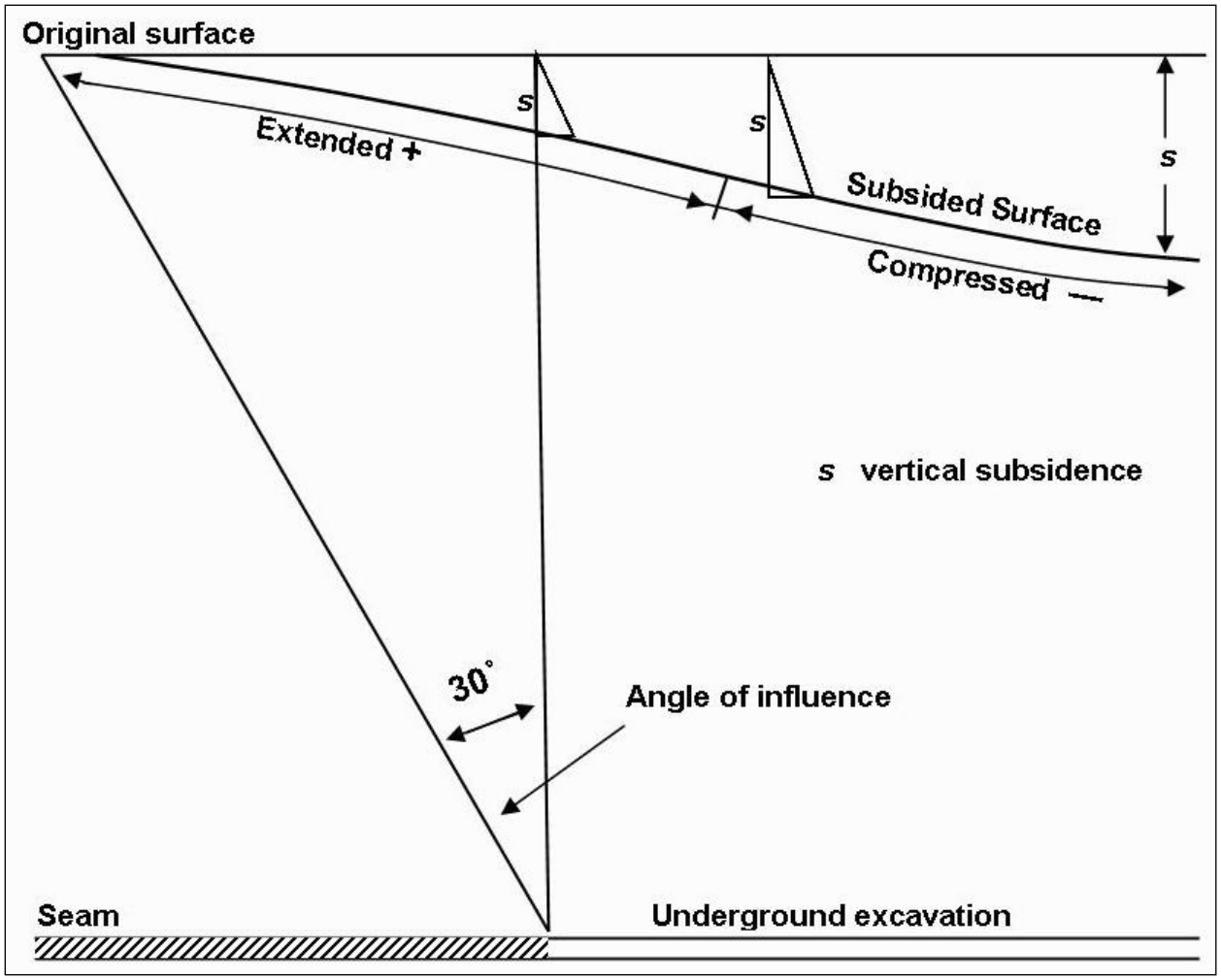

Figure 4.6.1. Angle of influence for underground mining (modified from Bell et al. 2006:91).

Note: The length of the land surface affected by underground mining operations, assuming that the surface is flat, was determined using the tangent function (tan A = o / a). Because the assumed angle of influence (A = 30˚) and the assumed length of the adjacent side or the overburden depth (a = 700′) are available, the length of the opposite side (o) or the land surface affected by underground mining operations was calculated by putting the known numbers into the function to solve for the length of the opposite side equaling 404.13′.

4.6.3.1 IMPACTS TO GEOLOGY, INCLUDING TOPOGRAPHY, PHYSIOGRAPHY, AND STRATIGRAPHY

4.6.3.1.1 Impacts Due to Surface Mining

The surface-mining operation would remove coal and return noncoal material back into the pit on an estimated 1,750 acres (pit disturbance) under the Proposed Action. The geology of the mine pit area would be permanently altered. The replaced overburden material would be similar to pre-mining lithologies; however, the physical characteristics of the material, including permeability and stratigraphy, would be altered through the placement of a mixture of sizes and rock types back into the mined-out pit. The removal and relocation of the overburden would create a blend of the original geologic units. The stratigraphy of the area would also be permanently altered by the removal of the coal layer itself, which is currently a component of the stratigraphic arrangement of rock layers in the tract. The geology underlying Bryce Canyon National Park would not be affected by surface or underground mining on the tract, because the tract is more than 10 miles away from the park.

Like the geology of the mine pit area, the topographical expression of the land surface would be permanently altered. The PMT would be determined during the DOGM permitting process, but in general terms the land would be returned to its AOC (unless a variance or exemption is granted by the DOGM). Alterations in final topography may be approved to improve wildlife habitat for species such as Greater Sage-Grouse, mule deer, and elk. Other alterations in final topography may be approved based on the desires of private surface owners. According to DOGM regulations and procedures, variances or exemptions granted by the DOGM to approve alterations in final topography must follow a process that includes the opportunity for public comment. The removal of the coal seam (approximately 15 feet thick) would not significantly alter the original elevation of the area following reclamation because overburden and topsoil (after excavation and replacement in the mined-out pit) swell by a factor of approximately 30% (Powell 2008). This swelling would compensate for the coal seam's removal. Although the replaced overburden and topsoil would settle slightly over time, the final ground surface elevation would not be significantly different from the tract's original elevation (Table 4.6.1).

Table 4.6.1. Calculation of Pre- and Post-mining Coal and Overburden Depths

	Current Conditions (feet)	**Post Mining, Proposed Action (feet)**	**Post Mining, Alternative C (feet)**	**Post Mining, Alternative K1 (feet)**
Overburden depth (approximate average)	100	120 (100 feet × 1.2 swell factor)	120 (100 feet × 1.2 swell factor)	120 (100 feet × 1.2 swell factor)
Coal seam thickness (approximate average)	15	0	0	0
Total	**115**	120	120	120

Reclamation would therefore result in the replacement of overburden and topsoil and the regrading to AOC (or a contour suitable for post-mining land use subject to the DOGM's variance or exemption regulations and procedures), and may also include the forming of pits and valleys (gouging) on the surface. The outcome would be a gradual overall topography with moonlike surface microbasins of varying depth and width. The DOGM and BLM would approve the final gouge specifications as a function of growth medium properties.

Under the Proposed Action, surface-mining impacts to geology as described above would be long term and adverse because the tract's topography, physiography, and stratigraphy would be permanently altered after mining operations have ceased and after reclamation is complete. The key differences between the Proposed Action, Alternative C, Alternative K1, and the No Action Alternative are shown in Table 4.6.2.

Table 4.6.2. Comparison of Impacts under the No Action Alternative, the Proposed Action, Alternative C, and Alternative K1

Resource Type	Impact Type	Alternative A (No Action)	Alternative B (Proposed Action)	Alternative C (Reduced Tract Acreage and Seasonal Restrictions)	Alternative K1 (Reduced Tract Acreage)
Topography, physiography, and stratigraphy	Acres surface mining	0	1,750	1,454	869
	Acres underground mining	0	613	613	613
	Acres within the angle of influence	0	166	166	166
Geologic hazards	Fault hazard from underground mining	No	Yes	Yes	Yes
	Landslide risk	Low	Low	Low	Low
Leasable mineral resources	Production of coal	None	44,900,000 tons	38,100,000 tons	30,000,000 tons
	Impacts to fluid minerals	None	Decreased likelihood of removal due to mining activities	Decreased likelihood of removal due to mining activities	Decreased likelihood of removal due to mining activities
Salable mineral resources	Burial of burnt shale	None	Possible burial	Possible burial	Possible burial
	Burial of gravel	None	Possible burial	Possible burial	Possible burial
Locatable mineral resources	Damage or burial of septarian nodules	None	Possible damage or burial	Possible damage or burial	Possible damage or burial
Underground coal fire	Risk of spontaneous combustion	None	Low	Low	Low

4.6.3.1.2 Impacts Due to Underground Mining

Assuming that surface mining would be feasible up to 200 feet of overburden removal, underground mining would occur beneath approximately 613 acres. Surface impacts from underground mining would generally be limited to the short-term placement of associated surface facilities and subsidence of the land above mined-out portions of the underground mine area and within the 30° angle of influence described above. At a minimum, underground mining operations on the tract would include building a portal, associated pad, and access route. The construction and placement of these facilities would typically require removing and stockpiling topsoil and overburden. However, because surface facilities for underground mining would be placed in areas previously surface mined, these impacts do not represent additional disturbances outside of those previously discussed. Upon completion of mining activities, just as with surface-mining operations, the facilities site would be reclaimed; facilities would be removed and the pit backfilled.

As underground mining operations proceed, removal of the coal would cause subsidence on portions of the Alton Coal Tract overlying the area of coal removal. Subsidence would be in the form of troughs and/or sinkholes formed on the surface, depending in part on the underground mining method used. Overburden geological characteristics (the overall structure and strength of the materials contained in the overburden) also affect subsidence. Sinkholes can present a danger to recreational users and wildlife. Thus, if the tract is leased, a design feature would require the lessee to monitor the mined areas for sinkhole formation and to provide the DOGM and BLM notice of such formation within 24 hours. Sinkholes occur more commonly when room and pillar methods are used, whereas troughs are more typical of long-wall mining operations (Pennsylvania Department of Environmental Protection 2008). The maximum extent of subsidence is a function of the coal seam thickness removed and a (unit-less) subsidence factor that ranges from 0.1 to 0.9 (Bell et al. 2006). Subsidence factors in the western United States range from 0.33 to 0.65 (Bell et al. 2006). To be conservative concerning potential impacts, this analysis assumes the higher of these values (0.65). Assuming that approximately 100% of the coal seam was removed (a conservative assumption for purposes of analysis), surface subsidence in the form of sinkholes and/or troughs directly above the area of coal removal would be up to approximately 9.75 feet. This is calculated by multiplying the thickness of the coal seam removed (15 feet) by the subsidence factor (0.65). In Utah, the effects of subsidence usually consist of surface cracks, general ground lowering, and cliff fracture or failure (Smith 2008). Based on the 30° angle of influence previously described, the effects of subsidence would extend approximately 405 feet beyond the north and northeastern edge of the tract (166 acres). A total of 779 acres including the 613 acres contained in the tract and the 166 outside of the tract boundary would be disturbed. Subsidence in this area would generally be less pronounced than in areas directly overlying those of coal removal (as illustrated in Figure 4.6.1), and would gradually taper toward the outside extent of this area. Surface impacts of underground mining as described would be permanent (long term) and adverse to the topography of the area because it would not be possible to resupport subsided areas. Impacts to stratigraphy from underground mining would also be permanent (long term) and adverse because the removal of the coal seam (a layer making up the stratigraphy of the area) and the lowering of subsided rock layers compared to surrounding rock layers that remain supported cannot be reversed. No mitigation measures for impacts to topography and/or stratigraphy are required by the DOGM. However, impacts to associated resources (e.g., water—surface and groundwater—which is the resource most commonly impacted by subsidence) would be repaired in accordance with DOGM rules and regulations and federal lease terms and stipulations. Mechanisms and methods used to repair damage to resources vary depending on the nature of the damage and the resource (Burton 2008).

Both surface and underground mining can pose risks to the health and safety of mine workers. These risks include injuries, illnesses, and even death. These risks can be exacerbated by things such as accidents, inadequate safety measures, inadequate training, and seismic activity. MSHA helps reduce these risks by developing and enforcing safety and health rules for all United States mines, and by providing technical, educational, and other types of assistance to mine operators. If the tract is leased, the lessee would be required to comply with all applicable MSHA rules and all other regulations related to mine safety.

4.6.3.2 IMPACTS RELATED TO GEOLOGIC HAZARDS

4.6.3.2.1 Faults

The area around the tract has been shown to experience seismic activity of low frequency, ranging from magnitudes of 1.0–3.6 on the Richter Scale. A magnitude 4.5 earthquake occurred on January 3, 2011, in the Tushar Mountains, approximately 8 miles northwest of Circleville, Utah (and approximately 70 miles north of the tract) (University of Utah 2011). A more recent earthquake of magnitude 3.6 occurred on February 11, 2012, approximately 2.4 miles northwest of Panguitch, Utah (and approximately 36 miles north of the tract) (University of Utah 2012). The probability of seismic events associated with any or all of the faults in the area (see Section 3.6) impacting mining and reclamation operations at the Alton Coal Tract is fairly low (DuRoss 2008). However, depending on the frequency and magnitude of seismic events and the stability of mine highwall construction, earthquakes could cause highwall failure (DuRoss 2008). Also, blasting activities would have the potential to initiate seismic activities on the tract. All highwalls and other mine-related structures would be required to comply with DOGM and MSHA safety regulations. Compliance with these regulations would limit or eliminate safety concerns with respect to seismic activity in the area.

The tract is shown on the USGS National Seismic Hazard Maps (2008) as having a 2% probability of exceeding a peak horizontal acceleration of between 20% and 30% of the acceleration due to gravity. This is above the 10% of gravity that is often assumed to be the threshold for damage to weak construction, such as unreinforced masonry buildings (Pechmann 2008). Although these are not particularly high hazards, large earthquakes are possible throughout Utah. The hazard to workers and equipment in a mine from seismic events is highly dependent on local conditions. Where coal is exposed and under considerable pressure, small events may cause considerable spalling (breaking up into chips or fragments) and other damage. If mines are stable, they may not experience any damage from large events (Pechmann 2008).

In many parts of Utah where mining is common, the seismic hazard from mining-induced seismic events can be greater than that from natural events (Pechmann 2008). The coal-mining process often induces seismic events due to subsidence, room collapse, and forces from the removal of coal and overburden. Seismicity associated with underground longwall mining of coal is strongly influenced by depth of cover, lithology of strata above and below the coal seam, and coal strength. Events ranging from 3.3 to 4.2 in magnitude have been observed at mines in the Wasatch Plateau–Book Cliffs region. Mining-induced events of up to magnitude 3.9 have been estimated as possible elsewhere in Utah (Arabasz et al. 2002), and would be possible under the Proposed Action.

4.6.3.2.2 Landslides

Landslide deposits are present at the Straight Cliffs/Tropic Shale contact (see Section 3.6). The deposits are located in a small portion of the tract's northwestern-most corner (see Map 3.10). At this contact, sandstone blocks of the Straight Cliffs Formation have moved onto the Tropic Shale. This condition has been facilitated by the presence of perched groundwater that has created a broad area of hummocky topography at the base of and adjacent to the Straight Cliffs (at the east of the Alton Amphitheater). Because these hummocky areas tend to hold moisture and because seeps are common, the potential for landslides exists where the Straight Cliffs/Tropic Shale is at or near the surface (Tilton 2001). Furthermore, blasting activities on the tract can initiate landslides in this area of the tract. Therefore, landslide hazards exist under the Proposed Action for structures that are built on or next to landslide deposits.

4.6.3.3 IMPACTS TO MINERAL RESOURCES

4.6.3.3.1 Leasable Minerals

4.6.3.3.1.1 Coal

The direct impact of the Proposed Action would be the production of up to approximately 44.9 million tons of recoverable coal from federal mineral reserves in the Alton Coal Tract over the 25-year life of the mine (2 million TPY of coal removal). This would represent the removal of approximately 4% of the total estimated recoverable coal reserves (1 billion tons) in the Alton Coal Field. Impacts to coal reserves would be permanent and adverse because coal resources extracted from the tract cannot be replaced, and extraction would result in a permanent depletion from the total coal reserve in the Alton Coal Field.

4.6.3.3.1.2 Oil and Gas

Under the Proposed Action, the primary impact on oil and gas resources would be their temporary unavailability for extraction due to coal mining (unless directionally drilled from beyond active coal-mining areas). If oil and gas resources are currently present in geologic formations beneath the tract (well below the Smirl Coal Zone that would be mined), they would remain in these formations for the life of the mine or longer under the Proposed Action.

Although coal-mining operations on the tract under the Proposed Action would not result in releases of oil and gas reserves, operations would cause the direct release of CH4 located in air pockets of the coal reserves (referred to as coalbed CH_4). This CH_4 is not currently considered recoverable; therefore, there would be no impact to commercial coalbed CH_4 based on its current market conditions. However, a long-term adverse impact to this resource would result because, once released, coalbed CH_4 contained in the Smirl Coal Zone cannot be restored, and any potential for recovery would be lost.

4.6.3.3.2 Salable Minerals

4.6.3.3.2.1 Burnt Shale

Because most of the burnt shale deposits in the tract have been or would be mined by the time a decision is made by the BLM on this EIS, direct impacts to burnt shale resources are unlikely. However, if mining operations expose burnt shale in the tract, they would likely be lost as economically recoverable resources due to mixing with other overburden during reclamation. If segregated from other overburden sufficiently, they may remain usable.

Although most of the salable burnt shale deposits have been previously mined, there are other known, unmined deposits west of the tract. The BLM may need to resolve any conflicts that could arise if there is interest in this deposit in the future (such as the proposed access route to the site) that could interfere with burnt shale mining operations. Thus, the only impacts to burnt shale deposits beyond the tract would be more difficult access; the actual resource would not be adversely impacted or removed. Impacts to access and local economies are discussed in Section 3.8, Land Use and Access, and Section 3.12, Socioeconomics.

4.6.3.3.2.2 Gravel

Salable pediment gravels in the tract would be directly impacted under the Proposed Action due to mixing with other overburden following surface mining. It is not known how many areas of salable gravel are present in the tract; therefore, impacts to gravel are assumed to correspond to the total acreage that would be surface mined and uniformly spread over the entire area.

4.6.3.3.3 Locatable Minerals

4.6.3.3.3.1 Septarian Nodules

It is not known how common septarian nodules are in the tract, or if they are present in sufficient density to be economically viable for development. However, any nodules present at or near the surface in areas that would be surface mined would be at risk of burial during reclamation, and therefore may be less accessible for development. The nodules would not be removed and would therefore still be available as a resource, but their development would likely be less economically viable and their concentration in any area would likely be reduced.

4.6.3.4 UNDERGROUND COAL FIRES

The likelihood of spontaneous combustion and underground fires on the tract was assessed by the BLM Utah State Office in November 2010 using two points 1) the U.S. Bureau of Mines software program (now under the National Institute for Occupational Health and Safety [NIOSH]) and 2) historical data and coal history of the tract. This technical summary can be found in *Alton LBA EIS – Coal Spontaneous Combustion* (McKenzie 2014), which is part of the administrative record for this EIS.

Multiple runs of the NIOSH software resulted in a spontaneous combustion rating of "high" for the Smirl Coal Zone (the seam proposed for mining under all action alternatives). This indicates that the coal is highly susceptible to spontaneous combustion and rapid oxidation leading to smoke or open flames. However, historical reviews of the coal history prepared by Doelling and Graham (1972) and site visits have not shown any indication of past coal mine fires near the tract. In addition, past mining of the Smirl Coal Zone in and near the tract has occurred at very shallow depths with more exposure of the coal to atmospheric oxygen. These shallow mines have a higher potential for spontaneous combustion than the deeper underground mining that would occur under all action alternatives. The lack of evidence of fires at this site suggests that the risk is lower for the Alton Coal Tract than shown in the NIOSH results (McKenzie 2010).

The BLM-required R2P2 would address the following:

- The monitoring and prompt control of any coal fires in surface coal pits, spoil piles, and surface coal stockpiles.
- Standard and, as necessary, enhanced monitoring of underground mine conditions to provide warning of possible mine fires (for both mine safety and environmental considerations).
- The design of underground workings to provide necessary, minimum overburden cover prior to commencing full extraction mining techniques and to ensure first mining efforts do not lead to introduction of atmospheric oxygen along fractures and/or bedding planes unless the actual conditions show the coals are stable.

The risk of underground coal fires as a result of spontaneous combustion would be the same under Alternatives C and K1.

The potential impacts from underground coal fires would include the destruction of the affected areas; ignition of grass, brush, or forest fires; surface subsidence; and emission of toxic gases, such as CO, SO_2, and CH_4.

4.6.4 Alternative C: Reduced Tract Acreage and Seasonal Restrictions

Impacts to geology (topography, physiography, and stratigraphy), impacts related to geologic hazards, and impacts to mineral resources would be the same in nature under Alternative C, the Proposed Action, and Alternative K1. Impacts would vary between Alternative C, the Proposed Action, and Alternative K1 in terms of the total amount of coal mined, the total amount of disturbed acres, and the life of the mine. The key differences between Alternative C, the Proposed Action, Alternative K1, and the No Action Alternative are shown in Table 4.6.2.

Under Alternative C, the BLM would hold a competitive lease sale for 38 million tons of federal, recoverable coal reserves (approximately 4% of the estimated one billion tons of recoverable coal reserves present in the Alton Coal Field, and 15% less than under the Proposed Action) in a modified tract; the tract would exclude Block NW under the Proposed Action. Mining operations under Alternative C would result in approximately 1,454 acres of disturbance from surface mining (14% less than under the Proposed Action), approximately 36 acres of disturbance for centralized facilities (the same as under the Proposed Action), approximately 135 acres of disturbance for dispersed facilities (16% less than under the Proposed Action), approximately 36 acres of disturbance for relocation of KFO Route 116 (24% less than under the Proposed Action), and approximately 779 acres (including the 613 acres in the tract) of surface disturbance from underground mining operations (the same as under the Proposed Action). The life of the mine under Alternative C would be approximately 21 years, or 16% less than under the Proposed Action. The no-coal zone under Alternative C would be approximately 1,034 acres. The suite of impacts associated with Alternative C would be smaller than that of the Proposed Action because the total acreage of the tract would be smaller.

4.6.5 Alternative K1: Reduced Tract Acreage

Impacts to geology (topography, physiography, and stratigraphy), impacts related to geologic hazards, and impacts to mineral resources would be the same in nature under Alternative K1, Alternative C, and the Proposed Action. Impacts would vary between Alternative K1, Alternative C, and the Proposed Action in terms of the total amount of coal mined, the total amount of disturbed acres, and the life of the mine. The key differences between Alternative K1, Alternative C, the Proposed Action, and the No Action Alternative are shown in Table 4.6.2.

Under Alternative K1, the BLM would hold a competitive lease sale for 30 million tons of federal, recoverable coal reserves (approximately 3% of the estimated 1 billion tons of recoverable coal reserves present in the Alton Coal Field, and 33% less than under the Proposed Action and 21% less than under Alternative C) in a modified tract; the tract would exclude Block NW and Block S under Alternative K1. Mining operations under Alternative K1 would result in approximately 869 acres of disturbance from surface mining (50% less than under the Proposed Action and 40% less than under Alternative C), approximately 92 acres of disturbance for dispersed facilities (43% less than under the Proposed Action and 32% less than under Alternative C), approximately 16 acres of disturbance for relocation of KFO Route 116 (54% less than under Alternative C and 65% less than under the Proposed Action), and approximately 779 acres (including the 613 acres in the tract) of surface disturbance from underground mining operations. The life of the mine under Alternative K1 would be approximately 16 years, or 36% less than under the Proposed Action and 24% less than under Alternative C. The no-coal zone under Alternative K1 would be approximately 581 acres. The suite of impacts associated with Alternative K1 would be smaller than that of the Proposed Action and Alternative C because the total acreage of the tract would be smaller.

4.6.6 Potential Mitigation Measures

The following mitigation measures could be used to reduce geologic hazards or impacts to geology and minerals associated with the implementation of the Proposed Action or Alternative C.

- Consider the mine and reclamation plan sediment pond location in relation to geologic hazards to reduce the risk of failure in the event of a seismic event. This is addressed as part of the mine plan approval and mine permitting processes.
- As required for the mine plan and the mine permitting and bonding, develop a regularly scheduled subsidence survey.
- Segregate the deposits if mining operations expose economic burnt shale.
- Segregate the deposits if mining operations expose economic gravel.

4.6.7 Unavoidable Adverse Impacts

There would be no unavoidable adverse impacts under the No Action Alternative. Under the action alternatives, the following adverse impacts would be unavoidable (i.e., they could not be mitigated):

- Mining operations would unavoidably remove between 42.3 and 44.9 million tons of coal from the tract. This coal would not be replaceable and mining operations would result in a permanent depletion of the coal reserves in the tract.
- The topography, physiography, and stratigraphy of the tract would be permanently altered after mining operations ceased and reclamation was complete.
- If and where full extraction mining is used, subsidence due to underground mining would adversely impact the topography of the area; it would not be possible to resupport subsided areas. Impacts to stratigraphy as a function of underground mining would also be unavoidable due to removal of the coal seam and the lowering of subsided rock layers compared to surrounding rock layers.
- Coalbed CH_4 contained in the Smirl Coal Zone would be released.

4.6.8 Short-term Uses versus Long-term Productivity

In the short term, the removal of between 30.0 and 44.9 million tons of recoverable coal would eliminate the future production of the Alton Coal Tract in this specific area. A defining characteristic of nonrenewable resources such as coal is that their use in the near-term eliminates their future use. However, the short-term use of the coal in the tract would not impact the long-term productivity of the remaining coal present in the Alton Coal Field.

4.6.9 Irreversible and Irretrievable Commitments of Resources

There would be no irretrievable impacts to geology and mineral resources under the Proposed Action, Alternative C, or Alternative K1. However, the following commitments of geological and mineral resources would be irreversible and could not be recovered under the action alternatives:

- The topography, physiography, and stratigraphy of the tract would be permanently altered after mining operations ceased and reclamation was complete.
- If and where full extraction mining is used, subsidence due to underground mining would adversely impact the topography of the area; it would not be possible to resupport subsided areas.
- Impacts to stratigraphy from underground mining would also be irreversible due to production of the coal seam (a layer making up the stratigraphy of the area) and the lowering of subsided rock layers compared to surrounding rock layers.
- If mining operations expose burnt shale in the tract, these resources would likely be lost as economically recoverable resources due to mixing with other overburden during reclamation. If segregated from other overburden sufficiently, they may remain usable but may be reduced in value.
- Once released, coalbed CH_4 reserves contained in the Smirl Coal Zone cannot be regained.
- The production of up to approximately 30, 38, or 44.9 million tons of recoverable coal from federal mineral reserves in the Alton Coal Tract over the 16-, 21-, or 25-year life of the mine would be permanent and adverse because coal resources extracted from the tract cannot be replaced once mined, and extraction would result in a permanent depletion from the total coal reserve in the Alton Coal Field.
- Without potential mitigation, pediment gravels, derived mostly from the erosion of the Tropic Shale, would be irreversibly mixed with other overburden following surface mining.

4.7 Hazardous Materials and Hazardous and Solid Waste

Under the action alternatives, sources of hazardous materials on the Alton Coal Tract would include liquid wastes, fuels such as diesel fuel and gasoline (potentially containing benzene, toluene, xylene, methyl tert-butyl, ether, and tetraethyl lead), coolants, antifreezes, lubricants such as motor oil and grease (potentially containing complex hydrocarbons and lithium compounds), paints, solvents, and solid wastes. Nonhazardous solid wastes would include floor sweepings, shop rags, lubricant containers, welding rod ends, metal shavings, worn tires, packing material, used filters, and office and food wastes. Solid wastes would include human waste from portable toilets and waste pumped from permanent toilets with sealed containment tanks.

Hazardous and solid materials and their related impacts are assessed using the number of vehicles in use at the site, the number of vehicles refueling, and the number of vehicles transporting hazardous materials to and from the site. Impacts under the action alternatives would be minimal because solid and hazardous wastes would be controlled through SOP. In addition, management of hazardous materials, substances, and waste, in addition to nonhazardous solid waste practices (including storage, transportation, and spills) would be conducted on the tract according to the procedures listed in Section 2.3.2.7 and in compliance with 29 CFR 1910, 49 CFR 100–185, 40 CFR 100–400, Comprehensive Environmental Response, Compensation, and Liability Act, Resource Conservation and Recovery Act, Superfund Amendments and Reauthorization Act, Toxic Substances Control Act, CWA, and other federal and state regulations and policies regarding hazardous materials management and solid waste management. Public land sites contaminated with hazardous and/or solid wastes would be reported, secured, and remediated according to applicable federal and state regulations and contingency plans (BLM 2008b).

4.7.1 Regulatory Framework

Minimizing the risks associated with hazardous materials is required by federal law (see Section 2.3.2.7 and Table 2.6.1). The measures listed below would be common to both action alternatives and are also discussed in Chapter 2. The minimization of risks would require the application of safety precautions during their transport, use, storage, and disposal. As required by law, the following precautions would be implemented as mitigation and prevention of hazardous materials and liquids spills or leakages.

- Used oil would be contained and recycled according to Utah Department of Environmental Quality Solid and Hazardous Waste Division guidelines.
- Solid waste and sewage within permit boundaries would be disposed of according to approved plans.
- All production, use, storage, transport, and disposal of hazardous waste would be in accordance with applicable existing or hereafter promulgated federal, state, and government requirements.
- Emergency reporting requirements for releases of hazardous materials, as established in Comprehensive Environmental Response, Compensation, and Liability Act, as amended, would be complied with.
- Files containing MSDS for all chemicals, compounds, and/or substances used during the course of mining would be maintained.

The lessee would be expected to prepare and implement several plans and/or policies to ensure environmental protection from hazardous and extremely hazardous materials. These plans and/or policies would include the following:

- Spill prevention control and countermeasure plans
- Spill response plans
- Inventories of hazardous chemical categories pursuant to Section 312 of the Superfund Amendments and Reauthorization Act, as amended
- Emergency response plans

4.7.2 Alternative A: No Action

Under the No Action Alternative, ACD's application to lease the coal included in the tract would not be approved, the tract would not be offered for competitive lease sale, and the coal included in the tract would not be mined.

No coal mining activities or infrastructure development would occur on the tract under the No Action Alternative, and therefore there would be no transportation, use, production, or risk of hazardous materials or hazardous and solid waste spills or leaks as a function of mining. Under the No Action Alternative, lands in the tract would continue to be managed in accordance with the KFO RMP. Land management in the tract currently includes livestock grazing, recreation (primarily OHV use and hunting), and vegetation treatments. These current uses could result in the introduction of fuel and lubricants to the tract. However, quantities would be minimal, largely resulting from minimal, dispersed use of the area by motorized recreationists and livestock grazing permittees accessing allotments by vehicle (generally truck or OHV).

4.7.3 Alternative B: Proposed Action

Mining activities under the Proposed Action would take place over approximately 25 years. Centralized facilities would occupy approximately 36 acres of land under this alternative. Another 160 acres would be used for construction of dispersed facilities, leading to 196 acres of constructed facilities. Under the Proposed Action, these acres would be subject to hazardous materials exposure for 25 years. However, adherence to SOPs and legal requirements would minimize or eliminate risks of hazardous material spills and contamination.

Under the Proposed Action, an estimated 153 coal haul vehicle round-trips per day would occur on the reasonably foreseeable coal haul transportation route. In addition, service vehicle visits to the tract would supply the mine with diesel fuel, machine equipment, office supplies, and other necessary materials. Service vehicle visits would also remove solid waste from dumpsters, remove other nonsolid wastes (such as used motor oil), and would service portable toilets and permanent toilet sealed containment tanks. This increased movement to and from the tract by service vehicles and coal haul trucks has the potential to increase the risk of fuel leakage or solid waste spills in the tract and adjacent transportation corridors. Risks of fuel leakage and spills are associated with coal truck accidents, transportation during service, refueling of vehicles, and the maintenance of vehicles used on-site. Transportation during service operations on the tract would include delivery of diesel fuel and machine and equipment parts (daily or weekly), servicing of portable toilets (weekly or biweekly), servicing of permanent toilet facilities (monthly or bimonthly), and removal of waste oil (weekly or biweekly), as necessary. Maintenance and major oil changes for most moveable equipment would take place inside the maintenance shop, and used oil would be contained and disposed of or recycled in accordance with Utah Department of Environmental Quality Solid and Hazardous Waste Division guidelines. Accidental or inadvertent leakages from storage tanks would also be possible.

If they are not contained and quickly cleaned up, leaks or spills of hazardous materials from the aforementioned activities would impact vegetation and wildlife by killing individuals and/or poisoning habitat resources or prey. Spills would also contaminate soil and water resources. Spilled fuel or other hazardous waste or materials could be transported through soils or water to aquifers or to surface waters in or outside of the tract, increasing the potential for both short-term and long-term adverse effects on vegetation, terrestrial and aquatic wildlife, and habitat quality in the tract.

4.7.4 Alternative C: Reduced Tract Acreage and Seasonal Restrictions

Impacts would be the same as those described under the Proposed Action with the following exceptions. Under Alternative C, the tract would be modified to exclude Block NW (see Map 2.2). The acreage of dispersed facilities constructed would be fewer than under the Proposed Action, and therefore the associated risks, such as fuel leakage and storage tank leakage, would be smaller under this alternative.

Mining activities under this alternative would take place over approximately 21 years, which is three years shorter than under the Proposed Action. Centralized facilities would occupy approximately 36 acres of land under this alternative. Another 135 acres would be used for construction of dispersed facilities, leading to 170 acres of constructed facilities. Under Alternative C, adherence to SOPs and legal requirements would minimize or eliminate risks of hazardous material spills and contamination.

4.7.5 Alternative K1: Reduced Tract Acreage

Impacts under Alternative K1 would be the same as those described under the Proposed Action and Alternative C with the following exceptions presented here. Under Alternative K1, the tract would be modified to exclude Block NW and Block S (see Map 2.3). The acreage of dispersed facilities constructed would be fewer than under the Proposed Action and Alternative C, and therefore the associated risks, such as fuel leakage and storage tank leakage, would be smaller under this alternative.

Mining activities under this alternative would take place over approximately 16 years, which is nine years shorter than under the Proposed Action and five years shorter than under Alternative C. Centralized facilities would occupy approximately 36 acres of land under this alternative. Another 92 acres would be used for construction of dispersed facilities, leading to 128 acres of constructed facilities. Under Alternative K1, adherence to SOPs and legal requirements would minimize or eliminate risks of hazardous material spills and contamination.

4.7.6 Potential Mitigation Measures

No potential mitigation measures, beyond legal and regulatory requirements, have been identified for hazardous materials and hazardous and solid waste.

4.7.7 Unavoidable Adverse Impacts

No unavoidable adverse impacts would occur because SOPs and mitigation measures would be followed.

4.7.8 Short-term Uses versus Long-term Productivity

No further risk of hazardous materials or liquid spills or leakages would exist at the close of mining operations, and therefore no long-term adverse effects on productivity of the site are anticipated.

4.7.9 Irreversible and Irretrievable Commitments of Resources

There would be no irreversible or irretrievable commitments of resources with respect to hazardous materials and hazardous and solid waste associated with mining.

4.8 Land Use and Access

4.8.1 Land Use and Ownership

Primary land uses in and adjacent to the Alton Coal Tract include tourism, farming, livestock grazing, and dispersed recreation including hunting. In addition, Alton Coal operates the Coal Hollow Mine east of Block S.

Impacts to land use and access were analyzed by determining which existing land uses would conflict with proposed mining activities. Land uses would be affected because public access would be eliminated during the life of the mine to ensure public safety. Land use would also be restricted during the post-mining reclamation period (10 or more years) to assist in the establishment of suitable vegetation. Disturbance from mine-related activities would include pit disturbance, grading for the construction and maintenance of centralized and dispersed facilities, and the relocation of KFO Route 116. Impacts from these activities are grouped together because the impacts to land use would result from a combination of all mine-related activities, and not specific aspects of each activity. Grazing and recreational activities in the tract would be prohibited from active mine areas for the life of the mine and the 10-year reclamation period. Tourism (sightseeing) would not be prohibited or restricted by mining activities because access to other federal lands in the area would still be available.

4.8.2 Regulatory Framework

FLPMA of 1976 ensures that public lands are managed for multiple uses to best meet the present and future needs of the public. The KFO RMP identifies management direction for land uses in the area in the form of goals and objectives; “Make public lands available for ROWs, permits, and leases. The suitability for these land actions would be judged on a case-by-case basis.” (BLM 2008b:2–44)

Although private lands in the tract are zoned for agriculture under the *Kane County, Utah General Plan* (FCAOG 2011), uses are regulated by land use ordinances and the general plan is used as an advisory guide for land use decisions. A zone change would be required before any mining takes place, as required by the Kane County Commission and Planning Commission (Kane County 2012).

Under both action alternatives, BLM-administered lands in the tract would be reclaimed and suitably restored for historic uses such as livestock grazing, wildlife habitat, and recreation. Private lands would be reclaimed and suitably restored to allow existing land uses to be resumed following mining. Post-mining land uses may differ from those presented here; however, their approval would require a process and approval by DOGM.

4.8.3 Alternative A: No Action

Under the No Action Alternative, land use, ownership, and prior rights to the tract would remain unchanged. The tract would not be mined and activities in the area would continue under their current condition. Dominant activities such as grazing, recreation, and vegetation treatments in the area would not be impacted as a function of mining on the tract.

4.8.4 Alternative B: Proposed Action

Under the Proposed Action, 1,993 acres of surface disturbance would occur on the 3,576-acre tract that encompasses federal and private lands (Table 4.8.1). Because the area is of mixed uses, some of the acres of impacts overlap.

Surface-mining activities would results in short-term impacts under the Proposed Action; livestock grazing would be restricted, wildlife habitat would be reduced, and public access and associate recreational use would be restricted. During the life of the mine, adjacent federal lands would support livestock grazing and recreation (e.g., hunting and OHV use).

There would be no long-term impacts under the Proposed Action; surface and vegetation in the tract would be reclaimed, and the land would be returned to a condition similar to its original status. The land would reopen to grazing, hunting, and other recreational opportunities that existed before the mine.

Table 4.8.1 shows the dominant land uses in the tract and the impacts that would occur from mining activities under the Proposed Action.

Table 4.8.1. Land Uses Impacted in the Alton Coal Tract under the Proposed Action

Affected Land Use	Type of Use	Impact
Grazing	Livestock, mainly cattle, for grazing and forage.	Loss of or unavailable access to approximately 92 AUMs annually (3,220 AUMs over the life of the mine and the 10-year reclamation period), due to mining activities (see Section 4.9 for additional information).
Agriculture	Farming	Loss of acres available for agriculture during the active mining period.
Recreation	Hunting and OHV use, common in and adjacent to the tract.	Unavailable access to lands for recreational use (throughout the life of the mine). Impacts to recreation experience by increased traffic, noise, and dust (see Section 4.11 for additional information).
Tourism	Visits to nearby park areas such as Bryce Canyon National Park, Grand Staircase-Escalante National Monument, and two scenic highways.	Negligible impacts to tourism from mining activities (see Section 4.12 for additional information).

4.8.4.1 FEDERAL LANDS

Under the Proposed Action, the primary use of federal lands would be coal extraction. Coal mining would preclude other possible uses of the land, making them unavailable during the life of the mine. Approximately 2,280 surface acres (64%) of the tract that would be unavailable for other uses under the Proposed Action are federally owned. Surface-disturbing activities to these lands would include the removal of vegetation, which would result in

- impacts to agriculture by removing acres available for crops,
- impacts to grazing by decreasing AUMs available for forage, and
- impacts to recreation from increased traffic, noise, and dust, diminishing the experience and opportunities available.

Although mining activities may result in changes noticeable to those visiting the nearby Dixie National Forest, Bryce Canyon National Park, and Grand Staircase-Escalante National Monument, it is not anticipated that the increased traffic, noise, and dust resulting from the mine would decrease the overall experience of visitors enough to affect visitation to these areas. Two-track roads also exist throughout the tract for OHV use and hunting access.

4.8.4.2 PRIVATE LANDS

All coal reserves in the tract are federally owned, though surface ownership is mixed, and mine activity would result in surface disturbance to private lands. Approximately 1,296 surface acres (36%) of the tract under the Proposed Action are privately owned, consisting of eight different private surface owners. Surface owners who are legally qualified to give consent to mine federal minerals under the private surface owner's estate would be determined should a decision to lease be made. Prior to any mining activity moving forward, the BLM would require written consent from the qualified surface owner. The BLM would not be involved in the content of the agreement. Private land uses in the tract and surrounding land include agriculture, domestic grazing, and dispersed recreation. Two-track roads also exist throughout the tract for private landowner access to private surface lands.

Impacts from surface disturbance on private lands would be the same as those described under federal lands. Impacts to counties from mining activity would be the temporary loss of lands that are zoned for activities such as agriculture, grazing, and recreation. Lands available for these uses would be removed for 25 years while mining activities took place; however, they would be available for use during the 10-year post-mining reclamation period. These activities are in compliance with the *Kane County, Utah General Plan*, which allows lands to be open for mineral exploration and development (FCAOG 2011). Additionally, the Alton town cemetery is 780 feet from the tract boundary. At this distance, it is not anticipated that any impacts would occur to the cemetery from mining activities.

4.8.5 Alternative C: Reduced Tract Acreage and Seasonal Restrictions

Impacts to land use under Alternative C would be similar to those described under the Proposed Action, but to a slightly lesser degree. The nature of activities would be the same under both alternatives; however, Alternative C would propose to mine 403 fewer acres (removal of Block NW) of private lands than Proposed Action. Additionally, the life of the mine would be 21 years plus the 10-year reclamation period (31 years).

The shorter timeframe would result in a loss of 2,852 AUMs, which is 368 fewer than under the Proposed Action over the life of the mine and reclamation period. Additionally, the Alton town cemetery would be located 6,380 feet from tract boundary, which would create less of an impact than under the Proposed Action.

4.8.6 Alternative K1: Reduced Tract Acreage

One of the intents of including Alternative K1 was to resolve issues related to land uses. Although the types of impacts to land use and access under Alternative K1 would be similar to those described under the Proposed Action, they would occur to a lesser degree. The nature of activities would be the same under both alternatives; however, under Alternative K1, 1,462 fewer acres are being considered for leasing (removal of Block NW and removal of Block S) than under the Proposed Action. These acres include 880 acres of private surface estate lands. Alternative K1 would result in a loss of 2,392 AUMs, which is 828 less than the Proposed Action and 460 less than Alternative C. Additionally, based on the reduction in available coal under Alternative K1, the life of the mine would be 16 years; nine fewer years than under the Proposed Action.

On the 880 acres of private surface estate that is excluded under Alternative K1, no surface use agreement with those qualified surface owners would be necessary should the decision to lease be made. The current private land uses in Block NW and Block S would continue undisrupted.

4.8.7 Potential Mitigation Measures

No potential mitigation measures are proposed to address land use conflicts resulting from mining activities.

4.8.8 Unavoidable Adverse Impacts

Unavoidable adverse impacts would include the loss of use and access to the tract for described land uses during the life of the mine. After mitigation, the described land uses would be lost until reclamation is complete.

4.8.9 Short-term Uses versus Long-term Productivity

It is not anticipated that the short-term use of the area for mining would adversely affect the long-term productivity of land uses. Mining activities would temporarily make the area unavailable for the existing land uses and access for agriculture, grazing, and recreation; however, in the long term, the area would be reclaimed to its approximate original condition, and uses would resume as they had previously existed.

4.8.10 Irreversible and Irretrievable Commitments of Resources

The removal of coal from the tract would be an irreversible commitment of resources because this coal cannot be regenerated. Measures would be implemented to return the area to its approximate pre-mining condition following coal mining, making the loss of opportunities for other land uses irretrievable, but not irreversible. The land status and prior rights to the land would remain unchanged during the life of the mine.

4.9 Livestock Grazing

Impacts to livestock grazing were analyzed by determining how proposed mining activities would conflict with existing grazing activities. Grazing and access would be eliminated during the active mining period to ensure public safety. It would also be restricted during post-mining reclamation to assist in establishing suitable vegetation. Because access to the tract would be restricted, the livestock grazing analysis area consists of all acres of allotments on the tract; impacts were not analyzed by specific acres of vegetation removed (these impacts are discussed in Section 4.15, Vegetation). Disturbance from mine-related activities would include pit disturbance, grading for the construction and maintenance of centralized and dispersed facilities, and the relocation of KFO Route 116. Impacts from these activities are grouped together because the impacts to land use would result from a combination of all mine-related activities, and not specific aspects of each activity.

4.9.1 Regulatory Framework

FLPMA of 1976 ensures that public lands are managed for multiple uses, including livestock grazing, to best meet the present and future needs of the public. The KFO RMP includes standards and guidelines for grazing management. These standards and guidelines provide management direction and the necessary regulatory framework for livestock grazing. Alternatively, they can be found on the Utah BLM website (BLM 2008b). If changes to public land use restrict livestock grazing, 43 CFR 4110.4-2 requires that permittees be notified two years in advance and receive compensation for authorized permanent range improvements.

4.9.2 Alternative A: No Action

Under the No Action Alternative, ACD's application to lease the coal in the Alton Coal Tract would not be approved, the tract would not be offered for competitive lease sale, and the coal included in the tract would not be mined. Therefore, under the No Action Alternative, there would be no impacts to livestock grazing as a function of coal mining; vegetation would be unaffected by mining, and grazing practices would remain unchanged. Grazing activities would continue to be managed as described in the KFO RMP (BLM 2008b). Impacts to livestock grazing from other land uses such as recreation and vegetation treatments would continue similar to current conditions.

4.9.3 Alternative B: Proposed Action

Mine-related surface activities on the tract would consist of land clearing, the construction of dispersed facilities, and the relocation of KFO Route 116. These would result in a long-term loss of vegetation access because livestock would be restricted to areas without mining activity throughout the life of the mine (25 years) and during the 10-year (or more) reclamation period. For purposes of analysis, it is assumed that grazing in the tract would be unavailable for 35 years; therefore, the allotments in the tract would be considered nonuse. Therefore, even in areas in the tract that would not be disturbed for mine-related activities, it is assumed that the use of available AUMs, existing water sources, and livestock facilities would be lost for the life of the mine and reclamation period. This approach provides the most conservative estimate of livestock grazing impacts for phased mining operations given that specific locations and timing of mining and reclamation activities are not available at this time.

Table 4.9.1 illustrates the total acres of disturbance and the percentage of allotments that would be affected by all alternatives, including the Proposed Action.

Table 4.9.1. Acres of Vegetation Impacted by Mining Activities, by Alternative

	Alternative A (No Action)	Alternative B (Proposed Action)	Alternative C (Reduced Tract Acreage and Seasonal Restrictions)	Alternative K1 (Reduced Tract Acreage)
Acres of vegetation disturbance	0	1,975	1,650	1,005
Percentage of total allotments*	0%	24%	20%	12%

*The total federal acreages of allotments is 8,222.

Assuming that that the annual disturbance would remain the same throughout the life of the mine, the Proposed Action would result in the loss of or restricted access to 1,975 acres of vegetation. This represents 24% of the total acres in all seven allotments (see Table 4.9.1).

Total acres of allotments are used to calculate the number of AUMs using the number of AUMs allocated and the percentage of AUMs that lie in the tract. To determine overall impacts to forage available for grazing (AUMs) from the Proposed Action, the number of AUMs impacted is compared to the total number of AUMs available in each of the allotments. Table 4.9.2 shows the number of AUMs that would be lost per grazing allotment from restricted access, as well as the overall percentage that those AUMs represent for the entire allotment.

Table 4.9.2. Allotment Acreages and Animal Unit Months in Alton Coal Tract

Allotment	Season of Use	Number of Permittees	Total AUMs Allocated to Livestock Annually	Percentage of Allotment in the Tract	Calculated AUMs in the Tract	AUMS Allocated to Livestock over the Life of the Mine and the Reclamation Period			AUMS lost over the Life of the Mine and the Reclamation Period		
						Alt. B (35 years)	Alt. C (31 years)	Alt. K1 (26 years)	Alt. B (35 years)	Alt. C (31 years)	Alt. K1 (26 years)
Alton	6/1/2013–10/31/2013	1	5	99%	5	175	155	130	175	155	130
Cove (Alton)	6/1/2013–10/31/2013	1	10	99%	10	350	310	260	350	310	260
Isolated Tracts	5/16/2013–10/31/2013	1	67	24%	16	2,345	2,077	1,742	560	496	416
Levanger Lakes	6/1/2013–11/15/2013	1	33	23%	8	1,155	1,023	858	280	248	208
Robinson Creek	6/1/2013–11/30/2013	1	24	40%	10	840	744	624	350	310	260
Syler Knoll	5/1/2013–10/31/2013	1	6	82%	5	210	186	156	175	155	130
Upper Sink Valley	6/1/2013–10/15/2013	1	311	12%	38	10,885	9,641	8,086	1,330	1,178	988
Total		**7**	**456**	**26%**	**92**	**15,960**	**14,136**	**11,856**	**3,220**	**2,852**	**2,392**

The Proposed Action would restrict or prohibit access to approximately 92 AUMs annually for seven permittees (see Table 4.9.2). Assuming that permits and seasons of use would remain the same over the life of the mine, approximately 3,220 AUMs would be lost over 35 years. The Proposed Action would have greater impacts to grazing than Alternative C, Alternative K1, and the No Action Alternative. During mine-related activities, the direct loss of livestock from vehicle collisions along transportation routes would be uncommon.

There is also a potential for livestock grazing to be affected along the approximately 110-mile reasonably foreseeable coal haul transportation route. Road dust, coal dust, and exhaust from coal hauling would add to the road dust and exhaust from existing traffic along the reasonably foreseeable coal haul transportation route. It is assumed that the effects from this road dust, coal dust, and exhaust would occur within a 100-foot buffer around the reasonably foreseeable coal haul transportation route. The deposition of road dust, coal dust, and vehicle exhaust can affect the overall health of vegetation used as forage for livestock within this buffer by inhibiting stomatal function and photosynthesis. However, it is assumed that all coal trucks would be covered or otherwise contained, preventing coal dust from escaping. There is also a risk of spills along the reasonably foreseeable coal haul transportation route from potential coal truck accidents, which also presents a risk to vegetation used as forage for livestock along the route.

Under the Proposed Action, and all other action alternatives, Block Sa (186.2 acres) would not be mined and the lessee would apply pre-mining vegetation treatments to the block. These proposed vegetation treatments would improve the health, vigor, recruitment, and production of perennial grasses, forbs, and shrubs and provide a more palatable and nutritional source of forage for both livestock and wildlife, as well as protect the soil resource and other associated watershed values.

4.9.4 Alternative C: Reduced Tract Acreage and Seasonal Restrictions

Impacts under Alternative C would be the same in nature to those under the Proposed Action because the activities would be the same in nature; however, the number of AUMs affected by Alternative C would be less than the Proposed Action. Alternative C would cause 1,650 acres of vegetation disturbance, compared to 1,975 acres of vegetation disturbance under the Proposed Action and 1,005 acres under Alternative K1. Under Alternative C, there would be a loss of 2,852 AUMs, compared to a loss of 3,220 AUMs under the Proposed Action and 2,392 AUMs under Alternative K1. Alternative C would therefore affect 368 fewer AUMs and 300 fewer acres of vegetation over the life of the mine and reclamation period than the Proposed Action. The impacts from Alternative C would have greater impacts to grazing than Alternative K1, affecting 645 more acres of vegetation and 460 more AUMs. Alternative C would also have greater impacts to grazing than the No Action Alternative, which would not impact vegetation or AUMs. Access under Alternative C would be restricted for 31 years (21-year mine life plus 10-year reclamation period) instead of the 35 years under the Proposed Action and 26 years under Alternative K1.

4.9.5 Alternative K1: Reduced Tract Acreage

Impacts under Alternative K1 would be the same in nature to those under the Proposed Action and Alternative C because the activities would be the same in nature; however, the acres of vegetation and number of AUMs affected by Alternative K1 would be less than the Proposed Action and Alternative C. Alternative K1 would cause 1,005 acres of vegetation disturbance, compared to 1,975 acres of vegetation disturbance under the Proposed Action and 1,650 acres under Alternative C. Under Alternative K1, there would be a loss of 2,392 AUMs, compared to a loss of 3,220 AUMs under the Proposed Action and 2,852 AUMs under Alternative C. Alternative K1 would therefore impact 828 fewer AUMs and 970 fewer acres of vegetation over the life of the mine and reclamation period than under the Proposed Action. Alternative K1 would also affect 460 fewer AUMs and 645 fewer acres of vegetation than Alternative C. Alternative

K1 would have greater impacts than the No Action Alternative, which would not impact vegetation or AUMs. Access under Alternative K1 would be restricted for 26 years (16-year mine life plus 10-year reclamation period) instead of the 35 years under the Proposed Action and 31 years under Alternative C.

4.9.6 Potential Mitigation Measures

Although no specific mitigation measures have been proposed for livestock, measures committed for vegetation reclamation would benefit livestock through either preservation or reclamation of forage. Reclamation measures proposed for vegetation that would benefit livestock consist of

- permanently revegetating reclaimed areas according to a comprehensive revegetation plan using approved reclamation seed mixtures consisting of suitable native and non-native species;
- using native shrubs for reclamation;
- prior to seeding with final seed mixture, controlling erosion on reclaimed lands using mulching, cover crops, or other approved measures;
- chemically and/or mechanically controlling weed infestation;
- selectively planting shrubs in riparian areas; and
- planting sagebrush seedlings in addition to seeding with sagebrush.

4.9.7 Unavoidable Adverse Impacts

The loss of access and land available for livestock grazing during the life of the mine would result in unavoidable adverse impacts to livestock grazing during the life of the mine and during reclamation.

4.9.8 Short-term Uses versus Long-term Productivity

Short-term uses associated with proposed mine-related activities (e.g., roads, grading, and vegetation removal) would reduce the forage productivity and available AUMs until the disturbances were successfully reclaimed. Overall, impacts to long-term productivity resulting from these activities would be minimal due to the limited overall percentages that would be impacted by both action alternatives.

4.9.9 Irreversible and Irretrievable Commitments of Resources

Assuming that the entire tract would be unavailable for access and any activities other than mining during the life of the mine, irretrievable impacts would include the loss of livestock forage and access to allotments for some 35 years until reclamation is successful. Irreversible impacts would include livestock mortality from collisions, should any occur.

4.10 Paleontology

Direct impacts to fossil resources from the Proposed Action, Alternative C, and Alternative K1 would consist of the following:

- The physical loss of the resources through physical damage, destruction, and/or through extraction, weathering, or unauthorized collection after extraction.
- The loss of important contextual data for the resources if they are excavated without documentation of their stratigraphic horizon (age) and environment of deposition (taphonomy). Their value to science and to the public would be permanently degraded.

Either outcome would significantly impact the value and state of paleontological resources in the area. For paleontological resources, all impacts would be long term because they would persist for the life of the mine and following reclamation.

4.10.1 Regulatory Framework

Certain types of regulations and other design features would be mandatory because of the significance of the fossil resource in the Alton area. Three of these measures would be employed to ensure reasonable benefit to the fossil resource.

As per FLPMA, 43 CFR, 8365.1–5, and the BLM Manual H-8270-1 (General Procedural Guidance for Paleontological Resource Management), the first measure would be to salvage significant in-situ specimens if they are discovered by mining personnel or qualified monitors during mining operations. Significant in-situ specimens are the most important specimens from both a scientific and public perspective because they have the most potential to be complete and in their original context. If potentially significant fossil remains are discovered, the mine operator (successful bidder) or qualified paleontological monitor would immediately notify the BLM-KFO paleontologist or their designated authority and protect the discovery from damage or looting, suspending all activities in the immediate vicinity of such discovery until the site can be evaluated by the BLM-KFO paleontologist or their designated authority. Next, a determination would be made as to whether the specimen is worth salvaging. Under normal circumstances, determinations would be completed within 24 hours of notification by the mine operator. If the specimen is determined to be of scientific significance and worth collecting, the BLM-KFO paleontologist, their designated authority, or a qualified paleontological consultant chosen by the mine operator would initiate scientific collection of the specimen. This would be completed within 72 hours of determination. Specimens would be housed at the Utah Museum of Natural History (UMNH) for the public benefit. Collection and curation costs of large specimens, which averaged $2,000–$5,000 in 2008 for a large specimen, would be borne by the mine operator. Costs for surface collection and curation of small specimens (1 m or less) would be borne by the BLM and the UMNH, the official BLM repository for Utah. Final determination on significance of smaller in-situ specimens would be made by the UMNH.

The second measure would be a design feature that involves monitoring both the overburden piles and pits by the BLM-KFO paleontologist or their designated authority. Any significant material found in the overburden piles would be collected with as much data as possible and reposited at the UMNH. Final determination on the significance of ex-situ specimens would also be made by the UMNH. The third measure would be a design feature that helps offset the unavoidable loss of significant resource in the course of operations (see discussion below of the monetary value of the ammonite fossils) by enhancing research and public enjoyment of similar resources off-site. A single $100,000 payment would be made by the successful bidder to support scientific research on paleontology within the KFO. This would also make the region's fossil resources more accessible to the public through exhibits and other forms of education and outreach. The BLM would administer this fund in cooperation with the mine operator, through a third party such as a Natural History Association or other nonprofit group. Each year for the

first five years of the mine's operation, calls for proposals for research and/or public outreach projects would be made, with all awards each year totaling approximately $20,000. Winning proposals from qualified scientific or public institutions would be awarded funds to complete a research or outreach project, with a report due at the end of the calendar year for research projects and an educational or exhibit product due for the outreach projects. The mine operator would be named as a partner in these projects.

4.10.2 Alternative A: No Action

Under the No Action Alternative, subsurface paleontological resources in the Alton Amphitheatre, including the Alton Coal Tract, would be unaffected by mining activities; therefore, there would be no significant impact to their condition or context. Permitted and unauthorized collections of ammonites would continue, which would result in a minor loss of fossil resources in the tract. Resources currently exposed at the surface would continue to weather and degrade over time, also causing a minor loss.

4.10.3 Alternative B: Proposed Action

Under the Proposed Action, surface-mining activities (pit disturbance) would remove approximately 1,750 acres of Tropic Shale overburden to access coal resources in the Smirl Coal Zone. This amount is equal to the amount of surface disturbance that would occur from the pits because the Tropic Shale occurs under the surface where coal is present. An additional 613 acres of coal is potentially minable through subsurface techniques, but this would directly affect only the Smirl Coal Zone and not the overlying Tropic Shale. Because mining activity would go deep into the subsurface into fresh geologic bedrock units, accurate modeling of the impact to subsurface resources is difficult.

A total of 196 acres would be disturbed for operational facilities. This would consist of centralized and dispersed facilities. Centralized facilities would be present on approximately 36 acres for the 25-year life of the mine under the Proposed Action. Dispersed facilities, which would likely shift as coal extraction activities progress, would be located on approximately 160 acres. In addition, 47 acres would be disturbed for the relocation of KFO Route 116 into the no-coal zone. Exposures of the middle member of the Dakota Formation would be affected almost entirely by road and facility construction rather than by the operations in the mine pit. The centralized facilities would be located on the higher elevations of the tract divided by Sections 24 and 19, north of Lower Robinson Creek. They would cover both the lower Tropic beds and the middle and upper portions of the Dakota Formation. Ground-disturbing activities associated with the construction of centralized facilities and the rerouting of KFO Route 116 would potentially impact vertebrates and significant invertebrates in the middle member of the Dakota Formation and the Tropic Shale. The nature of impacts to fossils in this area would be the same as described at the beginning of this section. The amount of Tropic Shale disturbance under the Proposed Action would be approximately 1,750 acres.

The most profound impacts to paleontological resources would be to fossils contained in the Smirl Coal Zone and fossils overlying the Tropic Shale overburden inside the pit disturbance areas. Quantifying the resource impacts in the Smirl Coal Zone is difficult because paleontology knowledge about the Smirl Coal Zone is limited. As stated earlier in Chapter 3's Paleontology section, the Smirl Coal Zone has the potential to preserve articulated vertebrates with soft tissue remains and delicate invertebrates such as insects (Konservat-Lagerstatte). However, such occurrences are rare in the Dakota Formation, and the presence of such resources in the pit disturbance areas associated with the Proposed Action would likely be revealed through the mining process. If such resources exist in the Dakota Formation, their importance to science and to the public cannot be overstated. They would be the only known example of a Cenomanian-age terrestrial Lagerstatte in the world, and its loss due to mining operations would be significant.

Increasing knowledge of the Tropic Shale's paleontology allows for some rough quantitative assessment and a better evaluation of impacts to fossil resources. Within 15 miles of the tract, there is 30,870 acres of Tropic Shale. A total of 1,750 acres of Tropic Shale would be disturbed in the tract under the Proposed Action. Therefore, approximately 5.7% of the Tropic Shale's paleontology within a 15-mile band would be adversely impacted over the long term.

The density of well-preserved ammonites or other invertebrate fossil material in the lower ironstone interval of the Tropic Shale is low; however, occasional pockets of significant three-dimensional specimens in concretions do occur. Up to 12 such pockets would be expected to occur in pit disturbance areas. Well-preserved ammonites from the *Vascoceras diartianum* zone are rare in the region; therefore, they are scientific significance and their loss through physical degradation and destruction would be an adverse impact. Fortunately, the concretionary horizons that contain most of the ammonites are fairly well defined. Each zone is typically distinctive enough that loss of contextual data would not be a great issue for specimens salvaged off of spoils piles.

The overlying *Euomphaloceras septemseriatum* zone contains a high density of well-preserved ammonite and other fossil material. Examining nondisturbed exposures of concretions from this zone in the Alton area, large *Metoicoceras geslinianum* and *Placenticeras cumminsi* ammonites can be encountered approximately every 10–30 feet. Using one ammonite per 1,000 square feet as an extremely conservative estimate of specimen density, 76,230 significant ammonite specimens would potentially be destroyed or damaged in the pit disturbance area during mining operations under the Proposed Action. Although these specimens have only moderate scientific value, they have great significance to amateur fossil enthusiasts who eagerly seek them out. Even though these specimens cannot be mined commercially and sold from public lands, one way to estimate the magnitude of loss to the public is to assign a conservative $50 commercial value for each individual ammonite specimen (these specimens actually sell for $100 or more when collected from private lands) as a way to calculate loss to the public. This results in the ammonites having a surprising approximately $3.8 million cash value ($50 multiplied by the estimated number of specimens of 76,230). The density of vertebrates in this interval is not as high as it is in the overlying zones; therefore, only one or two larger vertebrate sites might be damaged during the course of mining operations. However such specimens have very high scientific significance. Several dozen articulated fish might also be damaged or removed from context. Little is known about Cenomanian fish from Utah; therefore, any of these specimens would be scientifically significant. Unfortunately it would be difficult to recover contextual data (i.e., placement into stratigraphic order) for any of the vertebrates if they were collected from overburden piles, because they typically create their own concretionary halos that do not contain diagnostic invertebrates.

The remainder of the Cenomanian concretionary interval would mostly suffer loss of rare and scientifically significant ammonite specimens from the *Euomphaloceras costatum* through *Neocardioceras juddi* zones. However, in similar fashion to the *E. septemseriatum* zone, several dozen articulated fish specimens and one or two larger vertebrate skeletons might also occur in the pit disturbance areas and therefore be damaged or removed from context. The overlying lower Turonian interval (*Watinoceras coloradoense and Fagesia catinus* through *Mammites nodosoides* Ammonoid zones) is the opposite. Here, well-preserved invertebrates are not expected to be significantly impacted, but the density of larger marine vertebrate fossils is probably two or three times higher than it is in the underlying Cenomanian. As a result, four to six large vertebrate skeletons might be damaged in this interval over the life of the mine. Dozens of smaller fish skeletons could also be destroyed or salvaged out of context. Because the headwall of the mine would not exceed approximately 200 feet in height above the Smirl Coal Zone, its impacts would probably be limited to lower Turonian strata, and the *Collignoniceras woolgari* and *Prionocyclus hyatti* zones would not be affected.

When compared to the No Action Alternative, disturbance to the Smirl Coal Zone and overlying Tropic Shale overburden and estimated monetary impacts would be much greater under the Proposed Action, because the No Action Alternative proposes no disturbance to existing paleontological resources.

4.10.4 Alternative C: Reduced Tract Acreage and Seasonal Restrictions

Impacts would be similar to those discussed under the Proposed Action, except there would be approximately 1,454 acres of pit disturbance, 171 acres of disturbance from centralized and dispersed facility activities, and 36 acres of disturbance due to the relocation of KFO Route 116. The shorter time duration of mining activities under Alternative C (21 instead of 25 years) would not change impacts on paleontological resources because the impacts would occur from acreages disturbed regardless of the timeframe of when they occur.

The 16% smaller footprint of the mine would lower the overall impact to paleontological resources affected by pit operations. For example, the monetary value of the estimated number of ammonites damaged or destroyed would be decreased from approximately $3.8 million to approximately $3.6 million. For vertebrate resources, the estimated number of sites potentially affected by facilities construction, pit operations, and the rerouting of KFO Route 116 for Alternative C would be within the margin of error for the estimates made for the Proposed Action and would therefore be the same.

The total amount of disturbance to the 30,870-acre, 15-mile band of Tropic Shale in the area would be approximately 1,454 acres. Thus, an approximately 4.7% disturbance of the Tropic Shale's paleontology would occur under Alternative C.

When compared to the No Action Alternative, the 1,454 acres of pit disturbance, 171 acres of facilities, and 36 acres of road relocation would have a greater impact on the Smirl Coal Zone and overlying Tropic Shale overburden because 0 acres would be impacted under the No Action Alternative. The approximately $3.6 million estimated loss to the public would not occur under the No Action Alternative.

4.10.5 Alternative K1: Reduced Tract Acreage

Impacts would be similar to those discussed under the Proposed Action, except there would be approximately 869 acres of pit disturbance, 128 acres of disturbance from centralized and dispersed facility activities, and 16 acres of disturbance due to the relocation of KFO Route 116. The shorter time duration of mining activities under Alternative K1 (16 instead of 25 years) would not change impacts on paleontological resources because the impacts would occur from acreages disturbed regardless of the timeframe of when they occur.

The approximately 50% smaller footprint of the mine would lower the overall impact to paleontological resources affected by pit operations. For example, the monetary value of the estimated number of ammonites damaged or destroyed would be decreased from approximately $3.8 million to approximately $1.9 million. For vertebrate resources, the estimated number of sites potentially affected by facilities construction, pit operations, and the rerouting of KFO Route 116 for Alternative K1 would be within the margin of error for the estimates made for the Proposed Action and would therefore be the same.

The total amount of disturbance to the 30,870-acre, 15-mile band of Tropic Shale in the area would be approximately 869 acres. Thus, a 2.8% disturbance of the Tropic Shale's paleontology would occur under Alternative K1.

When compared to the No Action Alternative, the 869 acres of pit disturbance, 128 acres of facilities, and 16 acres of road relocation would have a greater impact on the Smirl Coal Zone and overlying Tropic Shale overburden because 0 acres would be impacted under the No Action Alternative. The approximately $1.9 million estimated loss to the public would not occur under the No Action Alternative.

4.10.6 Potential Mitigation Measures

No potential mitigation measures are proposed or recommended; however, certain regulations and design features would address potential impacts. These regulations and design features are discussed above in Section 4.10.1.

4.10.7 Unavoidable Adverse Impacts

The loss of a percentage of significant fossil resource or their contextual data is an unavoidable impact under both action alternatives. In many other regions of Utah, such as the Book Cliffs or Price areas, the commercially viable coal seams are not directly associated with such highly fossiliferous marine or terrestrial units, and therefore impacts to fossil resources are minimal. In the Alton area, it is anticipated that a large number of significant fossils would be destroyed or removed from context particularly in the Tropic Shale.

4.10.8 Short-term Uses versus Long-term Productivity

The short-term use of the tract for purposes of coal extraction would result in adverse impacts to the long-term productivity of paleontological resources. The coal extraction process would result in the permanent removal of fossils from the Dakota Formation and the Tropic Shale in the tract resulting in a long-term decrease in the productivity of paleontological resources in the area.

4.10.9 Irreversible and Irretrievable Commitments of Resources

All impacts to paleontological resources in the tract would be irreversible. Once disturbed and removed, fossils currently present in formations where disturbance would occur to facilitate the extraction of coal cannot be replaced or restored, or in some cases removed and preserved. They would be permanently removed.

4.11 Recreation

For all alternatives, short-term impacts to recreation resources are those impacts that would occur throughout the duration of mining operations. Long-term impacts are those impacts that would occur after mining operations and once reclamation activities are complete. With proper reclamation procedures, there would be no long-term impacts to recreation resources for all alternatives, and existing recreation opportunities would resume in areas affected either directly or indirectly by mining operations.

Impacts to recreation resources as a result of coal truck traffic on the reasonably foreseeable coal haul transportation route (see Section 2.6.4) are not discussed under the alternatives sections because based on the transportation analysis (see Section 4.14), impacts would be negligible. LOS is a measure of the quality of service on transportation infrastructure. It generally indicates the level of traffic congestion. LOS measurements vary from LOS A (the best) to LOS F (the worst); see Table 4.14.1 for a description of LOS A–F. Transportation analyses illustrate that the existing LOS on the transportation route is LOS A for most segments and intersections and LOS B and C for others. These LOS would be maintained even with the addition of coal truck traffic. Transportation analyses also project LOS on the transportation route in the year 2020. Conditions in the year 2020, with the addition of coal trucks, would result in a LOS D on SR-20 between US-89 and I-15. All other segments and intersections would be LOS A, B, or C. LOS D conditions are those that are approaching unstable flows of traffic, tolerable delays of 25–35 seconds per vehicle at unsignalized intersections, and delays of 35–55 seconds per vehicle at signalized intersections. LOS changes would be minimal with additional truck traffic added to existing traffic conditions and with additional truck traffic added to 2020 conditions; therefore, changes to time spent traveling to recreational resources, and changes to the settings, experiences, and activities of recreationists using the transportation route for sightseeing and/or to travel to and from recreation destinations, would also be minimal.

4.11.1 Regulatory Framework

Public lands in and surrounding the proposed tract are managed for dispersed recreation. The goals and objectives for recreation management, including OHV use, are discussed in the KFO RMP (BLM 2008b). Hunting regulations on the PPMA are maintained and enforced by UDWR.

4.11.2 Alternative A: No Action

Under the No Action Alternative, ACD's application to lease the coal included in the tract under the Proposed Action or Alternative C would not be approved, the tract would not be offered for competitive lease sale, and the coal included in the tract would not be mined.

Rejection of the application would not affect permitted mining activities on private land adjacent to the tract (the Coal Hollow Mine). The Coal Hollow Mine consists of approximately 635 acres of land and approximately 5 million short tons of recoverable coal leased from private surface and mineral owners. Discussion of impacts to recreation resources from the Coal Hollow Mine is included in Section 4.19 Cumulative Impacts.

Under the No Action Alternative, recreation use—predominantly big game hunting in and near tract—would continue at present or slightly increasing levels (Aoude 2008). Hunting in the Alton CWMU would continue, and the same amount of big game permits would be issued as in years past. No acres of big game hunting would be affected by mining under the No Action Alternative.

Other than hunting, little recreation occurs on lands directly affected by the tract (Christenson 2008; Rechsteiner 2008). According to adjacent land managers, some OHV use occurs on approximately 13 miles of OHV-accessible routes in the proposed tract. In addition, visitors traveling along KFO Route 116

engage in sightseeing when traveling between known destinations such as Bryce Canyon National Park and Grand Staircase-Escalante National Monument. These uses would not be affected by mine-related activities under the No Action Alternative because the tract would not be offered for competitive lease sale and no mining would occur.

Existing conditions for other types of dispersed recreation (e.g., camping, picnicking, and hiking) would continue on lands in the recreation analysis area. Because the No Action Alternative would not decrease the amount of land available for dispersed recreation, it would not decrease the recreational experience of those recreational users who engage in recreational activities in the analysis area. Because there are no estimates of recreation use for public or private lands affected by mining activity, there is no way to quantify the amount of recreation users either directly or indirectly affected.

Under the No Action Alternative, other land uses would continue, including livestock grazing, backcountry driving, and vegetation treatments to maintain and enhance livestock forage, wildlife habitat, and watershed condition. These presently occurring land uses would continue to interact with recreation trends in the analysis area similar to current conditions under this alternative.

4.11.3 Alternative B: Proposed Action

Under the Proposed Action, the tract would be offered for lease at a sealed-bid, competitive lease sale, subject to standard and special lease stipulations developed for the tract. The Proposed Action would directly affect 3,576 acres of land, including 2,280 acres of public land (federal surface and subsurface) on the tract and 1,296 acres of split estate: private surface and federal subsurface land. Under the Proposed Action, the life of the mine would be approximately 25 years.

Under the Proposed Action, some recreation use, predominantly big game hunting, would be displaced from the tract. Approximately 3,576 acres of potential big game hunting areas would be directly affected by the Proposed Action. Hunter access to big game habitat (predominantly mule deer) on the tract would be restricted, displacing them from the tract. It is assumed that all 3,576 acres would be unavailable for recreational use over the life of the mine (25 years). This represents approximately 0.4% of all big game hunting areas in the PPMA (approximately 957,122 acres) and 3.9% of the recreation resources analysis area (92,573 acres). Users would move onto adjacent public lands (public lands and the Dixie National Forest) for hunting opportunities. This could affect the recreational experiences of hunters displaced from the tract and hunters in the analysis area because of a slight increase in crowding in those areas. However, a 0.4% displacement of hunters would not likely lead to overcrowding on other lands in the PPMA.

Hunting in the Alton CWMU would continue, and the same amount of big game permits would be issued as in years past. Approximately 2,145 acres (4.9%) of the Alton CWMU (approximately 43,658 acres) would be directly affected by the Proposed Action. Because no big game kills have occurred in the proposed tract in the last 20 years and the tract does not fall within prime CWMU deer or elk habitat, adverse impacts to hunters who use the CWMU are not anticipated. See Section 4.17 for a description of direct and indirect impacts to big game species as a result of the Proposed Action.

Outside of hunting, little recreation use occurs on lands that would be directly affected by the tract (Christenson 2008; Rechsteiner 2008). Because access would be restricted on the tract, these recreationists, like hunters, would be displaced from the tract for the 25-year mine life. The short-term loss of 3,576 acres for OHV use represents 3.9% of the recreation analysis area (92,573 acres). Further, there is an estimated 13 miles of OHV routes on the proposed tract. Some of this would be removed for mining activity (and replaced post mining), and all would be inaccessible for the life of the mine. The temporary loss of these routes represents a 0.7% reduction in routes available for OHV use across the BLM-KFO (1,402.7 miles of routes are currently available for OHV use in the BLM-KFO). KFO Route 116, an OHV-accessible route, would remain accessible

to OHVs during mining operations. However, it is assumed that the road would be relocated to the no-coal zone to allow mining operations to occur. Also, the experiences and settings of OHV users traveling on KFO Route 116 adjacent to the tract would be modified from one characterized as semiprimitive and natural to one characterized by coal mining activities.

Other visitors traveling along KFO Route 116 engage in sightseeing when traveling between known destinations such as Bryce Canyon National Park and Grand Staircase-Escalante National Monument. Mining activity under this alternative would have an adverse effect on users seeking natural visual resources through the loss of natural visual resources over the life of the mine (25 years).

Under this alternative, the direct loss of lands available for other types of dispersed recreation (e.g., camping, picnicking, hiking) would lead to increased use and diminished recreational experiences on lands in the analysis area adjacent to the tract. Up to 92,573 acres (the recreation analysis area) could be indirectly affected by mining operations. Desired recreational experiences for lands in the analysis area include opportunities for undeveloped and self-reliant recreation, a natural environment, and a high probability of solitude. Over the life of the mine, increased use in the analysis area would diminish those recreational experiences. Quantifying the amount of recreation users that would be directly or indirectly affected by this alternative is impossible because of the following: 1) the analysis area is not a known destination point for recreation, 2) there are no known attractions in the analysis area, and 3) there are no estimates of use for public or private lands affected by mining activity.

Because all acres in the tract would be unavailable for hunting, OHV use, and dispersed recreation over the 25-year mine life, the loss of 3,576 acres to recreation opportunities under the Proposed Action would result in a complete decrease in lands available for recreation on the tract when compared to the No Action Alternative.

Under the Proposed Action, and all other action alternatives, Block Sa (186.2 acres) would not be mined and the lessee would apply pre-mining vegetation treatments to the block. Recreational activities on Block Sa may be temporarily disrupted or displaced during vegetation treatment activities. In the short term, post-treatment areas may become less or more attractive to the recreating public, depending on the nature of their activities and their preferred settings. For instance, creating more open areas might enhance wildlife viewing opportunities, but it might also discourage photographers in search of totally natural-appearing, unaltered landscapes. As native vegetation becomes reestablished on treatment areas, those sites could also attract some recreation activities while discouraging others, due to the altered vegetative cover, scenery, naturalness, and use by wildlife species.

4.11.4 Alternative C: Reduced Tract Acreage and Seasonal Restrictions

Under Alternative C, the tract would be modified to exclude Block NW (see Map 2.2). Furthermore, certain mining activities in Block S would be subject to seasonal restrictions to reduce impacts to the local sage-grouse population. Under Alternative C, the modified tract would be offered for lease at a sealed-bid, competitive lease sale, subject to standard and special lease stipulations developed for the tract. The boundaries of the modified tract would be reasonably consistent with the configuration shown in Map 2.2.

The modified tract under Alternative C would encompass approximately 3,173 acres, of which approximately 2,280 acres are federal surface and mineral estate and 893 acres are split estate: private surface estate and federal mineral estate (Map 2.2 depicts private and BLM surface in the modified tract). Alternative C also anticipates approximately 153 truck round-trips per day to a coal loadout location west of Cedar City. The life of the mine under Alternative C would be approximately 21 years.

Alternative C and the Proposed Action would result in the same types of impacts to recreational resources. However, Alternative C would result in fewer acres of impact based on the smaller acreage of the tract and fewer years of impact based on the shortened mine life. Under Alternative C, hunters would be displaced from the tract because an estimated 3,173 acres of potential big game hunting areas would be unavailable for recreational use over the 21-year mine life. This represents approximately 0.3% of all big game hunting areas in the PPMA (approximately 957,122 acres) and 3.4% of the analysis area (92,573 acres). Hunting in the Alton CWMU would continue, and the same amount of big game permits would be issued as in years past. Approximately 1,985 acres (4.5 %) of the Alton CWMU (approximately 43,658 acres) would be directly affected by the Alternative C. Because no big game kills have occurred in the proposed tract in the last 20 years and the tract does not fall within prime CWMU deer or elk habitat, adverse impacts to hunters who use the CWMU are not anticipated. Assuming that access on the tract would be restricted for the 21-year mine life, OHV users would lose 3,173 acres for OHV use, representing 3.4% of the analysis area (92,573 acres). Likewise, the 13 miles of OHV-accessible routes present on the tract would be inaccessible for the life of the mine and would represent a 0.7% reduction in routes available for OHV use across the BLM-KFO (1,402.7 miles of routes are currently available for OHV use in the BLM-KFO). As under the Proposed Action, KFO Route 116 would remain accessible to OHVs during mining operations, though it is assumed that it would be relocated to the no-coal zone. The experiences and settings of OHV users traveling on KFO Route 116 through the tract would be modified from one now characterized as semiprimitive and natural to one characterized by coal mining activities.

Other visitors traveling along KFO Route 116 engage in sightseeing when traveling between known destinations such as Bryce Canyon National Park and Grand Staircase-Escalante National Monument. Mining activity under this alternative would have an adverse effect on those users and their sightseeing experience through the loss of natural visual resources over the life of the mine (21 years).

Finally, as under the Proposed Action, up to 92,573 acres (the recreation analysis area) could be indirectly affected by mining operations. Recreation users would be displaced from areas directly affected by mining activities and would likely recreate on nearby areas. This would increase the amount of use in those areas and would result in a reduction of the desired recreational experiences in those areas.

Because all acres in the tract would be unavailable for hunting, OHV use, and dispersed recreation over the 21-year mine life, the loss of 3,173 acres to recreation opportunities under Alternative C would result in a complete decrease in lands available for recreation when compared to the No Action Alternative.

4.11.5 Alternative K1: Reduced Tract Acreage

Alternative K1 and the Proposed Action would result in the same types of impacts to recreation. Under Alternative K1, hunters would be displaced from the tract because an estimated 2,114 acres of potential big game hunting areas would be unavailable for recreational use over the 16-year mine life. This represents approximately 0.2% of all big game hunting areas in the PPMA (approximately 957,122 acres) and 2.3% of the analysis area (92,573 acres). Impacts to hunting in the Alton CWMU would be the same as those described for Alternative C, but would occur for five fewer years. Assuming that access on the tract would be restricted for the 16-year mine life, OHV users would lose 2,114 acres for OHV use, representing 2.3% of the analysis area (92,573 acres). Likewise, the 13 miles of OHV-accessible routes present on the tract would be inaccessible for the life of the mine and would represent a 0.7% reduction in routes available for OHV use across the BLM-KFO (1,402.7 miles of routes are currently available for OHV use in the BLM-KFO).

As described under the Proposed Action, KFO Route 116 would remain accessible to OHVs during mining operations, though it is assumed that portions of KFO Route 116 outside of Block NW and Block S would be relocated to the no-coal zone. Similar to the Proposed Action, the experiences and settings of OHV users traveling on KFO Route 116 through the tract under Alternative K1 would be modified from one now characterized as semiprimitive and natural to one characterized by coal mining activities.

Under Alternative K1, there would be 2,114 acres unavailable for hunting, OHV use, and dispersed recreation over the 16-year mine life. Of the 2,114 acres excluded from Alternative K1, 880 acres are private surface estate used for other purposes, and may not currently be available for public recreation opportunities. The loss of land available for recreation under Alternative K1 is 1,462 acres less than the Proposed Action, and would occur for nine fewer years than the Proposed Action.

4.11.6 Potential Mitigation Measures

During mining operations, mitigation measures to offset the loss of sightseeing opportunities could include installing viewing pull-off areas and interpretation panels along rerouted KFO Route 116. This would create new opportunities for sightseeing in the short term.

4.11.7 Unavoidable Adverse Impacts

Adverse impacts from all action alternatives would include a direct short-term loss of land available for recreation opportunities, predominantly hunting. In addition, there would be an indirect adverse impact to other recreational users from the displacement of recreational users, directly affected by mining activity, onto adjacent public and private lands. Following reclamation, existing recreation activities would return to areas previously affected by mining operations. This reclamation could enhance wildlife habitat and increase opportunities for hunting and wildlife viewing.

4.11.8 Short-term Uses versus Long-term Productivity

Mitigation and reclamation measures would be applied to areas affected by the mine; therefore, the long-term productivity of the tract to provide recreation opportunities would not be diminished once mining operations and reclamation are complete.

4.11.9 Irreversible and Irretrievable Commitments of Resources

As a result of mining operations, recreation resources and uses would be irretrievable over the life of the mine. Following completion of mining operations and reclamation, those uses and resources would be reestablished. No irreversible commitments of recreation resources are expected as a result of mining activity.

4.12 Socioeconomics

The socioeconomic analysis depends in part on the findings of other resource sections, primarily the analysis of impacts to recreation (see Section 4.11) and transportation (see Section 4.14). This analysis does not include an in-depth discussion comparing impacts between Alternative A (No Action) and the action alternatives. Both action alternatives would result in impacts to socioeconomics than would not occur under the No Action Alternative because selection of the No Action Alternative would not result in mining the tract.

A number of public concerns pertaining to this section were raised in comments on the DEIS. In response to these comments, the analysis of impacts to employment, familial relationships, housing, property values, tourism, and EJ has been expanded and updated. In addition, passionate statements were made by several individuals during scoping about the need for local employment as a means for families to return to or continue to live in the area. Also, numerical data in this section have been updated whenever appropriate, based on more recent U.S. Census numbers, updates of previously cited reports, and current economic conditions.

The analysis presented in this section is only as strong as the current state of knowledge within the social science of socioeconomics generally, and within that of socioeconomic impact assessments specifically. Socioeconomic impact assessments use both qualitative and quantitative measures to evaluate the impacts economic development has on community social and economic well-being. In this section, attempts are made to predict various social impacts as a result of proposed economic changes. Predicting these impacts is not a precise endeavor. Analyses can be aided by a combination of economic models, relevant research, case studies, and published government data on existing economic and social conditions. Oftentimes, regional economic models such as IMPLAN are relied on. In this case, modeling was not appropriate because there are no existing regional mine-related data available (over the necessary timescale) for input into the model. Having similar economic examples as those planned for analysis is a key component of IMPLAN's regional predictive capabilities. Instead, relevant research, government-produced data for the SESA and communities within, and similar case studies were used to produce an impacts analysis balanced in both qualitative and quantitative measures.

4.12.1 Regulatory Framework

Federal, state, and local regulations require that surface mines obtain reclamation bonds, pay royalties, and taxes based on the amount of coal extracted from the mine. Further, the Coal Mine Safety Act: UAC 40-2 of 2008 established the Office of Coal Mine Safety, which recommends to the governor measures that ensure the safety of those involved in Utah's coal mine industry.

4.12.2 Alternative A: No Action

Under the No Action Alternative, coal in the tract would not be mined; therefore, no impacts would occur to the social and economic conditions of nearby communities in Kane, Garfield, and Iron counties as a function of mining the tract. The local population, employment, fiscal conditions, tourism rates, and social climate would remain similar to current conditions, but 160 direct and 240–480 indirect jobs that would be produced by all action alternatives would be foregone. It is also possible that the jobs at the current mine (approximately 34) would be lost under the No Action Alternative (ACD 2013). Revenues from livestock grazing and recreation opportunities in the tract would continue. When compared to the Proposed Action, the No Action Alternative would result in the potential for forgone income for the successful bidder and revenue and royalties to federal, state, and local governments because the coal would not be mined and this revenue would not be generated.

4.12.3 Alternative B: Proposed Action

Under the Proposed Action, approximately 44.9 million tons of coal would be mined over a 25-year period (this equates to approximately 1.8 MMTPY though the target production rate, which is reflected in the socioeconomic analysis in this section, is 2 million TPY). To conduct mining and transportation operations over the life of the mine, approximately 160 employees would be required, and an estimated additional 240–480 indirect jobs would be created in the SESA assuming a range of economic multipliers (indirect employment to direct employment) from 2.5 to 4.0. An estimated 153 truck round-trips per day to and from the mine and along the reasonably foreseeable coal haul transportation route would occur. Mine operations would occur 24 hours a day, five to seven days a week, for the life of the mine. The Proposed Action would directly affect (by surface disturbance, precluded access, or both) 3,576 acres of land consisting of 2,280 acres of BLM-administered land (federal surface and subsurface) and 1,296 acres of private land (private surface and federal subsurface).

The projected (target), annual coal production under both action alternatives would be approximately 2 million short tons. This analysis considers 1.8 million short tons as the annual target amount under both action alternatives. It also provides recovery values and revenues for the range of recoverable coal reserves throughout the life of the mine under each action alternative (44.9 million short tons over approximately 25 years under the Proposed Action and 38.1 million short tons over approximately 21 years under Alternative C).

To understand the amount of electrical energy that would be generated from the projected annual amount of coal (2 million short tons) produced under the action alternatives, the following statistics are provided. These numbers are for perspective use only because it is not assumed that the coal mined from the tract would be used solely to supply electric energy to residential customers. Under the Action Alternatives, the number of United States households provided with one year of residential energy from 2 million short tons of coal would be approximately 185,010. According to the U.S. Census Bureau (U.S. Census Bureau 2013j) (2013), there are 2.6 persons per household on average in the United States. As such, 2 million tons of coal would provide approximately 480,000 individuals with one year of residential electrical energy (McKenzie 2008).

When compared to the No Action Alternative, the Proposed Action would result in an increase in employment, personal income, and government revenues. A slight increase in population is anticipated (as illustrated in the analysis below), but this would not necessarily lead to an increased need for public services. Under the No Action Alternative, no mining would occur, and therefore an increase in local employment, income, and government revenues as a result of mining would not occur. Under the Proposed Action, there would be a slight decrease in grazing revenues as a result of a decrease in AUMs (as illustrated in the analysis below). Also, any recreation-related economic contributions from individuals who choose to recreate on the tract would be foregone under the Proposed Action.

4.12.3.1 EMPLOYMENT AND INCOME

4.12.3.1.1 Employment

Under the Proposed Action, approximately 160 people would be employed to conduct mining operations. It is estimated that 100 workers would be needed at the mine for mining operations, and 60 workers would be required for trucking the coal to the loadout location. Approximately 10% (16 employees) of the mine employees would be specialists in coal mining operations and would relocate to the area specifically to work at the mine (McCourt 2008). These job figures could fluctuate based on industry demand and mine production levels.

Due to the physical distance and practical driving routes (especially in winter), mine employees would likely come from Kane and Garfield counties. These direct mine jobs would represent some 4.7% of the nonfarm employment level of these counties (U.S. Census Bureau 2013i). A like percentage in Salt Lake County, for the purpose of providing context for this analysis, would represent over 23,000 nonfarm jobs (U.S. Census Bureau 2013).

If the tract provides direct jobs to residents of Kane County, they would benefit in terms of wages, benefits, and job security. In addition, the local government would benefit from taxes collected from local residents employed as a result of the Proposed Action.

Employment related directly to coal mining operations would generate indirect jobs in the local economy. Indirect employment associated with the mine would include jobs in wholesale and retail trade, local government, and service sectors. Using a range of economic multipliers (indirect employment to direct employment) from 2.5 to 4.0, it is estimated that approximately 240–480 additional jobs (full- or part-time equivalents) would be generated as a result of mining operations on the tract. The economic multiplier of 4.0 comes from the Rocky Mountain Coal Mining Institute's 2009 estimates for direct and indirect Utah coal mining employment (Rocky Mountain Coal Mining Institute 2009), whereas the 2.5 multiplier comes from a University of Utah Bureau of Economic and Business Research report titled *The Structure and Economic Impact of Utah's Coal Industry*, which estimates direct and indirect Utah coal mining employment for the same year (Perlich et al. 2010).

Because a large portion of services directly and indirectly related to mining (e.g., fuel, equipment purchases and repairs, food, and retail services) would be in or around Cedar City in Iron County, it is likely that the indirect employees would be concentrated in this area as well.

4.12.3.1.2 Income

The range in salary for miners on the tract would be $18 to $21 per hour, not including benefits (McCourt 2008). Using $20 as an estimated average, the approximate annual wage for coal miners on the tract would be $41,600. Thus, the 160 employees of ACD would generate $6.65 million in total annual wages in the SESA and $166 million over the life of the mine under the Proposed Action. Employment and income impacts are shown in Table 4.12.1.

Table 4.12.1. Annual and Life-of-mine Employment and Income Impacts under the No Action Alternative, the Proposed Action, Alternative C, and Alternative K1 (in 2013 dollars)

	Alternative A (No Action)	Alternative B (Proposed Action)	Alternative C (Reduced Tract Acreage and Seasonal Restrictions)	Alternative K1 (Reduced Tract Acreage)
Direct employment (number of employees)	0	160	160	160
Indirect employment (number of employees)	0	240–480	240–480	240–480
Total annual wages (for direct employment)	$0	**$6.65 million**	**$6.65 million**	**$6.65 million**
Total life-of-mine wages (for direct employment)	$0	**$166 million**	**$140 million**	**$107 million**

4.12.3.1.3 Economic Contribution of Utah-produced Coal for Export[6]

In 2011, approximately 6% of Utah-produced coal was exported abroad, resulting in economic contributions in the form of employment, labor income, and gross value added in three distinct categories: export coal production, downstream transportation, and port operations and cargo handling. Assuming a 6% annual export figure for coal produced at the Alton Coal Tract (108,000 short tons), its share of annual economic export benefit is estimated in Table 4.12.2, as calculated for the State of Utah in *U.S. Coal Exports: National and State Economic Contributions* (Ernst & Young LLP 2013).

Table 4.12.2. Estimated Annual Economic Contribution of Alton Coal Tract–produced Export Coal

Estimated Economic Contribution	Category	Direct	Indirect and Induced	Total
Employment (number of full- and part-time employees)	Export coal production	20	60	80
	Downstream transportation	8	37	45
	Port operations and cargo handling	–	3	3
	Total	**28**	**100**	**128**
Labor income (millions of 2011 dollars)	Export coal production	$1.9	$2.7	$4.6
	Downstream transportation	$1.0	$1.4	$2.4
	Port operations and cargo handling	–	$0.1	$0.1
	Total	**$2.7**	**$4.2**	**$6.9**
Gross value added (millions of 2011 dollars)	Export coal production	$3.6	$5.1	$8.7
	Downstream transportation	$1.5	$2.5	$4.0
	Port operations and cargo handling	–	$0	$0
	Total	**$5.1**	**$7.8**	**$12.9**

4.12.3.2 GOVERNMENT AND PUBLIC FINANCE

Under the Proposed Action, approximately 1.8 million tons of coal would be mined each year, and approximately 44.9 million tons of recoverable coal would be mined over the 25-year mine life. The average sales price of coal in Utah was $35.78 in 2012 (Utah Geological Survey 2013a). The spot price for coal recovered in the tract would be slightly lower given that this coal heating value is lower than the Utah average. This analysis uses $32.00 per ton as the spot price. Spot prices for coal with a heat content more closely approximating the coal in the tract were not available to use in the analysis.

The annual sales value for 1.8 million tons of coal would be approximately $57.6 million (1.8 million tons of coal × $32.00). Over the 25-year mine life, recovery values would be approximately $1.44 billion (1.8 million tons × $32.00 × 25 years).

[6] Analyses of the potential impacts of exported coal are limited to the socioeconomics section because pertinent data were available to reasonably estimate potential economic impacts. Analyzing the impacts of exporting coal on other resources would be impractical and speculative because reasonable and foreseeable details regarding where the coal would be sold and how it would be transported are unknown.

4.12.3.2.1 Federal Royalties

Coal producers in the State of Utah must pay royalties to the United States government for coal mined on federal lands. The current royalty rate for surface mined coal is 12.5% of sales value and is paid to the DOI ONRR. Approximately 50% of the royalties are returned to the state where the mineral production occurs.

Assuming the annual recovery value for the coal produced under the Proposed Action would be $57.6 million per year, $7.2 million in royalties would be paid to ONRR ($57,600,000 × 0.125), and the State of Utah would receive approximately $3.6 million (approximately 1/2) per year. Under the Proposed Action, approximately $180 million in royalties would be paid to ONRR and $90 million would be disbursed to the State of Utah over a 25-year period.

Upon disbursement of royalty revenues to the State of Utah, more than 75% of the mineral revenue receipts are routinely appropriated to several state agencies. The distribution is as follows: 32.5% to the Permanent CIB, 40.0% to the UDOT for distribution to counties and county special service districts, and 5.0% to the Utah Department of Community and Culture for distribution to counties and special service districts. Projected appropriations as a result of mining the tract under each alternative, including the Proposed Action, are listed in Table 4.12.3.

Table 4.12.3. Estimated Recovery Value and Royalty Revenue under the No Action Alternative, the Proposed Action, Alternative C, and Alternative K1

	Alternative A (No Action) Annual and Life of Mine Values	Alternative B (Proposed Action), Alternative C, and Alternative K1 Annual Values (1.8 million short tons)	Alternative B (Proposed Action) Life of Mine Value (25 years of production)	Alternative C Life of Mine Value (21 years of production)	Alternative K1 Life of Mine Value (16 years of production)
Recovery value	$0	$57.60 million	$1.44 billion	$1.21 billion	$921.6 million
Total federal royalty revenue	$0	$7.20 million	$180.00 million	$151.20 million	$115.20 million
Royalties disbursed to state (50% of federal royalties)	$0	$3.60 million	$90.00 million	$75.60 million	$57.60 million
Appropriation to CIB (32.5% of state revenue)	$0	$1.17 million	$29.25 million	$24.57 million	$18.72 million
Appropriation to UDOT (40% of state revenue)	$0	$1.44 million	$36.00 million	$30.24 million	$23.04 million
Appropriation to Utah Department of Community and Culture (5% of state revenue)	$0	$180,000	$4.50 million	$3.78 million	$2.88 million

Under the Proposed Action, 92 AUMs allocated to livestock grazing would be lost annually. This loss of AUMs would total 3,220 over the life of the mine. The 2013 value of an AUM, according to the BLM, is $1.35. Thus, over the life of the mine (35 years for livestock grazing, 25 years for the mining activities, and 10 years for reclamation) a $4,347.00 (or $124.20 annually) decrease in contributions to the BLM would result. Should livestock permittees need to decrease livestock numbers as a result of the decrease in AUMs, this could result in lost revenue for permittees and a potential decrease in the workforce required to manage the livestock. However, with annual rotations in the tract over the life of the mine, adverse impacts to permittees would be minimized.

4.12.3.2.2 Additional Taxes and Fees

Black Lung Tax: The Black Lung Excise Tax on coal has been in effect since 1978. The tax finances the Black Lung Disability Trust Fund, which compensates miners (and their survivors and dependants) that have contracted "black lung disease" or pneumoconiosis. The current Black Lung Excise Tax rate for surface mines is $0.55 per ton. Under the Proposed Action, approximately $990,000 million annually and $24.7 million over the life of the mine would be paid to the Black Lung Disability Trust Fund (Table 4.12.4).

Table 4.12.4. Additional Taxes and Payments Associated with the No Action Alternative, the Proposed Action, Alternative C, and Alternative K1

	Alternative A (No Action) Annual and Life of Mine Values	Alternative B (Proposed Action) and Alternative C Annual Values (1.8 million short tons)	Alternative B (Proposed Action) Life of Mine Value (25-year mine life)	Alternative C Life of Mine Value (21-year mine life)	Alternative K1 Life of Mine Value (16-year mine life)
Black Lung Tax	$0	$1.0 million	$24.7 million	$20.8 million	$15.8 million
Abandoned Mine Land Tax	$0	$270,000	$6.8 million	$5.7 million	$4.3 million
Bonus bid payment	$0	n/a	$13.5–$20.2 million	$11.3–$17.0 million	$9.0–$13.5 million
Bonus bid payment disbursed to state (50% of federal payment)	$0	n/a	$6.8–$10.1 million	$5.7–$8.5 million	$4.5–$6.8 million

Abandoned Mine Lands: A reclamation fee of $0.15 per ton is assessed by the federal government on domestically produced, underground-mined coal to pay for the cleanup of abandoned mine lands. The fund was designed to be split evenly between the federal government and the state from which the money was generated. Assuming 1.8 million tons of coal are mined annually, $270,000 would be paid to the abandoned mine lands program and $6.8 million would be paid over the 25-year mine life.

Bonus Bid Payments: Before mining can begin in the tract, a company (or companies) must submit a sealed bid for the coal. The successful bidding company must pay one fifth of the total bonus at the time of the sale and would continue to pay one fifth every year for the next four years. The bid money would be paid to the federal government regardless of the production taxes and royalties that are paid by the mining company as the coal is mined. The federal government would keep half of this bonus bid payment and the State of Utah would receive the other half.

Although the exact amount of bid money anticipated through the lease of the tract is unknown, recently awarded bonus bids can be used to estimate potential federal and state revenue. In recent years, the bonus bids in Utah have varied from approximately $0.30 to $0.45 per recoverable ton for underground coal (McKenzie 2013). Using the same amount per ton and the assumption that 44.9 million tons of coal would be recovered over the life of the mine (under the Proposed Action), the successful bidder on the tract would pay between approximately $13.5 and $20.2 million to the federal government. Of the total bonus bid, between $6.8 and $10.1 million would be disbursed to the State of Utah.

Property Tax, Sales Tax, Equipment Costs, and Fuel Costs: The Utah Property Tax Division centrally assesses the ad valorem tax based on coal production, assessed property values, and current tax rates. Ad valorem taxes assessed on property and production generate revenue for local counties. The greater the production of coal, the greater the generation of property taxes for Kane County.

Sales and use taxes are levied by state and local governments on purchases of goods and services related to coal mining. The sales tax rate for Iron County is 5.95% and the sales tax for Kane and Garfield counties is 6.95%. The tax payments would indirectly benefit the local and national businesses supporting the coal mine operations. These economic impacts would be present throughout the life of the mine and to a lesser extent during the reclamation activities. It should be noted that because such a large percentage of mine-related services would be found in Cedar City, increases in sales tax revenues would be disproportionately higher in Iron County when compared to Kane and Garfield counties. Kane County conducted an analysis to estimate additional economic impacts to the county as a result of the mine under the Proposed Action. Results of this analysis are shown in Table 4.12.5, and figures were estimated for Alternatives C and K1 based on the life of the mine timespan reduction (in years).

Table 4.12.5. Additional Estimated Economic Impacts of Alternative A, the Proposed Action, Alternative C, and Alternative K1 (Kane County)

Economic Benefit	Alternative A (No Action)	Proposed Action (25-year mine life)	Alternative C (21-year mine life)	Alternative K1 (16-year mine life)
Fuel expenditures (mining) (at $4/gallon)	$0	$312,000,000	$262,080,000	$199,680,000
Fuel expenditures (trucking) (at 43.5 tons/load, 208-mile round-trip/load, at $4/gallon)	$0	$179,310,345	$150,620,690	$114,758,621
Equipment maintenance (mining and trucking)	$0	$165,324,138	$138,872,276	$105,807,448
Federal fuel tax collected at 24.4¢/gallon	$0	$25,211,931	$21,178,022	$16,135,636
State fuel tax collected at 24.5¢/gallon	$0	$25,315,259	$21,264,818	$16,201,766
Sales taxes (direct and indirect)	$0	$21,554,323	$18,105,631	$13,794,767
Property taxes paid (mining equipment and facilities)	$0	$2,543,450	$2,136,498	$1,627,808
Property taxes paid (trucking equipment and facilities)	$0	$3,423,875	$2,876,055	$2,191,280

Source: Kane County (2012).

The amount of property tax revenues and sales tax shares that Kane County can collect is greatly restricted due to the high percentage of federal land that restricts residential and commercial development within the county. Therefore, the promotion of multiple use activities on federal lands within the county generally improves Kane County's tax base. If multiple use activities on public lands are restricted, the overall tax base in Kane County is negatively impacted, including loss of revenues to local businesses and property and sales taxes collected.

Permanent CIB: As previously mentioned, Kane, Garfield, and Iron counties receive a portion of federal mineral lease monies returned to the State of Utah by the federal government through the CIB. The funds received by counties in the SESA for infrastructure projects would likely continue in amounts similar to current contributions regardless of the alternative selected, because CIB funding is not directly correlated with mineral production by county but rather by applicant eligibility. An estimated appropriation to the State of Utah as a result of the Proposed Action is given in Table 4.12.3.

Payments in Lieu of Taxes Program: Given that none of the alternatives would result in changes in federal land ownership in the SESA, Payments in Lieu of Taxes payments to Kane, Garfield, and Iron counties would remain similar to current conditions under all alternatives, including the No Action Alternative.

4.12.3.3 POPULATION AND HOUSING

As mentioned earlier, it is assumed that 90% (144 employees) of employees would commute from in the SESA and 10% (16 employees) of the 160 employees would relocate to the SESA. The average size of a family in the United States is 3.14 according to the 2000 U.S. Census (U.S. Census Bureau). Assuming in-migrants family size is similar to the United States average, approximately 50.24 additional people would move into the SESA during the life of the mine. Adding an additional 16 workers and their families concentrated in Kane County or dispersed throughout the SESA would have negligible impacts on population. Using the population data given in Section 3.12, the total population in the SESA is 58,593. An additional 50.24 people in the SESA would result in a 0.09% increase in the population of the SESA.

Although 16 employees would likely come from outside the SESA, the remaining employees would likely come from local communities. Given that 90% of the potential workforce is currently living in Kane, Garfield, and Iron counties, it is not anticipated that the demand for housing in the area would increase under the Proposed Action. The current housing market would accommodate the small percentage (0.09%) of in-migrants for short- or long-term housing because accommodations for 16 families in the SESA would likely be present at any given time.

As noted in Section 3.12 second-home ownership is largely influenced by scenic beauty and recreation opportunities. For many individuals, mining operations on the tract would detract from the desirable qualities associated with scenic views and recreation. As such, individuals may choose not to obtain second homes near the tract. However, because most of the second homes in Kane County are on Cedar Mountain (approximately 30 miles away from the tract), it is unlikely that most of the potential second-home purchases would be adversely impacted. Potential second-home purchases in Iron and Garfield counties are not likely to be adversely impacted by the Proposed Action given the distance from the tract.

In addition, numerous factors influence retirees' decisions regarding where to retire (including pre-existing ties to an area, affordability, and access to certain amenities); these decisions vary widely with individual choice and preference. Duncombe et al. (1999) found that, in general, retirees valued low housing prices, low tax rates, relatively high spending on public services by local governments (police, fire, etc), and access to amenities such as warm weather and coastlines. One study of survey respondent retirees who had moved to North Carolina found that retirement mobility was greatly associated with pre-existing social ties to a particular location. Two thirds of respondents had friends, family, or children living in the area that they migrated to or had previously lived or vacationed there. Of the survey respondents reporting social ties, 14% of that portion (9.3% of the total) of retirement migration was attributable to prior vacation experiences. The other third of respondents' retirement migration was attributed to "cold call" moves, because they did not have any pre-existing social ties to the area (Haas III et al. 2009). According to this survey, it is possible that some portion of the 9% (those with prior vacation experiences) and 30% (those choosing to "cold call" move to an area) of retirees, respectively, could choose not to move to the area because of perceived negative impacts of the Proposed Action.

The transportation analysis in Section 4.14.3 identifies a potential 4% increase in average daily traffic (ADT) on US-89 and a 2% increase on SR-56 along the most reasonably foreseeable coal haul route. A traffic study conducted by Fehr and Peers (2013) shows that LOS C or better would be maintained on all road segments and intersections of this route (see Section 3.14 for definitions of LOS levels). Though it is impossible to predict the exact route that a successful bidder might choose, given the slight increase in ADT and the limited congestion as reflected in the expected LOS levels, adverse impacts to property values along the reasonably foreseeable coal haul transportation route are not anticipated.

Should mining operations on the tract be perceived as an undesirable land use in areas near the tract, adverse impacts to the value of nearby property could be experienced. Several studies indicate that undesirable land uses, such as a power plant, superfund site, hazardous waste site, or landfill, do have a tendency to decrease the reported dollar value of a residence because of perceived disamenities, such as noise, traffic, air pollution and obstruction of view. The decrease in value is typically dependent on the distance (miles) from the site and can vary considerably depending on the existing land use, culture, amenities, housing markets, and size of the industrial site.

Hedonic valuation is a method of including the influence of external factors such as environmental amenities in the explanation of demand or price for a particular good. Although the empirical literature includes many hedonic valuation studies spanning the past several decades, most of these focused on impacts from hazardous waste sites and nuclear reactors. Very few have focused specifically on the impact of surface mining on surrounding property values.

A recent hedonic pricing study published by the University of Tennessee investigates the impacts that surface coal mines have on residential home values. The study (a dissertation) looked at 13 states, including Wyoming, that were characterized as having "high surface mining activity," defined as a state with five or more active surface coal mines. The study area included all of the counties in the 13 states (not just those with active coal mines), which totaled 1,154 counties. The average home value in the study area was $103,501.64, whereas SESA counties had median home values of $172,500 (in 2011 dollars). The study found that median home values declined as numbers of surface coal mines increased. In particular, the study estimated that the addition of a surface mine to the average county decreased residential property values between 0.34% and 1.7% (Williams 2011). If one were to apply this to the average home in Kane County, the impact would be a reduction in sale price of between $583.44 and $2,917.20 for homes with current median values of $171,600 in Kane County. This study is limited, however, in that it did not account for reduction in impacts as home distance increases from a mine site.

Another hedonic study examined the effects on single-family home sale prices from a nearby landfill in Minnesota over a 10-year period (1979–1989). The study found that homes adjacent to the landfill suffered a reduction in sale prices of approximately 12%, whereas those located 1 mile from the site saw approximately a 6% reduction while controlling for other variables such as the age of the home, number of bedrooms, and number of bathrooms. The study found that the landfill's negative effect on home values only applied to homes within 2 miles of the site. Another similar study found that properties within 2.5 miles of a power plant had a 6.3% reduction in property values as a result (Boyle et al. 2001).

According to U.S. Census (U.S. Census Bureau 2007–2011a), the town of Alton had 63 housing units (10 of which were vacant) with median home values of $195,000. County assessor tax parcel data were analyzed in relation to their distance from Block NW (the block closest to the town of Alton).

Approximately 112 municipally zoned county tax parcels intersect a 2.5-mile buffer of the tract under the Proposed Action. See Table 4.12.6 for detail regarding the number of parcels with and without associated addresses (indicating a residence) within each analyzed buffer zone.

Table 4.12.6. Municipally Zoned Parcels in the Town of Alton Close to the Tract under the Proposed Action and Action Alternatives

Buffer Zone (miles)	Proposed Action		Alternatives C and K1	
	Municipally Zoned Parcels Intersecting Buffer	Municipally Zoned Parcels Intersecting Buffer with Mailing Address	Municipally Zoned Parcels Intersecting Buffer	Municipally Zoned Parcels Intersecting Buffer with Mailing Address
0–1	106	43	12	5
1–2	13	2	103	40
2–3	5	3	9	0

Source: Utah AGRC (2013).

Note: County tax parcels that overlap more than one buffer zone are counted in each zone; therefore, double and sometimes triple counting may occur.

All of the parcels zoned municipal in Alton are within the 3-mile buffer of the mining blocks under the Proposed Action. Approximately 106 municipally zoned parcels (43 with mailing addresses associated) intersect a buffer zone of 0–1 mile from the tract (Block NW) under the Proposed Action. Approximately 13 parcels are within the 1- to 2-mile buffer zone, of which two have a mailing address listed in the parcel data. Lastly, within the 2- to 3-mile buffer zone, five parcels are zoned municipal and three have mailing addresses associated with them. The same data are listed in Table 4.12.6 above for Alternatives C and K1, which are identical in terms of proximity of mining to the town of Alton (Utah AGRC 2013). Based on the hedonic pricing studies cited above, impacts in terms of a reduction in sale price of the homes and properties in the SESA could be as low as 0.34% and as high as 12.0%.

Most hedonic pricing studies focus on the negative impact of an undesirable land use or site near residential properties, and little have looked at the positive impact of a site cleanup or remediation on home values. Dale et al. (1999) and McComb (2004) report that property values consistently rebounded for homes near sites following cleanup or remediation, but that the areas closest to the site rebounded more slowly than those farther away. Therefore, as reclamation of mined lands occurs, it is expected that any reduction in home or property value would be restored, with those homes and properties closest to the tract rebounding slower than those further away. Because reclamation is concurrent with mining, the reduction and restoration of property values could occur over the life of the mine, with potential impacts to home and property values lasting 35 years. The restoration of property values following mine reclamation, however, would not necessarily be felt by all current property owners, as some may not have the opportunity to experience property value restoration within their lifetimes.

Though hedonic pricing studies are valuable in assessing impacts to property values of various environmental amenities, they do have certain limitations. Limitations include the ability to discern outside market valuation influences on home values such as the overall housing market trends, suggesting that studies over long periods are more valuable. In addition, the amount that amenities influence the general population when purchasing a home vary widely across groups. For example, some home buyers are unwilling to move regardless of undesirable land use impacts. Others will accept certain undesirable land uses because they are offset by other desirable ones. Still, others deliberately locate to these areas seeking lower home values or access to certain home amenities (e.g., larger home size and more bedrooms), the costs of which are offset by the undesirable land use. Another limitation to using the hedonic valuation method is that in some cases, the addition of an undesirable land use can actually raise property values. For example, positive wage effects can often offset undesirable land uses in areas where a locally enhanced job market is created by industry, resulting in no change or increases to property values despite external disamenities (de Vor et al. 2009).

4.12.3.4 TOURISM

Section 4.11 identifies potential impacts to recreation due to the implementation of the Proposed Action. As stated in Section 4.11.2, there are currently no estimates for the amount and type of recreation use on or near the tract. The KFO RMP (BLM 2008b) states that information for recreational visitation based on actual use and economic expenditure data associated with such use are not available for the field office. Table 3.12.14 describes generalized estimates for nonmarket recreational use values on public lands in the Inter-mountain West. Because specific nonmarket use values are not available for the KFO and areas on and near the tract, it would be speculative to make quantitative estimates of the potential economic impact to the region from a potential decrease in use of recreation resources in the area. That said, qualitative discussions of impacts to nonmarket land us values can assist decision makers when considering a proposed versus existing land use (BLM 2010a).

Under the Proposed Action, recreation on the tract would be restricted for the life of the mine. Therefore, any nonmarket recreational use values associated with land on the tract would be eliminated ($0) until reclamation is complete. Nonmarket recreational use values on public lands adjacent to and near the tract would likely decline for the life of the mine. In addition, in places on public land from which the tract is visible (such as the nonmotorized trails in the Dixie National Forest east of the tract), nonmarket recreational use values would also likely decline. If nonmarket recreational use values were to decline in these areas, it is possible that recreation use would also decline or be relocated to areas with less or no impact. See Section 4.2.3.1.2 for more information regarding visual impacts to lands near the tract under the Proposed Action.

The Proposed Action would displace 3,576 acres of potential big game hunting. This represents approximately 0.4% of all big game hunting areas in the PPMA. Users would likely move onto adjacent public lands (BLM-administered lands and the Dixie National Forest) for hunting opportunities. Because hunters would be able to hunt on adjacent public lands and because the overall percentage of lands unavailable to big game hunting in the PPMA is less than 1%, it is unlikely that hunters would be adversely impacted by the Proposed Action. Direct and indirect sales and revenue generated by this recreational user group would continue similar to current conditions.

Privately issued big game hunting and viewing permits in the Alton CWMU would be impacted by the loss of available habitat and surface-disturbing activities. Hunting in the Alton CWMU would continue, and the same amount of big game permits would be issued as in years past. Approximately 2,145 acres (4.9%) of the Alton CWMU (approximately 43,658 acres) would be directly affected by the Proposed Action. Because no big game kills have occurred in the proposed tract in the last 20 years and the tract does not fall within prime CWMU deer or elk habitat, adverse impacts to hunters who use the CWMU are not anticipated.

As stated in Section 4.11.2, there is little recreation use that occurs on lands that would be directly affected by the tract. In addition to big game hunting, OHV use is the only other identified recreation use on the proposed tract. For the 25-year mine life, OHV users would be displaced from 3,576 acres (assuming that access to the tract would be precluded for the life of the mine); although, KFO Route 116 (an OHV accessible route) would remain accessible to OHVs during mining operations. The experiences and settings of OHV users traveling on KFO Route 116 through the tract would be modified from one now characterized as semiprimitive and natural to one characterized by coal mining activities. It would be speculative to assume that a change in landscape characterization along KFO Route 116 would preclude future OHV use.

From a qualitative perspective, the shift in landscape characterization from semiprimitive and natural to one characterized by coal mining would also be absorbed by local residents in the area who enjoy and/or depend on the naturalness of the area for their livelihood. An increase in truck traffic in and near Alton and communities along the reasonably foreseeable haul route such as Hatch and Panguitch would likely alter the essence of the rural community feel and semiprimitive landscape in these locations. The coal haul transportation route that is used for analysis purposes is the most reasonably foreseeable route, but it is impossible to predict the exact route that a successful bidder might choose. Individuals who moved to these areas specifically because of the rural feel and semiprimitive landscape, or those who operate tourist-related businesses, would likely notice a change in the social climate of the area. Although the transportation analysis anticipates negligible impacts to traffic flow or the ADT from a quantitative perspective (see Section 4.14), the frequency and noise of the daily truck traffic would adversely impact the quaint, small-town feel of Alton and communities along the reasonably foreseeable haul route. Altering the essence of these communities through daily truck traffic, noise, artificial lighting, and other mine-related operations could deter tourists from visiting Alton and the communities along the reasonably foreseeable haul route. If tourists choose not to visit the area because of the mining operations, tourist-related revenue would not be generated and tourist-dependent businesses would be adversely impacted.

While discussing potential negative impacts to tourism from the Proposed Action, it is important also to discuss generally the range of impacts that tourism itself has on rural regions and tourist-based economies. This is because tourism has both positive and negative effects, often placing the multi-part mission goals of national parks (attracting visitors and preserving the natural landscape and wildlife) into conflict with one another. Positive economic impacts of tourism include jobs for local residents, income for local economies, the preservation of rural services and businesses, and an increase in demand for local goods and services. Positive effects to the natural environment can include the preservation or improvement of environmental amenities due to visitor expectations of a scenic and/or nature-based experience. Negative economic impacts of tourism include that jobs provided are often low-paying and/or seasonal in nature, the demand for local goods and services can drive up costs for the resident population, goods and services provided can cater to the needs of tourists and not those of the resident population, and the demand for second homes can inflate housing costs for the resident population. Negative effects to the natural environment can include traffic congestion, air pollution, wildlife disturbance and mortality, and damage to the natural landscape in the form of litter, soil erosion, and vandalism (Association of National Park Authorities 2013).

The BLM received comments from the public regarding concern over the proposed lease's potential impacts to the tourism-based economy in the SESA, and to Bryce Canyon National Park in particular. Visitors to Bryce Canyon could encounter the impacts of proposed mine activities in the form of increased traffic, increased noise and vibration, night sky impacts, and air quality impacts (see Section 4.2 for potential impacts to night sky and soundscapes and Section 4.3 for potential impacts to air quality). To quantify potential impacts to tourism as a result of the Proposed Action, the relationship between highway traffic and tourism was analyzed. This analysis compares Bryce Canyon visitation to highway traffic levels over a five-year period using NPS visitation statistics alongside AADT for key sections of the reasonably foreseeable haul route that overlap routes tourists use to access the park (Table 4.12.7). UDOT AADT numbers presented include all passenger vehicles, combo trucks, and single trucks. Traffic counts at Bryce Canyon's entrance station were also included for reference.

Table 4.12.7. Bryce Canyon National Park Visitation and AADT for Selected Road Segments 2007–2011

Year	2007	2008	2009	2010	2011
Bryce Canyon National Park Visitation (thousands)	1,013	1,043	1,216	1,285	1,296
AADT for I-15 (SR-271 Paragonah)	16,785	15,510	16,320	16,645	16,445
AADT for SR-20 (I-15 Panguitch Interchange to SR-89)	1,520	1,635	1,665	1,700	1,480
All SR-89 Segments (300 North Hatch, SR-12 Red Canyon, Road to Rodeo grounds Panguitch)	7,985	7,055	7,650	7,715	7,000

Sources: NPS (2013a) and UDOT (2007, 2008, 2009, 2010, 2011).

When comparing Bryce Canyon visitation to AADT (which includes truck traffic numbers) over a five-year period for sections of the reasonably foreseeable haul route that overlap tourist access routes to Bryce Canyon, it is apparent that visitation has steadily increased despite traffic fluctuations on the highway segments. For example, AADT on SR-20 steadily increased from 2007 to 2010 and then dropped 13% in 2011, whereas visitation to Bryce Canyon over the same timeframe increased by 28%. On SR-89 road segments that overlap the reasonably foreseeable haul route, AADT fell by 12% from 2007 to 2008, increased by 8% from 2008 to 2009, and then dropped by 8% from 2010 to 2011. In the meantime, visitation to Bryce Canyon increased on average by 7% each year. In addition, 2012 saw 1,385,000 visitors to Bryce, 7% more than attended the previous year (AADT data were not available for 2012). The data presented in Table 4.12.7, show that when traffic levels increase on the road segments in question, visitation does not necessarily fall as a result.

Local recreation and tourism can be adversely and indirectly impacted by the mining industry if local lodging is disproportionately used by the mining employees, displacing visitors seeking hotel accommodations. Under both action alternatives, this is not likely to happen because nearly all of the 160 employees would be residents of Garfield, Iron, or Kane counties; thus, the existing stock of motel rooms in the SESA would continue to meet the demands of tourists to the area. Lastly, mining operations would likely draw nonmine personnel to the area for miscellaneous support and sales activities, such as equipment sales and repair, consulting services, regulatory activities, and others. This could lead to additional needs for hotels, housing, and restaurant facilities.

4.12.3.5 PUBLIC HEALTH AND SAFETY

4.12.3.5.1 Transportation

The transportation analysis in Section 4.14.3 identifies a potential 4% increase in ADT on US-89 through Hatch and Panguitch and a 2% increase on SR-56 through Cedar City. A traffic study conducted by Fehr and Peers shows that LOS C or better would be maintained on all road segments and intersections of the reasonably foreseeable coal haul transportation route (Fehr & Peers Transportation Consultants 2013) (see Section 3.14 for definitions of LOS levels). Given the slight increase in ADT and the limited congestion as reflected in the expected LOS levels, adverse impacts to public health and safety are not likely. Although it is plausible to consider that an increase in traffic on any given roadway would increase the potential risk for an accident, the findings of the transportation analysis do not suggest a measurable increase in transportation-related accidents.

4.12.3.5.2 Law Enforcement

A growth in population, which could occur to some extent in the SESA, could cause proportionate increases in crime. As mentioned earlier, 16 of the anticipated 160 employees and their families would relocate to the area specifically for employment at the mine. Such a slight increase in population across the SESA would not likely cause an increase in crimes. County and municipal law enforcement agencies would likely be able to accommodate the slight population growth projected under the Proposed Action.

With a slight increase in ADT along the transportation routes, there may be a potential need for increased traffic enforcement; however, it is not likely that an increase in current staffing conditions would be necessary because an increase in traffic does not assume an increase in traffic violations. Furthermore, the LOS of C or better estimated to be maintained on all transportation routes would not require increases in law enforcement.

4.12.3.5.3 Fire Protection

The fire department in the Town of Alton, the nine fire departments in Kane County, and the efforts of the BLM would provide adequate firefighting capabilities on the tract as a result of coal mining operations. Given the relatively small amount of acres impacted in the SESA (1,993 acres) and increase in ADT, it is assumed that aforementioned agencies could accommodate any increase in fires resulting from mining operations.

4.12.3.5.4 Health Care and Ambulance

The hospitals in the SESA would be able to handle the slight population growth and potential for acute traumas. As stated in Section 3.12.3.4, each county has a hospital that provides 24-hour emergency care. Air transport through Air-Med or Life Flight would provide emergency service to out-of-area hospitals.

4.12.3.5.5 Explosives

Under the Proposed Action, there could be a potential need for the use of explosives in the tract. Blasting activities could have adverse impacts on existing structures in the town of Alton. The potential damage to buildings would depend on the location of the explosive use and the condition of the structures in the town. However, a blasting plan would not be completed until the successful bidder has been awarded the contract; until then, detailed impacts from the use of explosives are unknown.

4.12.3.5.6 Underground Coal Fires

Under the Proposed Action, there is a potential risk for underground coal fires. In the event of an underground coal fire, potential impacts could include an increase in health and safety issues from toxic fumes, surface fires, subsidence, and damage to infrastructure such as roads, power lines, and buildings. Section 4.6.3.4, Geology, describes the risk of underground fires for the Alton Coal Tract.

4.12.3.6 ENVIRONMENTAL JUSTICE

The following communities in the SESA were identified as EJ communities because their poverty levels exceed that of their reference county:

- Communities of Panguitch, Cedar City, and Alton
- Census tract 3 in Garfield County
- Census tracts 1103, 1004, 1005, 1106, and 1107.02 in Iron County
- Census tract 1301 in Kane County

Census tract 3 and Panguitch (in Garfield County) were identified as EJ communities because they have minority population percentages of African American, American Indian and Alaska Native, and Asian/Pacific Islander groups that exceed the county levels. Iron County had multiple minority populations exceed county levels in both Cedar City and Summit, in addition to the following census tracts: 1103, 1004, 1005, 1106, 1107.01 and 1107.02 (see Tables 3.12.15 and 3.12.16). In the town of Alton, all minority group population percentages except African Americans exceeded Kane County levels.

Potential adverse impacts to the health, safety, and welfare of a potential EJ population are examined by looking for adverse impacts to resources that affect health and welfare. Under the Proposed Action, resources that could have impacts that could directly or indirectly affect the health and welfare of poverty or minority populations in the SESA are aesthetics, air quality, climate change, cultural resources, fire management, hazardous materials and hazardous and solid waste, land use and access, livestock grazing, recreation, socioeconomics, water resources, transportation, and wildlife and special status species.

As stated in Section 4.3, adverse air quality impacts would likely occur in Kane County in the town of Alton (however, air quality analyses only show modeled noncompliance with NAAQS [PM_{10}] under Alternative C). No adverse air quality impacts would be anticipated in Iron County or Garfield County; therefore, poverty or minority populations would not be impacted in these counties.

Census tract 1103 contains the rail loadout location and was identified as an EJ community because of its poverty level (31.5%) as compared to Iron County proper (20.7%). In addition, its minority population of American Indian and Alaska Native at 1.6% exceeded that of Iron County (1.2%). The closest community (unnamed) within census tract 1103 to the rail loadout is approximately 4.5 miles (7.2 km) west of the loadout. No adverse air quality impacts are anticipated in census tract 1103 because it is located in Iron County; therefore, poverty or minority populations would not be affected. Noise levels at the unnamed community west of the rail loadout are expected to reach a maximum of approximately 35 dBA, well below regulatory thresholds and likely below ambient background noise; therefore, poverty and minority populations would not be affected in this area.

The transportation analysis in Section 4.14.3 identifies a potential 4% increase in ADT on US-89 through Hatch and Panguitch and a 2% increase on SR-56 through Cedar City. A traffic study conducted by Fehr & Peers (2013) shows that LOS C or better would be maintained on all road segments and intersections of the reasonably foreseeable coal haul transportation route (see Section 3.14 for definitions of LOS levels). Given the slight increase in ADT and the limited congestion as reflected in the expected LOS levels, adverse impacts to EJ communities are not likely. Although it is plausible to consider that an increase in traffic on any given roadway would increase the potential risk for an accident, the findings of the transportation analysis do not suggest a measurable increase in transportation-related accidents. The increases in ambient noise levels from the 4% and 2% increase in truck traffic could result in increased annoyance but would not increase the risk for measurable hearing loss. Although poverty or minority populations living along the reasonably foreseeable transportation route in the SESA may be annoyed by increases in noise from truck traffic, they would not experience a disproportionate increase in ambient noise levels when compared to nonminority populations living along the route. The water quality analysis in Section 4.16 indicates that there would be no adverse impacts to the drinking water supply in the SESA; therefore, there would be no potential for disproportionate impacts to EJ communities living in the SESA. The impacts to general public health and safety (transportation, law enforcement, health care, etc.) for all individuals in the SESA would be negligible under the Proposed Action. Therefore, adverse impacts to EJ communities would also be negligible.

Table 4.12.8 displays information concerning whether or not there are adverse impacts and disproportionate adverse impacts to EJ communities by resource.

Table 4.12.8. Potential Environmental Justice Impacts of the All Action Alternatives

Resources	Adverse Impact to EJ Communities?	Disproportionate Impact to EJ Communities?
Aesthetic resources: soundscape	Yes	Yes. Noise and vibration impacts to the town of Alton would be greater than those at other communities in the SESA and would be above regulatory thresholds for noise and blasting under certain alternatives. Proposed Action (mining on Blocks NW, C, and S): While mining in Block NW, noise impacts to the town of Alton from mining on the tract and mine-related traffic would exceed regulatory thresholds for human annoyance. While mining on Blocks C and S, noise impacts to the town of Alton from mine-related traffic would exceed regulatory thresholds for human annoyance. See Section 4.2.2.2.1. Both noise and vibration impacts from blasting conducted in Block NW to the closest identified building in the town of Alton would be well in excess of both vibration and noise regulatory thresholds and any persons in the building may experience noise levels in excess of human comfort and regulatory threshold levels. See Section 4.2.2.2.2. Alternative C (mining on Blocks C and S): While mining in Blocks C and S, noise impacts to the town of Alton from mine-related traffic would exceed regulatory thresholds for human annoyance. See Section 4.2.2.2.1. Additionally, noise and vibration impacts from blasting in Blocks C and S could exceed regulatory thresholds for human annoyance, but not the threshold for building damage. See Section 4.2.2.2.2. Alternative K1 (mining on Block C): While mining in Block C, noise impacts to the town of Alton from mine-related traffic would exceed regulatory thresholds for human annoyance. See Section 4.2.2.2.1. Additionally, noise and vibration impacts from blasting in Block C could exceed regulatory thresholds for human annoyance, but not the threshold for building damage. See Section 4.2.2.2.2.
Aesthetic resources: visual	Yes	Yes. Visual impacts to the town of Alton would be greater than those at other communities in the SESA under the Proposed Action. Proposed Action (mining on Blocks NW, C, and S): Mining and construction of related facilities would noticeably change the landscape and would change the existing character of the landscape as viewed from the town of Alton in the short term but would be reclaimed upon completion. Alternative C (mining on Blocks C and S): Surface-mining activities would remain apparent on the landscape, but would occur over less acreage than the Proposed Action and at a greater distance from the town of Alton. Alternative K1 (mining on Block C): Surface-mining activities would remain apparent on the landscape, but would occur over less acreage than the Proposed Action and at a greater distance from the town of Alton.
Aesthetic resources: night sky	Yes	No. Impacts to night sky would not be disproportionate to local or EJ communities. Impacts would be felt by all individuals and would not be specific to EJ communities. Portable lights used for mining in pits adjacent to the town of Alton may impact residents by glare from direct lighting. Glare would be reduced through the use of directional lighting and by installing shields on lights. Glare would also be reduced by placing portable lights in the pit disturbance using the change in terrain resulting from mining activity to block any potential direct lighting on the town of Alton.

Table 4.12.8. Potential Environmental Justice Impacts of the All Action Alternatives

Resources	Adverse Impact to EJ Communities?	Disproportionate Impact to EJ Communities?
Air resources	Yes	No. Under the Proposed Action and Alternative K1, there are no modeled exceedances of NAAQS. Yes. Under Alternative C, there are modeled exceedances of the NAAQS for PM_{10}. Near-field air quality monitoring indicates that mine and transport-related pollutants would be in compliance with NAAQS for PM_{10} under the Proposed Action and AlternativeK1, but not for Alternative C. Modeled exceedances under Alternative C are off of the northwest side of the tract boundary near the boundary line. The public would only be exposed to lower concentrations of PM_{10} under this alternative, because concentrations drop off quickly further away from the tract boundary. See Section 4.3.3.1 of the SDEIS for more detail.
Climate change	Yes	No. Impacts are regional in nature, not localized to EJ communities.
Cultural resources	Yes	No. Potential for disturbance to tribal-sensitive areas could affect the natural character of previously undisturbed areas through visual and auditory intrusions as well as through an increased risk of the physical disturbance of sites. However, impacts would be mitigated through the tribal consultation process and the PA.
Fire management	Yes	No. Impacts from increased risk of human-caused wildfires from construction activities in undisturbed vegetation on and adjacent to the tract and from increased traffic along the reasonably foreseeable haul route would be felt by all individuals and communities in the SESA and would not be localized to EJ communities. In addition, the Western Utah RWPP does not consider the town of Alton as a state-identified community at risk of wildfire.
Geology and minerals	No. Impacts limited to the tract	–
Hazardous materials and hazardous and solid waste	Yes	No. Impacts from increased risk of hazardous waste spills as a result of mining and haul activities would be felt by all individuals and communities on the reasonably foreseeable haul route and would not be localized to EJ communities.
Land use and access	Yes.	No. The temporary loss of lands that are zoned for activities such as agriculture, grazing, and recreation would be felt by all individuals, not those specific to EJ communities.
Livestock grazing	Yes	No. There is no indication that the 2,392–3,220 AUMs lost over the life of the mine and reclamation period as a result of the action alternatives are disproportionately operated by members of EJ communities.

Table 4.12.8. Potential Environmental Justice Impacts of the All Action Alternatives

Resources	Adverse Impact to EJ Communities?	Disproportionate Impact to EJ Communities?
Paleontology	No. Impacts limited to the tract	–
Recreation	Yes	No. Impacts to recreation would not be disproportionate to local or EJ communities. Impacts would be felt by all individuals who recreate and would not be specific to EJ communities.
Socioeconomics	Yes	No. As royalty revenues are dispersed to counties, the local communities would likely see beneficial economic impacts. Adverse impacts to population and employment would not likely disproportionately impact EJ communities. The workforce required to mine (100 employees) and transport (60 employees) coal would likely already reside in existing rural communities, and given the proximity to services, would not impact more rural EJ communities' population and/or housing situation. The Proposed Action could result in direct and indirect jobs for members of EJ communities, thus having a beneficial impact on EJ community employment opportunities. Adverse impacts to housing values, if they were to occur, could disproportionately impact the town of Alton. That said, the analysis is not clear that adverse impacts to housing values would occur in Alton or elsewhere in the SESA as a result of the Proposed Action or its alternatives. The alteration of the existing rural, quiet nature of the town of Alton and surrounding areas due to truck traffic, noise, and artificial lighting would occur over the life of the mine, but these impacts would be felt by all communities on the reasonably foreseeable coal haul route in the SESA, not just EJ communities. In addition, the natural, rural landscape would be restored gradually as the vegetation is restored by concurrent reclamation over the life of the mine.
Soils	No. Impacts limited to the tract	–
Transportation	Yes	No. Increases in project-related vehicle traffic would go directly through the EJ community of Alton, but would not result in a change in LOS. Under the Proposed Action, traffic conditions at intersections and along road segments of the reasonably foreseeable coal haul transportation route would continue to operate at their current, acceptable LOS-C or better. A traffic study conducted demonstrates that LOS-C or better would be maintained on all road segments and intersections of the reasonably foreseeable coal haul transportation route (Fehr & Peers Transportation Consultants 2013). Capacity for additional traffic would remain, and increased traffic volume would not result in reductions in LOS or reach a level of significance. In addition, transportation impacts would be felt by all communities on the reasonably foreseeable coal haul route in the SESA, not just EJ communities.
Vegetation	No. Impacts limited to the tract and the KFO road relocation. Vegetation is expected to improve with the selected seed mix and removal of noxious weeds. Noxious weeds are not expected to be spread outside of the tract due to design features.	–

Table 4.12.8. Potential Environmental Justice Impacts of the All Action Alternatives

Resources	Adverse Impact to EJ Communities?	Disproportionate Impact to EJ Communities?
Water resources	Yes	No. The action alternatives would not impact community drinking water supplies; therefore, water quality in EJ communities would not be disproportionately impacted. With regard to water quantity, the action alternatives would require withdrawal from public water supplies, but water purchases are publicly available to all water users.
Wildlife and special status species	Yes	No. Loss of wildlife habitat and movement corridors are not directly connected to EJ populations because they are not dependent on wildlife per se.

4.12.4 Alternative C: Reduced Tract Acreage and Seasonal Restrictions

Under Alternative C, approximately 37.8 million tons of coal would be mined over a 21-year period. As under the Proposed Action, 1.8 million tons of coal would be mined annually, and 160 employees would be required to complete mining operations. Alternative C would also require an identical amount of truck round-trips to move coal from the tract to the reasonably foreseeable coal loadout location west of Cedar City. The tract, as modified under Alternative C, would encompass approximately 3,178 acres consisting of 2,280 acres of BLM-administered land (federal surface and subsurface and 893 acres of private land (private surface and federal subsurface. The life of the mine under Alternative C would be 21 years, four fewer years than under the Proposed Action. When compared to the No Action Alternative, Alternative C would result in an increase in employment, personal income, and government revenues. A slight increase in population is anticipated, but would not lead to an increased need for public services. Under the No Action Alternative, no mining would occur and therefore an increase in local employment, income, and government revenues as a result of mining would not occur. Under Alternative C, a slight decrease in grazing revenues would be lost as a result of a decrease in AUMs and any recreation-related economic contributions from individuals who choose to recreate on the tract would be foregone under Alternative C.

4.12.4.1 EMPLOYMENT AND INCOME

Employment requirements (for direct and indirect jobs) under Alternative C would be identical to the Proposed Action, though employment at the mine would be required for 21 years under Alternative C. The annual total wages generated (from direct and indirect jobs) would be the same under Alternative C as under the Proposed Action.

4.12.4.2 GOVERNMENT AND PUBLIC FINANCE

Under Alternative C, an estimated 1.8 million tons of coal would be mined each year. Over the 21-year mine life, approximately 37.8 million tons of recoverable coal would be mined. Using the same spot price as under the Proposed Action ($32.00 per short ton), the annual recovery value would be identical to the Proposed Action at approximately $57.6 million (1.8 million tons of coal × $32.00). Over the 21-year mine life, recovery values would be approximately $1.21 billion (1.8 million tons × $32.00 × 21 years). This is a 16% decrease in potential recovery value compared to the Proposed Action.

4.12.4.2.1 Federal Royalties

Under Alternative C, annual royalties paid to the federal government would be similar to those paid under the Proposed Action because the amount of coal mined each year would be similar. However, royalty revenues would be generated for 21 years, four fewer years than the Proposed Action. When compared to the Proposed Action, Alternative C would produce 16% less royalty revenue. Assuming the annual recovery value for the coal produced under the Proposed Action would be $57.6 million per year, $7.2 million in royalties would be paid to ONRR ($57,600,000 × 0.125) and the State of Utah would receive approximately $3.6 million (approximately 1/2) per year. Under Alternative C, $151.2 million in royalties would be paid to ONRR and $75.6 million would be disbursed to the State of Utah over a 21-year period (see Table 4.12.3 for more detail).

Under Alternative C, 118 AUMs allocated to livestock grazing would be lost annually. This loss of AUMs would total 2,852 over the life of the mine. Access under Alternative C would be restricted for 31 years (21-year mine life plus 10-year reclamation period) instead of the 35 years under the Proposed Action and 26 years under Alternative K1. The 2013 value of an AUM (grazing fee), according to the

BLM (2013a) is $1.35. Thus, over the 21-year mine life, this would result in a $4,938.30 (or $159.30 annually) decrease in contributions to the BLM. Should livestock permittees need to decrease livestock numbers as a result of the decrease in AUMs, this could result in lost revenue for permittees and a potential decrease in the workforce required to manage the livestock. However, with annual rotations in the tract over the life of the mine, adverse impacts to permittees would be minimized.

4.12.4.2.2 Additional Taxes and Fees

Under Alternative C, approximately 16% fewer coal mine-related taxes and fees would be generated. Contributions to the Black Lung Excise Tax would be between $20.8 million over the 21-year mine life, and Abandoned mine land fees would be between $5.7 million. Ad valorem taxes generated over the life of the mine would be 16% less than the Proposed Action. The sales and use tax generation on goods and services associated with the mine would taper off four years earlier under Alternative C.

Bonus bid payments: Approximately $11.3–$17.0 million would be paid in bonus bid payments under Alternative C, given that 37.8 million tons of coal are expected to be mined over a 21-year period. Of the total bonus bid payment, 50% ($5.7–$8.5 million) would be disbursed to the State of Utah.

4.12.4.3 POPULATION AND HOUSING

Impacts to population and housing under Alternative C would be nearly identical to impacts under the Proposed Action. However, because the duration of the mining activities would be 21 years under Alternative C, the 10% of the 160 employees (16 individuals) that would relocate to the tract for mine employment may choose to move away from the area once the mining operations are complete. Thus, the results would be a negligible decrease in population and an increase in housing availability.

4.12.4.3.1 Property Values

Potential property value impacts to residential plots and homes in the town of Alton would be reduced under Alternative C, because this alternative eliminates Block NW from mining (the block closest to the town of Alton). Under this alternative, the closest mining activities to the town of Alton would occur in Block C (see Map 2.2), the edge of which is approximately 1 mile from the south edge of Alton's municipal boundary. All of the parcels zoned municipal in Alton are within 3 miles of Block C. Given that the life of the mine would be four years shorter under Alternative C, reclamation would begin earlier, and adverse impacts to property values would be mitigated sooner than under the Proposed Action.

4.12.4.4 TOURISM

Both action alternatives would result in the same types of impacts to recreational resources. However, Alternative C would result in fewer acres of recreation-related impact based on the smaller acreage of the tract and fewer years of impact based on the shortened life of the mine. Big game hunting areas in the PPMA would be reduced by 0.3%. Hunting in the Alton CWMU would continue, and the same amount of big game permits would be issued as in years past. Approximately 1,985 acres (4.5 %) of the Alton CWMU (approximately 43,658 acres) would be directly affected by the Alternative C. Because no big game kills have occurred in the proposed tract in the last 20 years and the tract does not fall within prime CWMU deer or elk habitat, adverse impacts to hunters who use the CWMU are not anticipated. OHV users would not be able to access 13 miles of designated routes on the tract. It is unlikely that these slight reductions in availability would deter these types of recreationists to the area. Economic contributions from these user groups would likely remain similar to current conditions given the amount of nearby lands available for big game hunting and OHV use. See Section 4.11.4 for further detail on impacts to recreation resources under this alternative.

Impacts to tourists and tourism-related businesses under Alternative C would be similar to the Proposed Action. Under Alternative C, the alteration of the existing rural, quiet nature of the town of Alton and surrounding areas due to truck traffic, noise, and artificial lighting would occur at the same level as the Proposed Action, but would end four years earlier.

4.12.4.5 PUBLIC HEALTH AND SAFETY

Under Alternative C, impacts to public health and safety would be identical to the Proposed Action. However, the duration of impacts and need for services would be four fewer years.

4.12.4.6 ENVIRONMENTAL JUSTICE

Under Alternative C, the disproportionate impacts to the town of Alton identified in Table 4.12.8 (Air Quality, Noise and Visual impacts) would be reduced because this alternative eliminates Block NW from mining (the mining block closest to the town of Alton). Under this alternative, the closest mining activities to the town of Alton would occur in Block C (see Map 2.2), the edge of which is approximately 1 mile from the south edge of Alton's municipal boundary.

Under Alternative C, mining would take place 1 mile further from the town of Alton, the life of the mine would be four years shorter, the tract would be modified to exclude 321 acres closest to Alton, and reclamation would begin earlier. As a result, disproportionate adverse impacts to the town of Alton as described in Table 4.12.8 would be minimized when compared to the Proposed Action. Under Alternative C, there are modeled exceedances of the NAAQS for PM_{10} off the northwest side of the tract boundary near the boundary line of the town of Alton (see Section 4.3.3.1). While mining in Blocks C under Alternative C, noise impacts to the town of Alton from mine-related traffic would exceed regulatory thresholds for human annoyance. See Sections 4.2.2.2.1 and 4.2.2.3.1. Additionally, noise and vibration impacts from blasting in Blocks C could exceed regulatory thresholds for human annoyance, but not the threshold for building damage. See Sections 4.2.2.2.2 and 4.2.2.3.2. In terms of visual impacts, surface-mining activities would remain apparent on the landscape, but would be eliminated on 321 acres closest to the town of Alton when compared to the Proposed Action.

4.12.5 Alternative K1: Reduced Tract Acreage

Under Alternative K1, approximately 30 million tons of coal would be mined over a 16-year period. As under the Proposed Action, 1.8 million tons of coal would be mined annually, and 160 employees would be required to complete mining operations. Alternative K1 would also require an identical amount of truck round-trips to move coal from the tract to the reasonably foreseeable coal loadout location west of Cedar City. The life of the mine under Alternative K1 would be 16 years, nine fewer years than under the Proposed Action. When compared to the No Action Alternative, Alternative K1 would result in an increase in employment, personal income, and government revenues. A slight increase in population is anticipated, but would not lead to an increased need for public services. Under the No Action Alternative, no mining would occur, and therefore an increase in local employment, income, and government revenues as a result of mining would not occur. Under Alternative K1, a slight decrease in grazing revenues would be lost as a result of a decrease in AUMs, and any recreation-related economic contributions from individuals who choose to recreate on the tract would be foregone under Alternative K1.

4.12.5.1 EMPLOYMENT AND INCOME

Employment requirements (for direct and indirect jobs) under Alternative K1 would be identical to the Proposed Action, though employment at the mine would be required for 16 years under Alternative K1. The annual total wages generated (from direct and indirect jobs) would be the same under Alternative K1 as under the Proposed Action.

4.12.5.2 GOVERNMENT AND PUBLIC FINANCE

Under Alternative K1, an estimated 1.8 million tons of coal would be mined each year. Over the 16-year mine life, approximately 30 million tons of recoverable coal would be mined. Using the same spot price as under the Proposed Action ($32.00 per short ton), the annual recovery value would be identical to the Proposed Action at approximately $57.6 million (1.8 million tons of coal × 32.00). Over the 16-year mine life, recovery values would be approximately $921.6 million (1.8 million tons × 32.00 × 16 years). This is a 36% decrease in potential recovery value compared to the Proposed Action.

4.12.5.2.1 Federal Royalties

Under Alternative K1, annual royalties paid to the federal government would be similar to those paid under the Proposed Action, because the amount of coal mined each year would be similar. However, royalty revenues would be generated for 16 years, nine fewer years than the Proposed Action. When compared to the Proposed Action, Alternative K1 would produce 36% less royalty revenue. Assuming the annual recovery value for the coal produced under the Proposed Action would be $57.6 million per year, $7.2 million in royalties would be paid to ONRR ($57,600,000 × 0.125), and the State of Utah would receive approximately $3.6 million (approximately 1/2) per year. Under Alternative K1, $115.20 million in royalties would be paid to ONRR and $57.60 million would be disbursed to the State of Utah over a 16-year period (see Table 4.12.3 for more detail).

Under Alternative K1, 92 AUMs allocated to livestock grazing would be lost annually. This loss of AUMs would total 1,472 AUMs over the life of the mine. Access under Alternative K1 would be restricted for 26 years (16-year mine life plus 10-year reclamation period) instead of 35 years under the Proposed Action and 31 years under Alternative C. The 2013 value of an AUM, according to the BLM (2013a), is $1.35. Thus, over the 16-year mine life plus the 10-year reclamation period, this would result in a $3,229.20 (or $ 124.20 annually) decrease in contributions to the BLM. Should livestock permittees need to decrease livestock numbers as a result of the decrease in AUMs, this could result in lost revenue for permittees and a potential decrease in the workforce required to manage the livestock. However, with annual rotations in the tract over the life of the mine, adverse impacts to permittees would be minimized.

4.12.5.2.2 Additional Taxes and Fees

Under Alternative K1, approximately 36% fewer coal mine-related taxes and fees would be generated. Contributions to the Black Lung Excise Tax would be $15.8 million over the 16-year mine life, and abandoned mine land fees would be $4.3 million. Ad valorem taxes generated over the life of the mine would be 36% less than the Proposed Action. The sales and use tax generation on goods and services associated with the mine would taper off nine years earlier under Alternative K1.

Bonus bid payments: Approximately $9 to $13.5 million would be paid in bonus bid payments under Alternative K1, given that 30 million tons of coal are expected to be mined over a 16-year period. Of the total bonus bid payment, 50% ($4.5 to $6.8 million) would be disbursed to the State of Utah.

4.12.5.3 POPULATION AND HOUSING

Impacts to population and housing under Alternative K1 would be nearly identical to impacts under the Proposed Action. However, because the duration of the mining activities would be 16 years under Alternative K1, the 10% of the 160 employees (16 individuals) that would relocate to the tract for mine employment may choose to move away from the area once the mining operations are complete. Thus, the results would be a negligible decrease in population and an increase in housing availability.

4.12.5.3.1 Property Values

Potential property value impacts to the town of Alton would be reduced under Alternative K1, because this alternative eliminates Block NW from mining (the mining block closest to the town of Alton). Under this alternative, the closest mining activities to the town of Alton would occur in Block C (see Map 2.3), the edge of which is approximately 1 mile from the south edge of Alton's municipal boundary. All of the parcels zoned municipal in Alton are within 3 miles of Block C. Given that the life of the mine would be nine years shorter under Alternative K1, reclamation would begin earlier, and adverse impacts to property values would be mitigated sooner than under the Proposed Action.

4.12.5.4 TOURISM

All action alternatives would result in the same types of impacts to recreational resources. However, Alternative K1 would result in fewer acres of recreation-related impacts based on the smaller acreage of the tract and fewer years of impact (16 years) based on the shortened life of the mine. Big game hunting areas in the PPMA would be reduced by 0.2%. Impacts to hunting in the Alton CWMU would be the same as those described for Alternative C, but would occur for five fewer years. OHV users would not be able to access 13 miles of designated routes on the tract. It is unlikely that these slight reductions in availability would deter these types of recreationists to the area. Economic contributions from these user groups would likely remain similar to current conditions given the amount of nearby lands available for big game hunting and OHV use. See Section 4.11.5 for further detail on impacts to recreation resources under this alternative.

Impacts to tourists and tourism-related businesses under Alternative K1 would be similar to the Proposed Action. Under Alternative K1, the alteration of the existing rural, quiet nature of the town of Alton and surrounding areas due to truck traffic, noise, and artificial lighting would occur at the same level as the Proposed Action, but would end nine years earlier.

4.12.5.5 PUBLIC HEALTH AND SAFETY

Under Alternative K1, impacts to public health and safety would be identical to the Proposed Action. However, the duration of impacts and need for services would be nine fewer years.

4.12.5.6 ENVIRONMENTAL JUSTICE

Under Alternative K1, the EJ disproportionate impacts to the town of Alton identified in Table 4.12.8 (Air Quality, Noise and Visual impacts) would be reduced because this alternative eliminates Block NW from mining (the mining block closest to the town of Alton). Under this alternative, the closest mining activities to the town of Alton would occur in Block C (see Map 2.3), the edge of which is approximately 1 mile from the south edge of Alton's municipal boundary.

Under Alternative K1, mining would take place 1 mile further from the town of Alton, the life of the mine would be nine years shorter, the tract would be modified to exclude 745 acres (including 321 acres closest to Alton), and reclamation would begin earlier. As a result, disproportionate adverse impacts to the town of Alton as described in Table 4.12.8 would be minimized when compared to the Proposed Action. In contrast to Alternative C, under Alternative K1, mine and transport-related pollutants are modeled to be in compliance with NAAQS for PM_{10} in the town of Alton (see Section 4.3.3.1). Noise and blasting impacts to the town of Alton under Alternative K1 would be the same as for Alternative C. In terms of visual impacts, surface-mining activities would remain apparent on the landscape, but would be eliminated on 745 acres (including 321 acres closest to Alton) when compared to the Proposed Action.

4.12.6 Potential Mitigation Measures

No potential mitigation measures have been identified for socioeconomic resources. See Section 4.2.5 for a discussion of potential noise- and visual-related mitigation measures that could reduce disproportioned impacts to EJ communities.

4.12.7 Unavoidable Adverse Impacts

Given that natural resource development is finite and based on demand, the SESA is susceptible to a boom-and-bust cycle. Although the proposed development would temporarily have positive impacts on the local economy with regard to revenue generation, the depletion of the resource would result in a long-term adverse impact to the economy. Those who had been dependent on the jobs and revenue provided by the mining operation would be adversely impacted as a result of job and revenue loss following resource depletion.

4.12.8 Short-term Uses versus Long-term Productivity

Increases in the workforce would contribute to temporary increases in income, housing, and service requirements. The increase in employment and revenues resulting from the mining operation would have short-term benefits for the local communities. However, once mining is complete, local revenues would be reduced and jobs would be eliminated or redirected. Once the tract has been rehabilitated, AUMs could return to current levels and recreation opportunities could be restored. The revenues and employment from those land uses would be realized indefinitely, or as long as the land uses were permitted to exist.

4.12.9 Irreversible and Irretrievable Commitments of Resources

The extraction of coal would result in a permanent (irreversible) loss of a portion of our natural resources. The irreversible loss of the resource would preclude future potential revenues for local, state, and federal governments and the local communities.

Implementation of the Proposed Action or Alternative C could reduce recreational tourism and livestock grazing and associated revenues. Social well-being and feelings of community satisfaction could also be disrupted during the life of the mine. However, studies in natural resource communities have observed that disruptive social effects do not last once the mining operations have ceased and the stability of the community has been reestablished (BLM 2008e). In addition, if structural damage occurs to buildings in the town of Alton due to vibration impacts (see Section 4.2 and Appendix L), property value impacts to these buildings could be permanent.

4.13 Soils

4.13.1 Regulatory Framework

Numerous federal and state regulations shape the management of soils as a natural resource. Regulations that pertain to soils and potential impacts from mining and other land uses include, but are not limited to the following:

- The Taylor Grazing Act of 1934, as amended, provides for continued study of erosion and flood control, and provides for any work that may be necessary to protect and rehabilitate public lands to prevent soil deterioration.
- FLPMA requires that public lands be managed in a manner that will protect scientific, environmental, air and atmospheric, and water resource values. It also requires land use plans to comply with applicable pollution control laws, including state and federal air, water, and other pollution standards.
- The Utah Coal Mine Permitting Requirements for soils (UAC R645-301-200) include, but are not limited to, the following:
    - Development of an operation plan for removing, storing, and reclaiming soils
    - Development of a reclamation plan for redistributing and reclaiming of soils
    - Protection and stabilization of all exposed surface areas to control erosion and air pollution (fugitive dust)
    - Salvage of soils suitable to support plant growth for use in reclamation
    - Protection of soil stockpiles from contaminants, disturbance, compaction, and erosion

In addition to the aforementioned regulations, the BLM uses trends or changes in vascular plants (NRCS ecological sites) and soils conditions (rangeland health) to guide the management of biological soil crusts.

BLM's Rangeland Health: Fundamentals and Standards (43 CFR 4180.1), in addition to promoting ecosystem health, specifically require that "soil and plant conditions support infiltration, soil moisture storage, and the release of water that are in balance with climate and landform" and "upland soils exhibit permeability and infiltration rates that sustain or improve site productivity."

Management actions adopted in the KFO RMP would also be incorporated into the lease as required actions in the event of a lease sale for the tract. The KFO RMP lists the following management actions applicable to soils:

- Implement BMPs designed to minimize impacts on soils from ground-disturbing activities, as appropriate.
- Reduce soil loss on watersheds by performing appropriate land treatments.
- Initiate reclamation of surface disturbances, where appropriate, during or upon completion of the authorized project.
- Identify areas of "fragile soils" during preparation of project-level plans, as well as necessary mitigation measures to minimize risks and degradation.
- Develop and implement site-specific restrictions and/or mitigations for activities proposed in fragile soil areas on a case-by-case basis. Surface-disturbing activities must be approved by the BLM before construction and maintenance is authorized.
- Incorporate BMPs and soil protection measures into developments on sensitive soils. Measures to stabilize soils and minimize surface-water runoff would be required for slopes greater than 15%, both during tract activities and following tract completion.
- When feasible, identify and salvage biological crusts prior to disturbance; use salvaged soil crusts to inoculate reclaimed soils.

4.13.2 Alternative A: No Action

Under the No Action Alternative, no impacts to soils would occur as a result of mining activities. Some soil impacts associated with current surface uses, including livestock grazing, vegetation treatments, and OHV use, would continue. These impacts would generally be relatively minor in both extent and severity in comparison to the disturbances associated with surface mining under the action alternatives. These impacts would include erosion (related soil exposure) and compaction due to existing land uses. Under current uses, soil disturbance is generally limited to surface uses by livestock and light-duty vehicles, and heavy machinery is not a typical use. In addition, uses are generally limited to designated routes or grazing areas, rather than large swatches of major disturbance, as would occur under the action alternatives. Thus, in comparison to the action alternatives, impacts would be of lesser aerial extent and far lesser magnitude and severity. Impacts to sensitive soils would occur proportionally to the prevalence of the soils on the tract, as described in Chapter 3. However, these impacts would generally be minor and limited to surface disturbance and compaction by livestock and light-duty vehicles, and thus would not result in the need for major reclamation projects. Therefore, sensitive soils would unlikely limit reclamation success.

4.13.3 Alternative B: Proposed Action

4.13.3.1 TYPES AND NATURE OF IMPACTS TO SOILS

Under the Proposed Action, 1,993 acres of soils would be directly disturbed by surface mining and by the construction of related facilities and roads. Of this total, 1,750 acres of soil resources would be disturbed by surface mining, and 243 acres would be disturbed by other related activities, including the construction of centralized and dispersed facilities, the relocation and construction of roads, and the grading of road ROWs. Impacts under the Proposed Action would be considerably greater than under the No Action Alternative due to the large-scale removal and replacement of soils that would occur during proposed surface-mining operations (which would not occur under the No Action Alternative). Impacts to soils from current land uses on the tract from vegetation treatments, livestock grazing, and recreation would be discontinued under the Proposed Action. They would resume 35 years after mining commences (25 years for the life of the mine and 10 years for reclamation and rehabilitation).

Surface-mining activities under the Proposed Action would drastically disturb soil texture, structure, and porosity through the large-scale removal, stockpiling, and replacement of soils during surface mining. A total of 1,750 acres of soils would be removed to their full depth where surface mining takes place, and topsoil and suitable subsoil would be stockpiled for reclamation. Following the completion of mining, mined areas would be backfilled and regraded, then topped with the stockpiled soils. This would result in reclaimed soils with different long-term physical, structural, biological, and chemical properties than those present prior to surface mining. Post-mining soils would be more uniform in thickness, structure, type, texture, nutrient availability, and chemistry. The existing soil structure would largely be eliminated by the removal and replacement of soils in areas that are surface mined. In addition, changes in bulk density would occur due to mixing, aeration, and compaction. The bulk density of the entire soil profile would likely be reduced, as demonstrated by evidence that replaced soils in surface mines typically expand by approximately 15%–35% (Pfleider 1968). However, grading and compaction of topsoil would likely increase the bulk density of near-surface soils. Surface-mining impacts are referred to as “pit” impacts in this section’s tables.

Surface-mining activities would directly remove and stockpile up to 120 acres of soil per year. Topsoil would be stockpiled only until the overburden is moved to the next pit. Each of these up to 120-acre blocks would be replaced within a year, and the loss of soil productivity and increased potential for erosion related to soil removal and replacement would be short term. However, the drastic disturbance

(impact) caused by removing and replacing soils, as described above, would be long term. Revegetation and natural weathering would eventually reform new soil structures with the reclaimed soils, although this would be a long-term process (hundreds of years) in the arid environment present in the tract. Per State of Utah and OSM regulation, reclaimed surface soils would be free of acid-forming soils, sodic zones, or toxic materials. They would also have a rooting zone sufficient to establish an effective and permanent vegetative cover. Thus, the long-term fertility of the soils would not be affected.

Impacts to soil resources within the 243 acres of other related activities would generally be less drastic than in areas that are surface mined. The construction of roads and facilities in these areas would result in soils being covered by infrastructure, graded or mixed, moved, compacted, or otherwise disturbed. These soils would generally not be disturbed to as great a depth, would retain more of their original qualities, and would be less uniform following reclamation. However, most of these impacts (caused by facilities, some roads, etc.) would be long-term impacts, persisting for the life of the tract.

Where the near-surface soil is compacted during disturbance and/or reclamation, its infiltration capacity would be temporarily decreased, resulting in a greater potential for runoff and erosion. Numerous erosion control measures and reclamation measures would be employed per state and federal regulation, as detailed in Chapter 2. Specifically, reclaimed areas would be required (UAC R645-301-200) to use best available technology to prevent sedimentation. They would also be required to stabilize all exposed surfaces to effectively control erosion, and stabilize rilled (or eroded) areas where post-mining land use, vegetation, or water quality would be threatened. Because temporary erosion controls specified on unreclaimed areas often prevent erosion from traveling long distances rather than completely preventing erosion (e.g., silt fencing, retention basins, etc.), there would likely be some mass transfer of eroded materials downslope early in the reclamation process. This erosion would be reduced as vegetation is established, and eroded materials would generally be prevented from impairing other resources by the required controls.

The reclamation and restoration of soil structure and functioning is determined by physical, chemical, and biological factors. As described in the above paragraphs, both disturbance and reclamation alter soil structure through compaction and the resulting loss of porosity and biological activity. These structural changes can potentially diminish the movement of water into and through the soil (Stolt et al. 2001), reduce seed and spore viability, and prevent the establishment and growth of vegetation and biological soil crusts and associated soil microbes (Scoles-Sciulla et al. 2009).

Successful reclamation of soil structure and ecological function is assumed, provided that the management practices prescribed per UAC R645-301-200 are successfully implemented. However, ecological factors outside of human control, such as drought and other short-term climatic variations, can limit the effectiveness of soil reclamation efforts. There is limited information on reclamation success for arid west soils, but published studies clearly indicate that below-average precipitation during the restoration period can impede or delay the successful restoration of soils and associated vegetation (Romney et al. 1987; Bainbridge et al. 1999; Bainbridge et al. 1995; Bainbridge 1990).

Chemical suppressants and watering may be used to reduce fugitive dust from unpaved roads and disturbed areas under the Proposed Action and action alternatives. Dust suppressants may cause dissolution of some soil constituents. In soils from arid regions, which may have high salt content, water used as a suppressant can mobilize the salts and increase the salt concentration in nearby water bodies or groundwater. In more complex situations, the chemical constituents of the suppressant can react with and leach toxic components from the soils at the application site. The issue of leaching is particularly relevant at sites that may contain hazardous material, such as coal fields, landfills, and mine tailing piles (EPA and UNLV 2004). In addition, soil microorganisms may biotransform the suppressants into benign or more toxic compounds depending on the environmental conditions at the site of application (EPA and UNLV 2004).

The application of dust suppressants can have secondary effects on the characteristics of soils, including a decrease of surface permeability. Depending on precipitation, the change in surface permeability can lead to increased runoff, decreased soil moisture, and changes in patterns of erosion on and off the application site (EPA and UNLV 2004). Specific concerns have not been identified by experts on the use of dust suppressants due to the high amount of variability associated with site conditions, dust suppressant composition, and application techniques. The determination of whether a problem might exist in any given case must be based on the assessment of site-specific conditions (EPA and UNLV 2004).

There is also a potential for soils to be affected along the approximately 110-mile reasonably foreseeable coal haul transportation route. Road dust, coal dust, and exhaust from coal hauling would add to the road dust and exhaust from existing traffic along the reasonably foreseeable coal haul transportation route. It is assumed that the effects from this road dust, coal dust, and exhaust would occur within a 100-foot buffer around the reasonably foreseeable coal haul transportation route. The deposition of road dust, coal dust, and vehicle exhaust can affect the chemical composition and productivity of soils within this buffer over time. However, it is assumed that all coal trucks would be covered or otherwise contained, preventing coal dust from escaping. There is also a risk of spills along the reasonably foreseeable coal haul transportation route from potential coal truck accidents, which also presents a risk to soils along the route.

Under the Proposed Action, and all other action alternatives, Block Sa (186.2 acres) would not be mined and the lessee would apply pre-mining vegetation treatments to the block. The proposed vegetation treatments would involve removal of pinyon-juniper, which would allow perennial grasses and forbs to return to the block, adding stability to the soil layers and reducing upland erosion.

4.13.3.2 IMPACTS TO SENSITIVE SOILS

4.13.3.2.1 Water-erosive Soils

Under the Proposed Action, 368 acres of highly erosive soils and an additional 1,483 acres of moderately erosive soils would be disturbed. Together, 93% of all soil disturbances under this alternative would take place in highly or moderately erosive soils (Table 4.13.1). Most of this disturbance would occur in areas that are surface mined. The disturbances under this alternative would likely result in substantial erosion, particularly during the period following mining but prior to reclamation. Required erosion control measures would effectively mitigate the impacts of erosion on water bodies and other resources, but would likely not prevent short-term erosion over short distances. This could result in some rilling (formation of shallow linear erosional features on the soil surface by water) and varied soil depths in areas where erosion would occur, contributing to limited reclamation success by limiting the soil depth available to vegetation in some areas, and impacting other vegetation through sedimentation. In addition, accelerated erosion could contribute to excess sedimentation in streams (e.g., Kanab Creek or Robinson Creek), and stock ponds, and could affect the stability of slopes that are planted for reclamation purposes.

4.13.3.2.2 Drought-intolerant Soils

A total of 330 acres of highly drought-intolerant soils would be disturbed under the Proposed Action (Table 4.13.2). An additional 26 acres of moderately intolerant soils would be disturbed. Of the 356 acres of total disturbance in these soils, 295 acres would be disturbed in the surface mine pit. Overall, 18% of all soil disturbance under the Proposed Action would occur in highly or moderately drought-intolerant soils, and 15% of all disturbance would be associated with surface-mining removal and replacement of these soils. Any disturbance of drought-intolerant soils would require the reclamation of those areas, which would be at an increased risk of poor reclamation success due to low available water capacity. In addition, the need to reclaim areas with droughty soils that are disturbed would likely prolong the reclamation period.

Table 4.13.1. Acres of Highly and Moderately Water-erosive Soils Impacted under each Alternative (and percentage of the total disturbance under each alternative)

Disturbance Type	Alternative A[*] (No Action)	Alternative B (Proposed Action)[†]	Alternative C (Reduced Tract Acreage and Seasonal Restrictions)[‡]	Alternative K1 (Reduced Tract Acreage)[¥]
Highly Erosive				
Pit disturbance	0	322.3 (16.2%)	315.8 (19.0%)	237.1 (23.4%)
Other disturbance[§]	0	46.1 (2.3%)	41.4 (2.5%)	16.9 (1.7%)
Total disturbance	**0**	**368.4 (18.5%)**	**357.2 (21.5%)**	**254.0 (25.1%)**
Moderately Erosive				
Pit disturbance	0	1,288.6 (64.7%)	1,124.1 (67.6%)	619.8 (61.2%)
Other disturbance	0	194.1 (9.7%)	166.3 (10.0%)	126.5 (12.5%)
Total disturbance	**0**	**1,482.7 (74.4%)**	**1,290.4 (77.6%)**	**746.3 (73.7%)**
Sum of Highly and Moderately Erosive				
Pit disturbance	0	1,610.9 (80.8%)	1,439.9 (86.6%)	856.8 (84.7%)
Other disturbance	0	240.2 (12.1%)	207.7 (12.5%)	143.4 (14.2%)
Total disturbance	**0**	**1,851.1 (92.9%)**	**1,647.6 (99.1%)**	**1,000.2 (98.8%)**

[*] Although there would be no impact to soils related to mining under the No Action Alternative, impacts to soils due to other current land uses (grazing and vegetation treatments) would continue.

[†] 1,993 acres total soil disturbance.

[‡] 1,662 acres total soil disturbance.

[¥] 1,012 acres total soil disturbance.

[§] "Other" disturbances include centralized and dispersed facilities and roads with their adjoining ROWs.

Table 4.13.2. Acres of Highly and Moderately Drought-intolerant Soils Impacted under each Alternative (and percentage of the total disturbance under each alternative)

Disturbance Type	Alternative A* (No Action)	Alternative B (Proposed Action)†	Alternative C (Reduced Tract Acreage and Seasonal Restrictions)‡	Alternative K1 (Reduced Tract Acreage)¥
Highly Droughty				
Pit disturbance	0	291.0 (14.6%)	291.0 (17.5%)	212.2 (21.0%)
Other disturbance§	0	39.0 (2.0%)	36.8 (2.2%)	16.6 (1.6%)
Total disturbance	**0**	**330.0 (16.6%)**	**327.8 (19.7%)**	**228.8 (22.6%)**
Moderately Droughty				
Pit disturbance	0	3.8 (0.2%)	3.8 (0.2%)	3.8 (0.4%)
Other disturbance	0	22.1 (1.1%)	18.4 (1.1%)	21.5 (2.1%)
Total disturbance	**0**	**25.9 (1.3%)**	**22.2 (1.3%)**	**25.3 (2.5%)**
Sum of Highly and Moderately Droughty				
Pit disturbance	0	294.8 (14.8%)	294.8 (17.7%)	216.0 (21.3%)
Other disturbance	0	61.2 (3.1%)	55.2 (3.3%)	38.1 (3.8%)
Total disturbance	**0**	**356.0 (17.9%)**	**349.9 (21.1%)**	**254.1 (25.1%)**

* Although there would be no impact to soils related to mining under the No Action Alternative, impacts to soils due to other current land uses would continue.

† 1,993 acres total soil disturbance.

‡ 1,662 acres total soil disturbance.

¥ 1,012 acres total soil disturbance.

§ "Other" disturbances include centralized and dispersed facilities and roads with their adjoining ROWs.

4.13.3.2.3 Saline Soils

No highly or moderately saline soils would be disturbed under any of the alternatives. Therefore, there would be a relatively low risk of poor reclamation success due to excess salinity in the soils, or due to increases in salinity in downstream waters as a result of soil disturbance.

4.13.3.2.4 Sodic Soils

A total of 1.4 acres of highly sodic soils would be disturbed under the Proposed Action (Table 4.13.3). This disturbance would take place exclusively in the surface-mining pit, and would represent approximately 0.07% of the total soil disturbance under this alternative. Because OSM rules restrict the use of sodic soils for reclamation, the disturbed areas would be reclaimed with less sodic soils, which would likely improve growing conditions for most vegetation. High sodium levels in soils affect reclamation potential by inhibiting the establishment of vegetation in disturbed areas. Thus, where sodic soils are used, reclamation success would have an increased risk of failure or delayed success of vegetation establishment. Areas with sodic soils that are

reclaimed could also require different seed mixes and species in order to be successfully reclaimed. Therefore, the disturbance of sodic soils would result in either an increased risk of impeded reclamation or would require their burial, which would in turn reduce the depth of topsoil for use elsewhere for reclamation (as discussed under Shallow Soils, below).

Table 4.13.3. Acres of Highly and Moderately Sodic Soils Impacted Under Each Alternative (and percentage of the total disturbance under each alternative)

Disturbance Type	Alternative A[*] (No Action)	Alternative B (Proposed Action)[†]	Alternative C (Reduced Tract Acreage and Seasonal Restrictions)[‡]	Alternative K1 (Reduced Tract Acreage)[¥]
Highly Sodic				
Pit disturbance	0	1.4 (0.07%)	1.4 (0.08%)	1.4 (0.1%)
Other disturbance[§]	0	0 (0%)	0 (0%)	0 (0%)
Total disturbance	**0**	**1.4 (0.07%)**	**1.4 (0.08%)**	**1.4 (0.1%)**
Moderately Sodic				
Pit disturbance	0	0 (0%)	0 (0%)	2.5 (0.3%)
Other disturbance	0	0 (0%)	0 (0%)	0 (0%)
Total disturbance	**0**	**0 (0%)**	**0 (0%)**	**2.5 (0.3%)**
Sum of Highly and Moderately Sodic				
Pit disturbance	0	1.4 (0.07%)	1.4 (0.08%)	3.9 (0.4%)
Other disturbance	0	0 (0%)	0 (0%)	0 (0%)
Total disturbance	**0**	**1.4 (0.07%)**	**1.4 (0.08%)**	**3.9 (0.4%)**

[*] Although there would be no impact to soils related to mining under the No Action Alternative, impacts to soils due to other current land uses would continue.

[†] 1,993 acres total soil disturbance.

[‡] 1,662 acres total soil disturbance.

[¥] 1,012 acres total soil disturbance.

[§] "Other" disturbances include centralized and dispersed facilities and roads with their adjoining ROWs.

4.13.3.2.5 Shallow Soils

Almost all of the soil disturbance under the Proposed Action would occur in areas where the soil's A horizon is less than 20 inches deep, or where the soil is at a high or moderate risk of limited reclamation due to its shallow depth (Table 4.13.4). Approximately 75% of all disturbance would occur in areas with less than a 10-inch-deep A horizon. The considerable disturbance of shallow soils under this alternative would limit the depth of topsoil that could be used for reclamation, and would increase the reliance on

subsoils in the rooting zone during reclamation. The use of shallow topsoil and subsoil during reclamation would increase the risk of inhibited restoration potential due to limited water holding capacity and nutrient availability during plant establishment.

Table 4.13.4. Acres of Highly and Moderately Shallow Soils Impacted Under Each Alternative (and percentage of the total disturbance under each alternative)

Disturbance Type	Alternative A* (No Action)	Alternative B (Proposed Action)†	Alternative C (Reduced Tract Acreage and Seasonal Restrictions)‡	Alternative K1 (Reduced Tract Acreage)¥
Highly Shallow				
Pit disturbance	0	1,285.9 (64.5%)	1,177.8 (70.9%)	653.6 (64.6%)
Other disturbance§	0	213.0 (10.7%)	184.8 (11.1%)	121.5 (12.0%)
Total disturbance	**0**	**1,498.9 (75.2%)**	**1,362.6 (82.0%)**	**775.1 (76.6%)**
Moderately Shallow				
Pit disturbance	0	452.0 (22.7%)	276.3 (16.6%)	215.1 (21.3%)
Other disturbance	0	29.4 (1.5%)	23.1 (1.4%)	21.9 (2.2%)
Total disturbance	**0**	**481.4 (24.2%)**	**299.4 (18.0%)**	**237.0 (23.4%)**
Sum of Highly and Moderately Shallow				
Pit disturbance	0	1,737.9 (87.2%)	1,454.1 (87.5%)	868.7 (85.8%)
Other disturbance	0	242.4 (12.2%)	207.9 (12.5%)	143.4 (14.2%)
Total disturbance	**0**	**1,980.3 (99.4%)**	**1,662.0 (100%)**	**1,012.1 (100%)**

* Although there would be no impact to soils related to mining under the No Action Alternative, impacts to soils due to other current land uses would continue.

† 1,993 acres total soil disturbance.

‡ 1,662 acres total soil disturbance.

¥ 1,012 acres total soil disturbance.

§ "Other" disturbances include centralized and dispersed facilities and roads with their adjoining ROWs.

4.13.3.2.6 Alkaline Soils

No highly alkaline soils would be disturbed under any alternative. Under the Proposed Action, 316 acres of moderately alkaline soils would be disturbed, primarily in the surface-mining pit (Table 4.13.5). Alkaline soils limit plant establishment during reclamation, and their disturbance under this alternative would result in either an increased risk of impeded reclamation or would require their burial, which would in turn reduce the depth of topsoil for use elsewhere for reclamation (as discussed under Shallow Soils, above).

Table 4.13.5. Acres of Highly and Moderately Alkaline Soils Impacted Under Each Alternative (and percentage of the total disturbance under each alternative)

Disturbance Type	Alternative A* (No Action)	Alternative B (Proposed Action)†	Alternative C (Reduced Tract Acreage and Seasonal Restrictions)‡	Alternative K1 (Reduced Tract Acreage)¥
Moderately Alkaline				
Pit disturbance	0	295.4 (14.8%)	228.7 (13.8%)	184.4 (18.2%)
Other disturbance§	0	20.8 (1.0%)	17.6 (1.1%)	15.2 (1.5%)
Total disturbance	**0**	**316.2 (15.9%)**	**246.3 (14.8%)**	**199.7 (19.7%)**

* Although there would be no impact to soils related to mining under the No Action Alternative, impacts to soils due to other current land uses would continue.

† 1,993 acres total soil disturbance.

‡ 1,662 acres total soil disturbance.

¥ 1,012 acres total soil disturbance.

§ "Other" disturbances include centralized and dispersed facilities and roads with their adjoining ROWs.

4.13.3.2.7 Biological Soil Crusts

Biological soils crusts are found on various soil surfaces throughout the analysis area, though no data on the prevalence of biological soil crust are available for the tract. Because the amount of biological soil crusts cannot be quantified, impacts are discussed qualitatively.

Biological soil crusts in the analysis area are mostly cyanobacteria (*Microcoleus*) and nitrogen-fixing lichens (*Collema*) (BLM 2001a). It is likely that these cyanobacteria and nitrogen-fixing lichens are limited and sparse in the analysis area due to its relatively high average elevations and relatively dense vascular plant cover. Total crust cover (cyanobacterial, moss, and lichen) is typically high where elevations are low (and low where elevations are high) (BLM 2001a). Total crust cover is usually inversely related to vascular plant cover, because less plant cover results in more surfaces available for colonization and growth of crustal organisms (Belnap et al. 2001). Within the 1,993 acres of predicted surface disturbance where biological soils are not identified beforehand, existing soils crusts would be adversely impacted by surface-disturbing activities. The crusts could be removed entirely and buried or disrupted to the point of nonfunctionality. Burial generally results in a greatly simplified crustal community and disturbance flattens pinnacled and rolling crusts, thus decreasing water infiltration and increasing runoff (Belnap et al. 2001).

Soil crusts are thought to improve the moisture capacity of soils, stabilize them against erosion, enhance soil nutrients, and discourage the growth of some types of annual weeds. Thus, their disturbance would reduce the moisture capacity, nutrient availability, and erosion resistance of the disturbed areas' soils. This would therefore reduce the soils' productivity, fertility for vascular plants, and reduce reclamation success. At this time, the success of reclamation measures is poorly understood for the tract; therefore, impacts from the disturbance of soil crust would likely persist as long-term impacts. However, when feasible, crusts would be identified and preserved, and efforts would be made to inoculate newly replaced topsoil with biological soil crust spores.

4.13.4 Alternative C: Reduced Tract Acreage and Seasonal Restrictions

4.13.4.1 TYPES AND NATURE OF IMPACTS TO SOILS

Under Alternative C, 1,662 acres of soils would be disturbed by surface mining and the construction of related facilities and roads. Of this total, 1,454 acres of soil resources would be disturbed by surface mining, and 207 acres would be disturbed by related activities, including the construction of centralized and dispersed facilities, the relocation and construction of roads, and the grading of road ROWs. Impacts under Alternative C would be of the same type in nature as under Proposed Action, and they would (similarly) be considerably greater than under the No Action Alternative. Impacts to soils from current land uses on the tract from vegetation treatments, livestock grazing, and recreation would be discontinued under Alternative C and would resume 31 years after mine-related activities begin (21 years for the life of the mine and 10 years for reclamation and rehabilitation).

4.13.4.2 IMPACTS TO SENSITIVE SOILS

4.13.4.2.1 Water-erosive Soils

Under Alternative C, 357 acres of highly erosive soils and an additional 1,290 acres of moderately erosive soils would be disturbed. Together, 99% of all soil disturbances under this alternative would take place in highly or moderately erosive soils (see Table 4.13.1). This is slightly less disturbance of erosive soils than would take place under the Proposed Action. Impacts would be of the same nature as described for the Proposed Action in all other respects.

4.13.4.2.2 Drought-intolerant Soils

A total of 328 acres of highly drought-intolerant soils would be disturbed under Alternative C (see Table 4.13.2). An additional 22 acres of moderately drought-intolerant soils would be disturbed. This is slightly less disturbance of drought-intolerant soils than would take place under the Proposed Action. Of the 350 acres of total disturbance in these soils, 295 acres would be disturbed in the surface-mining pit. Overall, 21% of all soil disturbance under Alternative C would occur in highly or moderately drought-intolerant soils; 18% of all disturbance would be associated with surface-mining removal and replacement of these soils. Impacts would be of the same nature as described for the Proposed Action in all other respects.

4.13.4.2.3 Saline Soils

No highly or moderately saline soils would be disturbed under any of the alternatives. Therefore, there would be a relatively low risk of poor reclamation success due to excess salinity in the soils, or to increases in salinity in downstream waters as a result of soil disturbance.

4.13.4.2.4 Sodic Soils

Impacts under Alternative C would be the same as described for the Proposed Action, except that the disturbance would represent approximately 0.08% (rather than 0.07% with the Proposed Action) of the total soil disturbance under this alternative.

4.13.4.2.5 Shallow Soils

All of the soil disturbance under Alternative C would occur in areas where the soil's A horizon is less than 20 inches deep, or where the soil is at a high or moderate risk of limited reclamation due to its shallow depth (slightly more than the Proposed Action) (see Table 4.13.4). Under Alternative C, approximately 82% of all disturbance would occur in areas with less than a 10-inch-deep A horizon. Impacts would be of the same nature as described for the Proposed Action in all other respects.

4.13.4.2.6 Alkaline Soils

No highly alkaline soils would be disturbed under any alternative. Under Alternative C, 246 acres of moderately alkaline soils would be disturbed, primarily in the surface-mining pit (slightly less than under the Proposed Action; see Table 4.13.5). Impacts would be of the same nature as described for the Proposed Action in all other respects.

4.13.4.2.7 Biological Soil Crusts

Impacts would be of the same nature as described for the Proposed Action, except that 331 fewer acres of predicted surface disturbance would occur under Alternative C.

4.13.5 Alternative K1: Reduced Tract Acreage

4.13.5.1 TYPES AND NATURE OF IMPACTS TO SOILS

Under Alternative K1, 1,012 acres of soils would be disturbed by surface mining and the construction of related facilities and roads. Of this total, 869 acres of soil resources would be disturbed by surface mining and 144 acres would be disturbed by other related activities, including the construction of centralized and dispersed facilities, the relocation and construction of roads, and the grading of road ROWs. Impacts under Alternative K1 would be of the same type and nature as under Proposed Action, and they would (similarly) be considerably greater than under the No Action Alternative. Impacts to soils from current tract land uses from vegetation treatments, livestock grazing, and recreation would be discontinued under Alternative K1 and resume 35 years after mine-related activities begin (25 years for the life of the mine and 10 years for reclamation and rehabilitation).

4.13.5.2 IMPACTS TO SENSITIVE SOILS

4.13.5.2.1 Water-erosive Soils

Under Alternative K1, 254 acres of highly erosive soils and an additional 746 acres of moderately erosive soils would be disturbed. Together, 99% of all soil disturbances under this alternative would take place in highly or moderately erosive soils (see Table 4.13.1). This is fewer total acres of disturbance of erosive soils than would take place under the Proposed Action. Impacts would be of the same nature as described for the Proposed Action in all other respects.

4.13.5.2.2 Drought-intolerant Soils

In all, 229 acres of highly drought-intolerant soils would be disturbed and an additional 25 acres of moderately drought-intolerant soils would be disturbed under Alternative K1. This is less than the total acres of drought-intolerant soils impacted under the Proposed Action (see Table 4.13.2). Of the 254 acres of total disturbance in these soils under Alternative K1, 216 acres would be disturbed in the surface-mining pit. Overall, 25% of all soil disturbance would occur in highly or moderately drought-intolerant soils and 21% of all disturbance would be associated with surface-mining removal and replacement of these soils. Impacts would be of the same nature as described for the Proposed Action in all other respects.

4.13.5.2.3 Saline Soils

No highly or moderately saline soils would be disturbed under Alternative K1 or the other action alternatives. Therefore, there would be a relatively low risk of poor reclamation success due to excess salinity in the soils or to increases in salinity in downstream waters as a result of soil disturbance.

4.13.5.2.4 Sodic Soils

Impacts under Alternative K1 would be the same as described for the Proposed Action, except that 2.5 acres of moderately sodic soils would also be disturbed (in addition to 1.4 acres of highly sodic soils). This is more than twice the total acres of disturbance of highly and moderately sodic soils under the Proposed Action. All of the 3.9 acres of total disturbance in highly and moderately sodic soils under Alternative K1 would occur in the surface-mining pit (see Table 4.13.3). Overall, 0.4% of all soil disturbance would occur in highly or moderately sodic soils.

4.13.5.2.5 Shallow Soils

All of the soil disturbance under Alternative K1 would occur in areas where the soil's A horizon is less than 20 inches deep, or where the soil is at a high or moderate risk of limited reclamation due to its shallow depth (slightly more than under the Proposed Action; see Table 4.13.4). Under Alternative K1, approximately 77% of all disturbance would occur in areas with less than a 10-inch-deep A horizon. Impacts would be of the same nature as described for Proposed Action in all other respects.

4.13.5.2.6 Alkaline Soils

No highly alkaline soils would be disturbed under Alternative K1 or the other action alternatives. Under Alternative K1, 200 acres of moderately alkaline soils would be disturbed, primarily in the surface-mining pit (less than under the Proposed Action; see Table 4.13.5). Impacts would be of the same nature as described for the Proposed Action in all other respects.

4.13.5.2.7 Biological Soil Crusts

Impacts would be of the same nature as described for the Proposed Action, except that 981 fewer acres of predicted surface disturbance would occur under Alternative K1.

4.13.6 Potential Mitigation Measures

Potential mitigation measures to reduce impacts to soil resources could include the following:

- Whenever feasible, direct haul topsoil to areas currently being reclaimed to retain viable biological components of the soil (seeds, root fragments and rhizomes, soil microbes).
- Identify and map rocky outcrops prior to disturbance; replace rocky outcrops with rock or rocky subsoil rather than topsoil to increase habitat diversity and increase the depth of topsoil available for reclamation elsewhere.

4.13.7 Unavoidable Adverse Impacts

Under the Proposed Action, Alternative C, and Alternative K1, the physical, structural, biological, and chemical properties of soils disturbed by surface mining would be unavoidably impacted. Post-mining soils would be far more uniform in thickness, structure, type, texture, nutrient availability, and chemistry. The existing soil structure would largely be eliminated by the removal and replacement of soils in areas that are surface mined. In addition, changes in bulk density would occur due to mixing, aeration, and

compaction. In areas where sensitive soils are disturbed, their use in reclamation would limit the success of reclamation due to increased erosion, limited water holding capacity, high pH, or high sodium content. These soil attributes would limit the establishment of vegetation relative to areas without sensitive soils.

Successful reclamation of soil structure and ecological function is assumed provided that reclamation practices are successfully implemented. Nevertheless, drought and other ecological factors outside of human control can limit the effectiveness of soil reclamation efforts by limiting soil productivity or increasing the time required for soil recovery.

4.13.8 Short-term Uses versus Long-term Productivity

The short-term removal and replacement of soils in areas that are surface mined would result in long-term changes in the productivity of soils under the Proposed Action, Alternative C, and Alternative K1. Soil productivity following mining and reclamation would be far less diverse and far more uniform. Soils capable of limiting productivity (i.e., sodic, acid-producing, droughty) that are currently present on the tract would be buried or mixed into other soils. Therefore, post-mining productivity may be slightly higher, but would also reduce the productivity of highly productive areas and reduce the prevalence of less productive areas. Some productivity would be lost due to the removal of soil structure and changes in soil properties. Despite the slight loss in productivity, the soil would still be able to support rangeland plants (native and suitable non-native species). The productivity of soils impacted by other mine-related activities (dispersed and centralized facilities, roads, and ROWs) would be eliminated or reduced during the life of the mine (up to 25 years depending on the alternative). Soil productivity in areas that are only disturbed at their surface, or that are covered by facilities (that are eventually removed), would largely be restored once those facilities were removed because the severity of impact would be minor relative to areas that are surface mined.

4.13.9 Irreversible and Irretrievable Commitments of Resources

Under the Proposed Action, Alternative C, and Alternative K1, the physical, structural, biological, and chemical properties of soils that are removed for surface mining would be irreversibly altered (because it may take hundreds of years to reform). The productivity of soils impacted by other mine-related activities (dispersed and centralized facilities, roads, and ROWs) would be irretrievably removed or reduced until reclamation is completed at the tract's termination.

4.14 Transportation

The analysis of impacts to transportation near the tract is an assessment of the changes in LOS caused by the Proposed Action and alternatives. LOS is a measure of the quality of service on transportation infrastructure and generally indicates the level of traffic congestion. LOS on two-lane highways is a reflection of traffic flow conditions, average speed, and time spent following other vehicles. Three different alternatives are analyzed in this section. Each alternative considers different tract sizes and duration of operations. LOS is rated on a scale of A (the best) to F (the worst). Table 4.14.1 provides a description of LOS A–F (Fehr & Peers Transportation Consultants 2013). The coal haul transportation route that is used for analysis purposes is the most reasonably foreseeable route, but it is impossible to predict the exact route that a successful bidder might choose.

Table 4.14.1. Intersection Level of Service Descriptions

LOS	Description of Traffic Conditions
A	Free Flow/Insignificant Delay Extremely favorable progression. Individual users are virtually unaffected by others in the traffic stream.
B	Stable Operations/Minimum Delays Good progression. The presence of other users in the traffic stream becomes noticeable.
C	Stable Operations/Acceptable Delays Fair progression. The operation of individual users is affected by interactions with others in the traffic stream.
D	Approaching Unstable Flows/Tolerable Delays Marginal progression. Operating conditions are noticeably more constrained.
E	Unstable Operations/Significant Delays Can Occur Poor progression. Operating conditions are at or near capacity.
F	Forced Flows/Unpredictable Flows/Excessive Delays Unacceptable progression with forced or breakdown of operating conditions.

Source: Fehr & Peers (2013).

4.14.1 Regulatory Framework

Coal haul trucks operating in the tract would be within the weight and size limitations established by the UDOT's Motor Carrier Division. There are also no regulations concerning the volume of coal haul trucks allowed on tract-associated roadways. Therefore, the weight and size of trucks as well as truck volume are not components of the analysis.

4.14.2 Alternative A: No Action

Under the No Action Alternative, ACD's application to lease the coal included in the Alton Coal Tract would not be approved, and the coal included in the tract would not be mined. Roads along the reasonably foreseeable coal haul transportation route would continue to operate under their current LOS. Peak-hour LOS projected for 2020 under the No Action Alternative would continue to have low delays per vehicle and little to no congestion (Fehr & Peers Transportation Consultants 2013). Changes to LOS would not reach a level of significance. Under the No Action Alternative, coal haul trucks would use the reasonably foreseeable coal haul transportation route to deliver coal from the Coal Hollow Mine (private mining area) to the rail loadout at Iron Springs. This activity would occur for the life of the Coal Hollow Mine (approximately 2–3 years).

Continued increases in population in Iron County, largely in and near the Cedar City area (as indicated in Section 3.12) could increase LOS on certain roads over time, regardless of mining activity.

4.14.3 Alternative B: Proposed Action

Under the Proposed Action, workers would commute from their homes to the tract according to the normal operating hours. Service operations would include delivery of diesel fuel and machine and equipment parts (daily or weekly), servicing of portable toilets (weekly or biweekly), servicing of permanent toilet facilities (monthly or bimonthly), removal of waste oil (weekly or biweekly), and incidental trips such as delivery of office supplies (biweekly or monthly), as necessary. Up to 100 workers would be employed at the tract. Although the traffic study completed by Fehr & Peers (2013) does not include projections of mine employee traffic, it is assumed that these employees would commute individually to the mine from communities within a one-hour to two-hour radius of the tract, resulting in an estimated 100 round-trips per day to and from the tract. Because of the proximity of the communities of Panguitch and Hatch to the tract, it is assumed that most of the commuter traffic would occur on US-89. The additional commuter traffic along US-89 would represent a 5% increase in ADT. Based on service and operations needs, it is estimated that no more than 20 service trips per week or an average of four round-trips per day to the tract would occur. This would be a 0.1% increase in ADT along US-89. Commuter traffic and service trips would represent a minimal contribution to traffic levels and would not result in any changes to LOS.

The following actions under the Proposed Action would result in impacts to LOS.

- An estimated 153 truck round-trips per day would occur to and from the tract and along the reasonably foreseeable loadout location.
- Mine production operations could occur 24 hours a day, seven days a week for the 25-year life of the mine.[7]

The reasonably foreseeable coal haul transportation route ADT on US-89 through Hatch and Panguitch is currently 3,600–4,100 vehicles per day. The additional coal truck traffic would represent a 4% increase in overall ADT through Hatch and Panguitch when compared to the No Action Alternative. When compared with existing heavy truck traffic on US-89 through Hatch and Panguitch, the additional coal truck traffic would represent a 33% increase over current heavy truck traffic. The ADT on SR-56 through Cedar City is 8,600 (Fehr & Peers Transportation Consultants 2013). The additional coal truck traffic would represent a 2% increase in ADT through Cedar City when compared to the No Action Alternative. Under the Proposed Action, traffic conditions at intersections and along road segments of the reasonably foreseeable coal haul transportation route would continue to operate at their current, acceptable LOS-C or better. A traffic study conducted demonstrates that LOS-C or better would be maintained on all road segments and intersections of the reasonably foreseeable coal haul transportation route (Fehr & Peers Transportation Consultants 2013). Capacity for additional traffic would remain, and increased traffic volume would not result in reductions in LOS or reach a level of significance.

4.14.4 Alternative C: Reduced Tract Acreage and Seasonal Restrictions

Impacts to transportation would be the same as those described under the Proposed Action but would occur over a 21-year period.

[7] Operating hours would depend on the successful bidder; however, this EIS generally analyzes mine operations between 5 and 7 days per week, 24 hours per day. At the same time, it is also indicated throughout that ACD's plans are to operate 6 days/week (avoiding operations on Sundays).

4.14.5 Alternative K1: Reduced Tract Acreage

Impacts to transportation would be the same as those described under the Proposed Action but would occur over a 16-year period.

4.14.6 Potential Mitigation Measures

The lessee will contribute to the road maintenance on the paved segment of KFO Route 116 between Alton and US-89, other impacted county roads, and will work closely with the Kane County Road Department.

4.14.7 Unavoidable Adverse Impacts

Increase in vehicle traffic of no more than 4% in the tract and on the reasonably foreseeable coal haul transportation route would occur over time under all action alternatives; however, no unavoidable adverse impacts to LOS would result from those increases.

4.14.8 Short-term Uses versus Long-term Productivity

Because there would be an increase in vehicle traffic of no more than 4%, surface mining and infrastructure development and use during the life of the mine would not impact the short-term use or the long-term productivity of local transportation.

4.14.9 Irreversible and Irretrievable Commitments of Resources

Under all action alternatives, there would be no irreversible impacts to transportation, because transportation resources would not be permanently altered as a result of mining operations on the tract. The increase in vehicle traffic that would occur during the life of the mine would be an irretrievable impact that would dissipate once mining operations ceased.

4.15 Vegetation

This section discusses the impacts of the Proposed Action and alternatives, as described in Chapter 2, on upland, wetland, and riparian vegetation. Upland vegetation communities in the tract are pinyon-juniper woodland, mountain brush, annual and perennial grasses, rabbitbrush, sagebrush/grassland, and sagebrush/grassland (treated) communities (Section 3.15). The meadow communities in the tract are considered potential wetlands for the purpose of this analysis due to the presence of predominately hydrophytic vegetation (Section 3.15.2.4). Impacts to riparian vegetation are analyzed separately.

4.15.1 Impact Indicators, Thresholds, and Analysis Assumptions

Acres of surface disturbance in the vegetation communities are used as the primary indicator of impacts to the vegetation resource by implementation of the alternatives. This disturbance would mainly be incurred by minerals development and construction activities as planned under both action alternatives.

Acres of increased susceptibility to noxious or weedy plant species invasion are also used as an indicator of impacts to this resource. Gelbard and Belnap (2003) found that weed densities were highest in vegetation up to 14 m (average) away from paved roads, although weeds were also found in areas farther away from the roads (up to 50 m, the extent of the survey area). This is mainly from 1) weed seed transport during road construction, and subsequent vehicle traffic on roads; 2) ground disturbance during construction that creates bare soil, deeper soil, or soil with greater nutrient availability; and 3) soil compaction by construction and travel that creates conditions that favor invasive species (Gelbard et al. 2003). These factors are also similar to those that occur in other types of facilities construction and as a result of mining activities; therefore, a buffer would also be used around these areas for the purpose of this analysis. Increased susceptibility would be calculated by creating a GIS buffer of 30 m around roads, pipelines, construction areas, and surface-mined areas that would demark acres of land with an increased susceptibility to weed invasion. The 30-m buffer was chosen as a safe estimate for the likely spread of weed species; this is meant to represent 14 m with high weed occurrence (Gelbard et al. 2003) with an additional 16 m of lower weed occurrence. This model is not meant to predict the actual spread of weeds in the tract following mining operations, but illustrates that the potential for weed invasion is likely to increase in undisturbed lands adjacent to disturbance areas. Use of a buffered area around construction and mining areas would also allow for a more quantitative comparison between action alternatives. To simplify these calculations, environmental variables such as soil depth, vegetation community structure, slope, ecosystem health, and moisture availability in the surrounding areas would not be taken into consideration even though these factors do contribute to the ability of vegetation communities to withstand invasion. Data on these parameters in the tract are not currently available, and an accurate model for invasion is not feasible at this time.

A site-specific, detailed MRP would be created by the lessee in consultation with DOGM. The operation portion of the plan requires the operator to promptly establish and maintain an interim vegetative cover on disturbed areas that would not be immediately redisturbed. The reclamation portion of this plan would include specifications for grading the surface to an acceptable PMT, replacement of salvaged topsoil to an acceptable depth over suitable overburden, and reestablishment of vegetation for the determined post-mining land use. Reestablishment of vegetation would serve to mitigate some of the negative effects of surface disturbance on vegetation communities. This is discussed in the Regulatory Framework section below, as well as in the alternatives analyses. Revegetation would also increase the quality of vegetation communities over current conditions due to agency objectives for reclamation. Because there are no regulatory measures to address thresholds for impacts to non–special status species vegetation, these impacts would be addressed through BMPs, reclamation, and mitigation measures, such as the vegetation treatments outlined in the sage-grouse mitigation plan (see Section 4.18.2.1.2.3).

Consequences of increased dust due to area travel and construction is also analyzed for all action alternatives.

4.15.2 Regulatory Framework

There are numerous federal and state regulations that shape the management of vegetation resources. Regulations that pertain to vegetation and potential impacts from mining and other land uses include but are not limited to the following:

- The Taylor Grazing Act of 1934, as amended, provides for continued study of erosion and flood control, and provides for any work that may be necessary to protect and rehabilitate public lands to prevent soil deterioration.
- The ESA of 1973 protects endangered species and their habitat. This act is also used as a basis for eradicating non-native invasive species that threaten endangered species.
- The federal CWA, with amendments in 1972 and 1977, has the objective of restoring and maintaining the chemical, physical, and biological integrity of the nation's waters. The CWA of 1987 provides additional authorizations.
- Section 404 of the federal CWA requires the identification of all wetlands and waters under the jurisdiction of USACE, replacement of all jurisdictional and functional wetlands, and monitoring of reclaimed wetlands that may be impacted by proposed activities.
- The Federal Noxious Weed Act of 1974 authorizes measures to eradicate or control the spread of noxious weeds.
- FLPMA of 1976 directs managers to determine areas suitable for livestock grazing under the multiple-use, sustained-yield mandate.
- The Public Rangelands Improvement Act of 1978 provides policy to manage, maintain, and improve public rangelands to increase productivity while remaining consistent with management objectives.
- The Plant Protection Act of 2000 consolidates and modernizes all major statutes pertaining to plant protection and quarantine (e.g., the Federal Noxious Weed Act, the Plant Quarantine Act).
- The Utah Seed Act (Utah Code, Title 4, Chapter 16) provides guidelines for the labeling and distribution of seeds, in conjunction with the Seed Law (Rule R68-8), which prohibits the sale and distribution of noxious weed seeds.
- The Utah Noxious Weed Act, as amended (Utah Code, Title 3 Chapter 17), authorizes measures to eradicate or control the spread of noxious weeds.
- The Utah Noxious Weed Act (Rule R68-9) designates State of Utah noxious weeds and sources capable of weed dissemination.

Utah coal mine permitting requirements for vegetation (UAC R645-301.300) include but are not limited to the following:

- Description of the vegetative resources of the tract and potential impacts to vegetation resources adequate to predict the potential for reestablishing vegetation.
- Description of the productivity of the land before mining in the tract.
- Reclamation designed to restore and enhance vegetation resources to a condition suitable for designated post-mining land uses. Control of erosion on reclaimed lands prior to seeding with final seed mixture using mulching, cover crops, or other approved measures.
- Monitoring of revegetation growth and diversity until release of final reclamation bond (after a minimum of 10 years).
- Monitoring of erosion to identify any need for corrective action during the establishment of vegetation.

The KFO RMP and other BLM documents such as the *Standards for Rangeland Health and Guidelines for Livestock Management* have provided the framework for other required mitigation measures. The following standards would be applied to vegetation resources and special status plant species:

- Using grazing exclosures and monitoring vegetation during revegetation to determine suitability for post-mining land uses
- Controlling weed infestation chemically and mechanically
- Directly hauling topsoil
- Selectively planting shrubs in riparian areas
- Planting sagebrush seedlings in addition to seeding the area with sagebrush
- Creating depressions and rock piles
- Using special planting procedures around rock piles
- Promptly establishing interim vegetative cover in disturbed areas that would not be immediately redisturbed

4.15.3 Actions that Would Cause Change to the Existing Vegetation Resource

4.15.3.1 ALTERNATIVE A: NO ACTION

Under the No Action Alternative, ACD's application to lease the coal included in the Alton Coal Tract would not be approved, the tract would not be offered for competitive lease sale, and the coal included in the tract would not be mined.

No coal mining activities or infrastructure development would occur under the No Action Alternative, and therefore no acres of vegetation communities would be disturbed. Likewise, no acres in the tract would be at an increased susceptibility to weed invasion due to actions associated with mining activities or infrastructure development.

Management of vegetation on BLM-administered lands in the tract would continue at the discretion of the BLM under the KFO RMP (BLM 2008b). Specifically, this would mean managing vegetation in the tract to improve wildlife habitat, increasing forage production for livestock grazing, providing watershed protection, and reducing soil loss. In addition to vegetation treatments and livestock grazing, other land uses such as OHV use would continue similar to current levels.

The use of vegetation management is emphasized under the KFO RMP. The management process restores sagebrush grasslands that have been invaded by pinyon-juniper woodlands for ecosystem restoration and watershed health. In the short term, vegetation treatments would increase the risk of invasion by noxious weeds and invasive species by vegetation removal and ground disturbance. Areas where vegetation treatments were not successful could be invaded by weed species and/or become infested with other undesired vegetation, which could also reduce the health of the upland communities over the long term. Implementing general treatment design features such as prescribed burning in lieu of mechanical treatment when suitable, evaluating treatment sites for soil suitability and stability prior to manipulation, and excluding livestock from all treatment areas until seedlings are established, would help facilitate reestablishment of the desired vegetation communities. Using desired species of grasses, forbs, and browse in the rehabilitation and reseeding of treated areas would facilitate vegetation reestablishment and avoid creating single-species communities.

Vegetation treatments, if successful, would have long-term benefits to the area by removing undesired species, increasing species diversity and age class of certain communities, improving vegetation composition and structure, and increasing overall vegetation cover. This would result in healthier woodlands, upland communities, and riparian areas that are more capable of retaining moisture and nutrients and resisting disease, invasive species, drought, and other natural disturbances and/or stressors.

Vegetation treatments could also improve watershed health, reduce soil loss, and enhance forage vegetation conditions. Implementing erosion control measures in fragile watershed areas would help reduce short-term impacts such as soil erosion, surface runoff, and sedimentation of water sources. These vegetation treatments would help to reestablish upland communities, maintain or improve the health of riparian/wetland communities, reestablish seedlings and understory vegetation, and retain soil moisture and nutrients in forests and woodlands (BLM 2008b).

4.15.3.2 ALTERNATIVE B: PROPOSED ACTION

Under the Proposed Action, the Alton Coal Tract would be offered for lease at a sealed-bid, competitive lease sale, subject to standard and special lease stipulations developed for the tract. The boundaries of the tract under the Proposed Action (see Map 1.2) would be reasonably consistent with the tract reconfiguration completed by the BLM after ACD's original LBA submittal (see Map 2.7). A total of 1,993 acres of surface disturbance (surface mining and infrastructure development) would occur in the Alton Coal Tract under the Proposed Action. However, this disturbance would not all occur at one time. There would be a single open pit (approximately 120 acres), and at any one time, there would be approximately 120 acres of open surface-mining pit disturbance and an additional 120 or more acres in some stage of reclamation.

Underground mining would occur on 613 acres of land in the tract (depending on the extent of surface mining). Though subsidence related to underground mining is not expected to impact the overlying vegetation, any adverse effects would be repaired in accordance with DOGM rules and regulations (UAC 40-10). In Utah, the effects of subsidence usually consist of surface cracks, general ground lowering, and cliff fracture or failure (Smith 2008). Under the Proposed Action, as well as all other action alternatives, Block Sa (186.2 acres) would not be mined, and the lessee would apply pre-mining vegetation treatments to the block. The proposed vegetation treatments would involve removal of pinyon-juniper from areas traditionally dominated by sagebrush/grasslands and would improve the overall health of sagebrush communities by increasing age class diversity and allowing a more open canopy for grasses, forbs, and shrubs.

4.15.3.2.1 Effects of Surface-mining Activities on Vegetation

Of the total 1,993 acres of surface disturbance that would occur in the Alton Coal Tract under the Proposed Action, 1,750 acres would be the direct result of surface-mining operations (pit disturbance). Of this total, approximately 17 acres would occur on existing roads and the remaining 1,733 acres would occur in the vegetation communities.

4.15.3.2.1.1 Upland Areas

Of the approximately 3,437 acres of vegetated land in the tract to be impacted by surface mining, approximately 1,677 (49%) would occur in upland areas. Of this total, 609 acres would be in pinyon-juniper communities, 315 acres would be in the sagebrush/grassland community, 472 acres would be in the sagebrush/grassland (treated) community, 259 acres would be in the annual and perennial grassland community, and 22 acres would be in the mountain brush community. This information is shown in Table 4.15.1.

Table 4.15.1. Acres of Upland Vegetation Communities Directly Disturbed by Surface Mining under the Proposed Action

Upland Vegetation Community	Acres Disturbed	Total Upland Acres in Tract	Percentage Disturbed by Surface Mining
Pinyon-juniper woodlands*	609.0	1,430.0	42.6%
Sagebrush/grassland	314.9	860.2	36.6%
Sagebrush/grassland (treated)	471.5	749.1	62.9%
Annual and perennial grasses	259.3	324.1	80.0%
Mountain brush	22.0	62.8	35.0%
Rabbitbrush	0.0	10.7	0.0%
Surface mining total	**1,676.7**	**3,436.9**	**48.8%**

*This association includes areas of pinyon-juniper/mountain brush, pinyon-juniper/sagebrush, and pinyon-juniper/sagebrush/mountain brush communities.

Surface mining would result in the removal of 49% of 3,437 acres of upland vegetation in the tract. These vegetation communities require long periods of time and the relative absence of invasive annual plant species (such as cheatgrass) in order to reestablish naturally. Active restoration would be needed after mining operations are complete and the land has been regraded. The reestablishment of vegetation is based on the ability of reclaimed soils to support new native and suitable non-native vegetation. See the Soils section of Chapter 4 for soils analysis.

The mountain brush community would experience an approximately 35% reduction in acreage from surface-mining disturbance. Likewise, 37% of sagebrush/grassland acres, 63% of sagebrush/grassland (treated) communities, and 43% of pinyon-juniper woodlands in the tract would also be eliminated from surface-mining activities. Revegetation efforts would focus on restoring these areas to sagebrush and grassland ecosystems to benefit watershed health, wildlife, and livestock. Because of this, a total elimination of pinyon-juniper and mountain brush community acreages in the mining footprint would be likely in the short and long term.

Because annual and perennial grasses are not considered a native vegetation community, a reduction of 80% is not necessarily considered a loss to the resource. This is especially true of annual and perennial grasses displaced by surface mining that are to be revegetated with native and non-native rangeland-suitable vegetation at the completion of mining activities.

4.15.3.2.1.2 Wetland Areas

Disturbance from surface mining is expected to impact 52.5 acres of meadow vegetation. This is approximately 84% of the total 62.8 acres of meadow vegetation in the tract. A preliminary JD was issued in November 2012, identifying the potential limits of existing wetlands, streams, and other water bodies within the tract that may be subject to the USACE's regulatory jurisdiction under the CWA. The preliminary JD identified approximately 54 acres of wetlands (USACE 2012a). These wetlands were classified into three habitat types: approximately 18.5 acres were classified as riparian wet meadow wetlands, 31.6 acres were classified as irrigated wet meadow wetlands, and 3.8 acres were classified as mixed riparian scrub-shrub/wet meadow wetlands (Frontier Corporation USA 2012). Acres of potential disturbance in wetland areas would require avoidance, minimization, or compensatory mitigation measures as approved by the USACE in a Section 404 permit that would be granted upon review of the official wetland delineation.

Canada thistle, the only listed noxious weed currently identified in the tract, is found in the meadow community. Further disturbance in this community would lead to an increase in the spread of this species in the tract, but reclamation would use an approved seed mix without noxious weeds.

4.15.3.2.1.3 Riparian Areas

Disturbance from surface mining is expected to impact 3.8 acres of riparian vegetation. This is approximately 7% of the total 55.3 acres of riparian vegetation in the tract. Revegetation of this area at the completion of mining activities would be required, with the objective of restoring riparian communities to achieve rangeland health standards and proper functioning condition (PFC).

4.15.3.2.2 Effects of Facilities Construction Activities on Vegetation

Centralized facilities associated with mining activities on the Alton Coal Tract would be located on approximately 36 acres of BLM-administered land in the tract's no-coal zone (areas outside of pit disturbance boundaries) (see Map 1.2). Other dispersed facilities such as temporary light-use roads and haul roads, electrical poles and lines, various temporary ponds and water-control structures, temporary topsoil and overburden stockpiles, and temporary berms and screens would result in approximately 160 acres of vegetation removal, and would be sited to avoid disturbances to wetlands, floodplains, stream channels, and intact sagebrush stands wherever possible. Where it is not possible to avoid disturbances to these areas, the mitigation measures described in the Regulatory Framework section above would be prescribed.

Approximately 36 acres of vegetation would be removed as a result of construction of centralized facilities. Of this total, 34.3 acres (96%) would be in the sagebrush/grassland (treated) community, and 1.4 acres (4%) would be in pinyon-juniper communities. This information is shown in Table 4.15.2.

Table 4.15.2. Acres of Upland Vegetation Communities Directly Disturbed by Construction of Centralized Facilities under the Proposed Action

Upland Vegetation Community	Acres Disturbed	Percentage Total Area Disturbed by Centralized Facility Construction
Pinyon-juniper woodlands*	1.4	4%
Sagebrush/grassland (treated)	34.3	96%
Centralized facilities construction total	**35.7**	**100**%

* This association includes areas of pinyon-juniper/mountain brush, pinyon-juniper/sagebrush, and pinyon-juniper/sagebrush/mountain brush communities.

Land disturbed by construction of centralized facilities would remove approximately 1% of the total 3,437 acres of upland vegetation in the tract. The 34.3 acres of disturbance in the sagebrush/grassland (treated) vegetation community is approximately 5% of its total 749 acres. The 1.4 acres of disturbance in pinyon-juniper woodlands is less than 0.001% of all the land occupied by these communities (1,430 acres). No acres of riparian or wetland vegetation would be removed by construction of centralized facilities.

A total of 160 acres would be disturbed by construction of other dispersed facilities; however, the locations of these facilities have yet to be determined. To estimate vegetation disturbance from dispersed facility construction, total potential acreage was identified by acres of no-coal zone for each vegetation community (Table 4.15.3). This acreage was capped, when applicable, to the total maximum extent of disturbance (160 acres) and provides the most conservative estimate of potential dispersed facility impacts to tract vegetation. It is assumed that only a portion of the maximum potential acreage would be disturbed for each vegetation community. Total acres of dispersed facility disturbance were apportioned across vegetation communities based on their percentage of land in the tract (see Section 3.15.2). Based on this approach, 64.3 acres (40%) would be in pinyon-juniper communities, 38.6 acres (24%) would be in sagebrush/grasslands, and 33.4 acres (21%) would be treated sagebrush/grasslands. Remaining acres of disturbance would be distributed across other vegetation communities in the tract.

Care would be taken to avoid wetland and riparian areas when selecting sites for these facilities. Assuming that all these facilities would be placed in upland areas, this would represent a loss of approximately 5% of the 3,437 acres of upland vegetation communities in the tract. When constructing dispersed facilities, riparian and meadow vegetation would be avoided where practicable.

Table 4.15.3. Acres of Vegetation Communities Potentially Disturbed by Construction of Dispersed Facilities under the Proposed Action

Vegetation Community	Maximum Potential Acres Disturbed	Estimated Acres Disturbed
Pinyon-juniper woodlands*	160	64.3
Sagebrush/grassland	160	38.6
Sagebrush/grassland (treated)	160	33.4
Mountain brush	5.8	2.9
Annual and perennial grasses	39.1	14.6
Rabbitbrush	10.1	0.5
Riparian	47.6	2.4
Meadow	10.3	2.9

* This association includes areas of pinyon-juniper/mountain brush, pinyon-juniper/sagebrush, and pinyon-juniper/sagebrush/mountain brush communities.

4.15.3.2.3 Effects of Road Relocation on Vegetation

Approximately 47 acres of vegetation in the tract would be removed from surface disturbance (clearing) for the relocation of KFO Route 116 under the Proposed Action. Table 4.15.4 shows the acres of surface disturbance to each vegetation community that would occur from the relocation of the actual road surface and from the KFO Route 116 ROW.

Table 4.15.4. Acres of Vegetation Communities Directly Disturbed by Kanab Field Office Route 116 Relocation on BLM-administered Lands in the Tract under the Proposed Action

Vegetation Community	Acres Disturbed Road Surface	Acres Disturbed ROW	Total Acres in Tract	Percentage Disturbed by Road Relocation
Meadow	0.0	0.0	62.8	0%
Mountain brush	0.0	0.0	62.8	0%
Annual and perennial grasses	1.7	2.9	324.1	1.4%
Pinyon-juniper woodlands*	7.1	12.7	1,430.8	1.4%
Rabbitbrush	0.2	0.3	10.7	4.7%
Riparian	0.2	0.3	55.3	0.9%
Sagebrush/grassland	4.8	8.1	860.2	1.5%
Sagebrush/grassland (treated)	3.0	5.2	749.1	1.1%
Road relocation total	17.0	29.5	3,555.8	1.3%

* This association includes areas of pinyon-juniper/mountain brush, pinyon-juniper/sagebrush, and pinyon-juniper/sagebrush/mountain brush communities.

Road relocation by itself would not disturb large acreages of land in the tract. The greatest disturbance by percentage (4.7%) would occur in the sagebrush/grassland vegetation community. No disturbance from road relocation would affect the meadow or mountain brush communities.

4.15.3.2.4 Increased Risk for Weed Invasion

Because BMPs would be implemented during mining activities, it is assumed that no new weed species would be introduced to the tract. It is also assumed that BMPs would prevent the spread of weeds from the tract to the reasonably foreseeable coal haul transportation route. However, it is possible that weed species currently present in the tract could expand their ranges. This is especially likely for species such as cheatgrass that thrive in disturbance areas. Canada thistle, the only state-listed noxious weed in the tract, also tends to spread into disturbed areas (Morishita 1999). Soil and vegetation disturbance associated with mining are planned to occur in areas currently occupied by both these species under this alternative.

A 30-m buffer around all proposed roads, construction facilities, and surface mines was used to calculate the potential spread of weeds as a result of proposed activities under the Proposed Action. The results of these calculations are shown in Table 4.15.5.

Table 4.15.5. Acres of Land at Increased Risk for Weed Invasion under the Proposed Action

	Area (acres) or Length (miles)	Additional Area (acres) included in 30-m Buffer*	Total Acres at Increased Risk for Weed Invasion
Centralized facilities	35.8	9.5	45.3
Dispersed facilities	160.0	unknown	160.0 (plus unknown buffer)
KFO Route 116 relocation	17.23 (6.5 miles)	138.8	156.0
Surface mine	1,750.1	154.3	1,904.3
Total			**2,265.6**

* Some buffered areas extend outside the tract.

Mined areas, even though they are to be revegetated at the completion of activities, would still be susceptible to weed invasion. Disturbed soils are generally more susceptible to invasion (DiTomaso 2000); the soils in these areas would be repositioned and regraded and would otherwise be dissimilar to the native soils that existed pre-disturbance.

The construction and mining activities proposed under the Proposed Action would increase the acres of land susceptible to weed invasion by 2,266 acres over the No Action Alternative. This acreage includes the 30-m buffers as well as the mined and construction footprint areas.

4.15.3.2.5 Revegetation

Under the Proposed Action, recoverable portions of in-place coal reserves would be mined over approximately 25 years using surface and underground mining methods. Reclamation would be concurrent with mining over the course of the estimated 25-year mine life, and would be followed by a potential 10-year reclamation and revegetation monitoring period.

The entire 1,733 acres affected by surface mining under the Proposed Action would be revegetated. The 196 acres of vegetated land affected by centralized and dispersed facilities construction would also be revegetated as deconstruction occurs. Specific revegetation plans, including target communities for

restoration, would be made by the lessee in accordance with guidance from the BLM and DOGM. Wetland revegetation plans would have to be made in accordance with USACE guidelines and mitigation requirements. General methods for revegetation are outlined in Chapter 2.

Revegetation in the mining and development footprint would change the distribution of vegetation communities. Reclamation measures proposed include an overall reduction in pinyon-juniper woodlands and an increase in sagebrush and grassland communities.

4.15.3.2.6 Other Actions

Increased traffic on highways and new roads, construction, and mining would lead to an increase in fugitive dust, which would create short-term, direct negative impacts to vegetation in all communities in the tract and surrounding area. Dust on the surface of leaves inhibits stomatal function and photosynthesis (Hirano et al. 1995), and therefore impacts overall plant health. Dust would impact vegetation in the tract and surrounding area for the life of mining operations on the tract. It is assumed that the coal haul trucks would be covered or otherwise contained, preventing coal dust from escaping and affecting vegetation along the reasonably foreseeable coal haul transportation route.

Increased O_3 pollution from the burning of fossil fuels in coal haul trucks and construction vehicles/equipment would also lead to potential impacts on vegetation communities in the tract and along the reasonably foreseeable coal haul transportation route. Ground-level O_3 causes more damage to plants than all other air pollutants combined (USDA 2012). O_3 enters plants' leaves through their stomata during normal gas exchange. Plants exposed to O_3 can exhibit symptoms such as chlorosis (yellowing of leaves due to reduced production of photosynthetic pigments) and leaf die-off. Other symptoms of O_3 exposure include flecks (irregular, light-tan spots less than 1 mm in diameter), stipples (small, darkly pigmented areas approximately 2–4 mm in diameter), bronzing, and reddening (USDA 2012). The type and severity of the symptoms depend on factors such as the duration and concentration of O_3 exposure, and the symptoms can vary from one species to another (USDA 2012). With constant daily exposure to O_3, flecking, bronzing, and reddening are gradually replaced by yellowing and loss of leaves (USDA 2012).

The effects of vegetation management would be the same in nature as those described under the No Action Alternative. However, because the sage-grouse mitigation plan (see Section 4.18.2.1.2.3) would be applied to any of the action alternatives as a design feature, the level of vegetation management would be greater under the Proposed Action than under the No Action Alternative to compensate for the greater level of surface disturbance.

4.15.3.2.7 Summary of Effects of Management Actions on Vegetation under the Proposed Action

The acres of vegetation affected by each type of surface disturbance under the Proposed Action are shown in Table 4.15.6. Acres affected by underground mining are not shown because these would not result in direct removal of vegetation at the surface.

Table 4.15.6. Acres of Each Vegetation Community to be Removed from Surface-disturbing Activities in the Alton Coal Tract under the Proposed Action

Vegetation Community	Total Acres in Tract	Acres Disturbed by:				Total Acres Removed*	Percentage Total to be Disturbed
		Surface Mining	Centralized Facilities Construction	Dispersed Facilities Construction†	KFO Route 116 Relocation		
Pinyon-juniper woodlands‡	1,430.8	609.0	1.4	64.3	19.8	694.4	48.6%
Sagebrush/grassland	860.2	314.9	0.0	38.6	12.9	366.5	42.6%
Sagebrush/grassland (treated)	749.1	471.5	34.3	33.4	8.2	547.5	73.1%
Annual and perennial grasses	324.1	259.3	0.0	14.6	4.6	278.4	85.9%
Meadow	62.8	52.5	0.0	2.9	0.0	55.5	88.3%
Mountain brush	62.8	22.0	0.0	2.9	0.0	24.9	39.6%
Riparian	55.3	3.8	0.0	2.4	0.5	6.7	12.1%
Rabbitbrush	10.7	0.0	0.0	0.5	0.5	1.0	9.2%
Total	**3,555.8**	**1,732.9**	**35.7**	**160**	**46.5**	**1,974.8**	**55.5%**

* In addition to dispersed facilities to be constructed.

† Specific placement of facilities is unknown at this time; however, acres of vegetation removal were estimated by apportioning total dispersed facility acres across vegetation communities based on their percentage of land in the tract. Additional information on this approach, as well as a more conservative estimate of total potential acreage, is discussed in Section 4.15.3.2.2.

‡ This association includes areas of pinyon-juniper/mountain brush, pinyon-juniper/sagebrush, and pinyon-juniper/sagebrush/mountain brush communities.

Within the total 3,556 acres of land in the tract currently occupied by vegetation, 1,975 acres, or 56% of these, would be removed from surface-mining and construction activities. Approximately 40% of the vegetation in the mountain brush community would be removed, approximately 88% of the vegetation in the meadow community and 86% in the annual and perennial grasses community would be removed, 49% of the vegetation in the pinyon-juniper woodlands would be removed, 73% of the vegetation in the sagebrush/grassland (treated) community would be removed, and 43% of the vegetation in the sagebrush/grassland community would be removed. Approximately 12% of vegetation in the riparian community would also be removed.

Vegetation in the tract and surrounding areas would be negatively impacted by dust from increased travel and construction activities during the life of mining operations.

All areas affected by surface mining and facilities and road construction would be revegetated at the completion of the mine activities. However, it would be assumed that revegetated areas would still be susceptible to weed invasion due to the increased nutrient availability of disturbed soils that favors invasive species colonization (Lowe et al. 2003). A 30-m buffer around these areas (see rationale in this chapter's Introduction section) leads to 2,266 acres that would become more susceptible to invasion by noxious and invasive weeds because of mining and infrastructure development activities.

4.15.3.3 ALTERNATIVE C: REDUCED TRACT ACREAGE AND SEASONAL RESTRICTIONS

Under Alternative C the tract would be modified to exclude Block NW (see Map 2.2). Further, certain mining activities in Block S would be subject to seasonal restrictions to reduce impacts to the local sage-grouse population. Under Alternative C, the modified tract would be offered for lease at a sealed-bid, competitive lease sale subject to standard and special lease stipulations developed for the tract. The boundaries of the modified tract would be reasonably consistent with the configuration shown in Map 2.2.

Consistent with the purpose and need for the action, the intent of Alternative C is to resolve in part or in full issues related to the local sage-grouse population, noise, and visual impacts to the town of Alton as well as issues related to conflicting land uses (agriculture versus surface mining). Alternative C may also reduce impacts to other resources such as AVF, springs and surface waters, wildlife, soils, public health and safety, paleontological resources, cultural resources, and vegetation. Potential impacts to vegetation would be the same in nature as those described under the Proposed Action (see Section 4.15.3.2), but would vary in magnitude.

4.15.3.3.1 Effects of Surface-mining Activities on Vegetation

Of the total 1,662 acres of surface disturbance that would occur in the Alton Coal Tract under Alternative C, 1,454 acres would be the direct result of surface-mining operations (pit disturbance). Of this total, 11 acres of disturbance would occur on existing roads, and the remaining 1,443 acres would occur in vegetation communities. However, this disturbance would not all occur at one time. At any one time, active and suspended (due to seasonal timing restrictions) mining operations would involve an estimated 240 acres (two pits).

4.15.3.3.2 Upland Areas

Under Alternative C, approximately 1,439 (46%) of the 3,107 acres of vegetated uplands in the tract would be disturbed by surface mining (Table 4.15.7). Of this total, 22 acres would be in mountain brush, 182 acres would be in annual and perennial grasses, 602 acres would be in pinyon-juniper communities,

162 acres would be in the sagebrush/grassland community, and 472 acres would be in the sagebrush/grassland (treated) community. Active restoration would be needed after mining operations are complete and the land has been regraded.

Table 4.15.7. Acres of Upland Vegetation Communities Directly Disturbed by Surface Mining under Alternative C

Upland Vegetation Community	Acres Disturbed	Total Acres in Tract	Percentage Disturbed by Surface Mining
Pinyon-juniper woodlands*	601.7	1,410.2	42.7%
Sagebrush/grassland (treated)	471.5	749.1	62.9%
Sagebrush/grassland	161.7	627.8	25.8%
Annual and perennial grasses	182.2	247.0	73.8%
Mountain brush	22.0	62.8	35.0%
Rabbitbrush	0.0	10.7	0.0%
Surface mining total	**1,439.1**	**3,107.1**	**46.3%**

* This association includes areas of pinyon-juniper/mountain brush, pinyon-juniper/sagebrush, and pinyon-juniper/sagebrush/mountain brush communities.

The mountain brush community would experience an approximately 35% reduction in acreage from surface-mining disturbance. Likewise, approximately 26% of sagebrush/grassland acres, 63% of sagebrush/grassland (treated) communities, and 43% of pinyon-juniper woodlands in the tract would also be eliminated from surface-mining activities. Revegetation efforts would focus on restoring these areas to sagebrush and grassland ecosystems to benefit the watershed, wildlife, and livestock; and as such, a total elimination of pinyon-juniper and mountain brush community acreages in the mining footprint would be likely in the short and long term.

Because annual and perennial grasses are not considered a native vegetation community, a reduction of 74% is not considered a loss to the native vegetation resource. Impacts to annual and perennial grasses removed during surface mining and associated activities would be mitigated by reclamation and revegetation with native and non-native rangeland-suitable plants upon completion of mining activities.

4.15.3.3.2.1 Wetland Areas

Disturbance from surface mining would not impact the meadow vegetation community because the area containing the meadow vegetation community would not be included in the tract under this alternative.

4.15.3.3.2.2 Riparian Areas

Disturbance from surface mining is expected to remove 3.7 acres of riparian vegetation. This is approximately 8% of the total 54 acres of riparian vegetation in the tract. Revegetation of this area at the completion of mining activities would be required, and would lead to an increase in vegetation quality due to the requirements of rangeland health standards and agency objectives for reclamation.

4.15.3.3.3 Effects of Facilities Construction Activities on Vegetation

Centralized facilities associated with mining activities on the Alton Coal Tract would be located on approximately 36 acres of BLM-administered land in the tract's no-coal zone (areas outside of pit disturbance boundaries) (see Map 2.2). This is the same as under the Proposed Action.

Dispersed facilities would occupy 135 acres of land in the tract. The placement of these facilities would be the same as under the Proposed Action. Although the maximum potential and estimated vegetation disturbance by vegetation community would be less due to the smaller size of the tract under this alternative (Table 4.15.8). When constructing dispersed facilities, riparian vegetation would be avoided where practicable.

Table 4.15.8. Acres of Vegetation Communities Potentially Disturbed by Construction of Dispersed Facilities under Alternative C

Vegetation Community	Maximum Potential Acres Disturbed	Estimated Acres Disturbed
Pinyon-juniper woodlands*	135	60.2
Sagebrush/grassland	135	26.8
Sagebrush/grassland (treated)	135	32.0
Mountain brush	5.8	2.7
Annual and perennial grasses	39.9	10.5
Rabbitbrush	10.2	0.5
Riparian	46.5	2.3

* This association includes areas of pinyon-juniper/mountain brush, pinyon-juniper/sagebrush, and pinyon-juniper/sagebrush/mountain brush communities.

Avoidance criteria would also be the same as under the Proposed Action. Assuming construction of dispersed facilities takes place in upland areas, this would be a loss of an additional 135 acres of upland vegetation, or 4% of the total 3,107 upland acres in the tract.

4.15.3.3.4 Effects of Road Relocation on Vegetation

Approximately 36 acres of vegetation on BLM-administered land in the tract would be removed from the relocation of KFO Route 116 under Alternative C (Table 4.15.9).

Table 4.15.9. Acres of Vegetation Communities Directly Disturbed by Kanab Field Office Route 116 Relocation on BLM-administered Lands in the Tract under Alternative C

Upland Vegetation Community	Acres Disturbed Road Surface	Acres Disturbed ROW	Total Acres in Tract	Percentage Disturbed by Road Relocation
Pinyon-juniper woodlands*	5.9	10.4	1,410.2	1.2%
Sagebrush/grassland (treated)	3.0	5.2	749.1	1.1%
Sagebrush/grassland	2.6	4.6	627.8	1.1%
Annual and perennial grasses	1.4	2.4	247.0	1.5%
Mountain brush	0.0	0.0	62.8	0.0%
Riparian	0.1	0.2	54.0	0.6%
Rabbitbrush	0.2	0.3	10.7	4.7%
Meadow	0.0	0.0	0.0	0.0%
Road relocation total	**13.2**	**23.1**	**3,161.6**	**1.1%**

*This association includes areas of pinyon-juniper/mountain brush, pinyon-juniper/sagebrush, and pinyon-juniper/sagebrush/mountain brush communities.

Road relocation alone would not disturb large acreages of land in the tract. The greatest disturbance by percentage (4.7%) would occur in the rabbitbrush vegetation community. No disturbance from road relocation would affect meadow or mountain brush communities. These acreages are similar to, but less than those under the Proposed Action and greater than those under Alternative K1.

4.15.3.3.5 Increased Risk for Weed Invasion

Because BMPs would be implemented during mining activities, it is assumed that no new weed species would be introduced to the tract. It is also assumed that BMPs would prevent the spread of weeds from the tract to the reasonably foreseeable coal haul transportation route. However, it is possible that weed species currently present in the tract could expand their ranges. Canada thistle, the only state-listed noxious weed in the tract, also tends to spread into disturbed areas (Morishita 1999). Soil and vegetation disturbance associated with mining are planned to occur in areas currently occupied by both these species under this alternative.

A 30-m buffer around all proposed roads, construction facilities, and surface mines was used to calculate the potential for spread of weeds as a result of proposed activities under Alternative C. The results of these calculations are shown in Table 4.15.10.

Table 4.15.10. Acres of Land at Increased Risk for Weed Invasion under Alternative C

	Area (acres) or Length (miles)	Additional Area included in 30-m Buffer*	Total Acres at Increased Risk for Weed Invasion
Centralized facilities	35.8	9.5	45.3
Dispersed facilities	135.0	unknown	135.0 (plus unknown buffer)
KFO Route 116 relocation	13.4 (4.6 miles)	108.8	122.2
Surface mine	1,454.0	130.4	1,584.4
Total			**1,886.9**

* Some buffered areas extend into the surrounding nontract area.

The construction and mining activities proposed under Alternative C would increase the acres of surface disturbance and land susceptible to weed invasion by 1,887 acres over the No Action Alternative. This includes the mining and construction footprint areas, as well as the 30-m buffers around these disturbances. Mined areas, even though they are to be revegetated at the completion of activities, would still be susceptible to weed invasion. Disturbed soils are generally more susceptible to invasion (DiTomaso 2000); the soils in these areas would be repositioned and regraded and would otherwise be dissimilar to the native soils that existed pre-disturbance.

4.15.3.3.6 Revegetation

Under Alternative C, recoverable portions of in-place coal reserves would be mined over approximately 21 years using surface and underground mining methods. Reclamation would be concurrent with mining over the course of the estimated 21-year mine life and would be followed by a minimum 10-year reclamation and revegetation monitoring period.

The entire 1,443 acres affected by surface mining under Alternative C would be revegetated. The 171 acres affected by centralized and dispersed facilities construction would also be revegetated as deconstruction occurs. Specific revegetation plans, including target communities for restoration, would be

implemented by the lessee in accordance with guidance from the BLM and the DOGM. Wetland revegetation plans would have to be made in accordance with USACE guidelines and mitigation requirements. General methods for revegetation are outlined in Chapter 2.

Revegetation in the mining and development footprint would most likely change the distribution of vegetation communities; mainly as a reduction in pinyon-juniper woodlands and an increase in sagebrush and grassland communities.

4.15.3.3.7 Other Actions

Increased traffic on highways and new roads, construction, and mining would lead to an increase in fugitive dust, which would create short-term direct negative impacts to vegetation in all the communities in the tract and the surrounding area. Dust on leaf surfaces inhibits stomatal function and photosynthesis (Hirano et al. 1995) and reduces overall plant health. This effect is likely to be felt by vegetation in the tract and surrounding area for the life of the mine. It is assumed that the coal haul trucks would be covered or otherwise contained, preventing coal dust from escaping and affecting vegetation along the reasonably foreseeable coal haul transportation route.

Increased O_3 pollution from the burning of fossil fuels in coal haul trucks and construction vehicles/equipment would also lead to potential impacts on vegetation communities in the tract and along the reasonably foreseeable coal haul transportation route. Ground-level O_3 causes more damage to plants than all other air pollutants combined (USDA 2012). O_3 enters plants' leaves through their stomata during normal gas exchange. Plants exposed to O_3 can exhibit symptoms such as chlorosis (yellowing of leaves due to reduced production of photosynthetic pigments) and leaf die-off. Other symptoms of O_3 exposure include flecks (irregular, light-tan spots less than 1 mm in diameter), stipples (small, darkly pigmented areas approximately 2–4 mm in diameter), bronzing, and reddening (USDA 2012). The type and severity of the symptoms depend on factors such as the duration and concentration of O_3 exposure, and the symptoms can vary from one species to another (USDA 2012). With constant daily exposure to O_3, flecking, bronzing, and reddening are gradually replaced by yellowing and loss of leaves (USDA 2012).

The effects of vegetation management would be the same in nature as those described under the No Action Alternative. However, because the sage-grouse mitigation plan (see Section 4.18.2.1.2.3) would be applied to any of the action alternatives as a design feature, the level of vegetation management would be greater under the Alternative C than under the No Action Alternative to compensate for the greater level of surface disturbance.

4.15.3.3.8 Summary of Effects of Management Actions on Vegetation under Alternative C

The acres of vegetation affected by each type of surface disturbance are shown in Table 4.15.11. Acres affected by underground mining are not shown because they would not result in direct removal of vegetation at the surface.

Table 4.15.11. Acres of Each Vegetation Community to be Removed from Surface-disturbing Activities in the Alton Coal Tract under Alternative C

Vegetation Community	Total Acres in Tract	Acres Disturbed by:				Total Acres Removed*	Percentage Total to be Disturbed
		Surface Mining	Centralized Facilities Construction	Dispersed Facilities Construction†	KFO Route 116 Relocation		
Meadow	0.0	0.0	0.0	0.0	0.0	0.0	0%
Mountain brush	62.8	22.0	0.0	2.7	0.0	24.7	39.3%
Annual and perennial grasses	247.0	182.2	0.0	10.5	3.8	196.5	79.6%
Pinyon-juniper woodlands‡	1,410.2	601.7	1.4	60.2	16.83	680.1	48.2%
Rabbitbrush	10.7	0.0	0.0	0.5	0.5	1.0	8.0%
Riparian	54.0	3.7	0.0	2.3	0.3	6.3	11.7%
Sagebrush/grassland	627.8	161.7	0.0	26.8	7.2	195.7	31.2%
Sagebrush/grassland (treated)	749.1	471.5	34.3	32.0	8.2	546.0	72.9%
Total	**3,161.6**	**1,442.8**	**35.7**	**135.0**	**36.8**	**1,650.38**	**52.2%**

* In addition to dispersed facilities to be constructed.

† Specific placement of facilities is unknown at this time; however, acres of vegetation removal were estimated by apportioning total dispersed facility acres across vegetation communities based on their percentage of land in the tract. Additional information on this approach, as well as a more conservative estimate of total potential acreage, is discussed in Section 4.15.3.3.3.

‡ This association includes areas of pinyon-juniper/mountain brush, pinyon-juniper/sagebrush, and pinyon-juniper/sagebrush/mountain brush communities.

Within the total 3,161 acres of land in the tract currently occupied by vegetation, 1,650 acres (52%) would be removed from surface-mining and construction activities (including 135 acres for dispersed facilities). Thirty-nine percent of the vegetation in the mountain brush community would be removed, approximately 80% of the vegetation in the annual and perennial grasses community would be removed, 48% of the vegetation in the pinyon-juniper woodlands would be removed, 73% of the vegetation in the sagebrush/grassland (treated) community would be removed, and 31% of the vegetation in the sagebrush/grassland community would be removed. Approximately 12% of vegetation in the riparian community would also be removed and no acres of the meadow community would be removed.

All areas affected by surface mining and facilities and road construction would be revegetated at the completion of mine activities. However, it is assumed that revegetated areas would still be susceptible to weed invasion due to the increased nutrient availability of disturbed soils that favors invasive species colonization (Lowe et al. 2003). A 30-m buffer out from these areas (see rationale in this chapter's Introduction section) leads to 1,887 acres that would become more susceptible to invasion by noxious and invasive weeds because of soil and vegetation disturbance resulting from mining and infrastructure development activities.

Vegetation in the tract and surrounding areas would be negatively impacted by dust from increased travel and construction activities during the life of mining operations.

4.15.3.4 ALTERNATIVE K1: REDUCED TRACT ACREAGE

Under Alternative K1, the tract would be modified to exclude Block NW and Block S (see Map 2.3). This modified tract would be offered for lease at a sealed-bid, competitive lease sale subject to standard and special lease stipulations developed for the tract. The boundaries of the modified tract would be reasonably consistent with the configuration shown in Map 2.3.

Consistent with the purpose and need for the action, the intent of Alternative K1 is to resolve in part or in full issues related to the local sage-grouse population, noise, and visual impacts to the town of Alton as well as issues related to conflicting land uses (agriculture versus surface mining). Alternative K1 may also reduce impacts to other resources such as AVF, springs and surface waters, wildlife, soils, public health and safety, paleontological resources, cultural resources, and vegetation. Potential impacts to vegetation would be the same in nature as those described under the Proposed Action and Alternative C, but would vary in magnitude.

4.15.3.4.1 Effects of Surface-mining Activities on Vegetation

Of the total 1,012 acres of surface disturbance that would occur in the Alton Coal Tract under Alternative K1, 869 acres would be the direct result of surface-mining operations (pit disturbance). Of this total, 11 acres of disturbance would occur on existing roads, and the remaining 858 acres would occur in vegetation communities. However, this disturbance would not all occur at one time. There would be a single open pit (approximately 120 acres), and at any one time, there would be approximately 120 acres of open surface-mining pit disturbance and an additional 120 or more acres in some stage of reclamation.

4.15.3.4.2 Upland Areas

Under Alternative K1, approximately 858 (42%) of the 2,052 acres of vegetated uplands in the tract would be disturbed by surface mining (Table 4.15.12). Of this total, 182 acres would be in annual and perennial grasses, 415 acres would be in pinyon-juniper communities, 73 acres would be in the sagebrush/grassland community, and 188 acres would be in the sagebrush/grassland (treated) community. Active restoration would be needed after mining operations are complete and the land has been regraded.

Table 4.15.12. Acres of Upland Vegetation Communities Directly Disturbed by Surface Mining under Alternative K1

Upland Vegetation Community	Acres Disturbed	Total Acres in Tract	Percentage Disturbed by Surface Mining
Pinyon-juniper woodlands*	414.5	1,095.1	37.9%
Sagebrush/grassland (treated)	188.1	289.5	65.0%
Sagebrush/grassland	72.9	369.1	19.8%
Annual and perennial grasses	182.2	247.0	73.8%
Mountain brush	0.0	40.8	0.0%
Rabbitbrush	0.0	10.7	0.0%
Surface Mining Total	**857.7**	**2,052.2**	**41.8%**

* This association includes areas of pinyon-juniper/mountain brush, pinyon-juniper/sagebrush, and pinyon-juniper/sagebrush/mountain brush communities.

Approximately 20% of sagebrush/grassland acres, 65% of sagebrush/grassland (treated) communities, and 38% of pinyon-juniper woodlands in the tract would be eliminated from surface-mining activities. Revegetation efforts would focus on restoring these areas to sagebrush and grassland ecosystems to benefit the watershed, wildlife, and livestock; therefore, a total elimination of pinyon-juniper and mountain brush community acreages in the mining footprint would be likely in the short and long term.

Because annual and perennial grasses are not considered a native vegetation community, a reduction of 74% is not considered a loss to the native vegetation resource. Impacts to annual and perennial grasses removed during surface mining and associated activities would be mitigated by reclamation and revegetation with native and non-native rangeland-suitable plants upon completion of mining activities.

4.15.3.4.2.1 Wetland Areas

Disturbance from surface mining would not impact the meadow vegetation community because the area containing the meadow vegetation community would not be included in the tract under this alternative.

4.15.3.4.2.2 Riparian Areas

Disturbance from surface mining is expected to remove 3.7 acres of riparian vegetation. This is approximately 8% of the total 54 acres of riparian vegetation in the tract. Revegetation of this area at the completion of mining activities would be required, and would lead to an increase in vegetation quality due to the requirements of rangeland health standards and agency objectives for reclamation.

4.15.3.4.3 Effects of Facilities Construction Activities on Vegetation

Centralized facilities associated with mining activities on the Alton Coal Tract would be located on approximately 36 acres of BLM-administered land in the tract's no-coal zone (areas outside of pit disturbance boundaries) (see Map 2.3). This is the same as under the Proposed Action and Alternative C.

Dispersed facilities would occupy 92 acres of land in the tract. The placement of these facilities would be the same as under the Proposed Action. Although, the maximum potential and estimated vegetation disturbance by vegetation community would be less due to the smaller size of the tract under this alternative (Table 4.15.13). When constructing dispersed facilities, riparian vegetation would be avoided where practicable.

Table 4.15.13. Acres of Vegetation Communities Potentially Disturbed by Construction of Dispersed Facilities under Alternative K1

Vegetation Community	Maximum Potential Acres Disturbed	Estimated Acres Disturbed
Pinyon-juniper woodlands*	92	47.7
Sagebrush/grassland	92	16.1
Sagebrush/grassland (treated)	92	12.6
Mountain brush	5.7	1.7
Annual and perennial grasses	39.9	10.8
Rabbitbrush	10.2	0.5
Riparian	46.5	2.4

* This association includes areas of pinyon-juniper/mountain brush, pinyon-juniper/sagebrush, and pinyon-juniper/sagebrush/mountain brush communities.

Avoidance criteria would also be the same as under the Proposed Action and Alternative C. Assuming construction of dispersed facilities takes place in upland areas, this would be a loss of an additional 92 acres of upland vegetation, or 4% of the total 2,114 upland acres in the tract.

4.15.3.4.4 Effects of Road Relocation on Vegetation

Approximately 16 acres of vegetation on BLM-administered land in the tract would be removed from the relocation of KFO Route 116 under Alternative K1 (Table 4.15.14).

Table 4.15.14. Acres of Vegetation Communities Directly Disturbed by KFO Route 116 Relocation on BLM-administered Lands in the Tract under Alternative K1

Upland Vegetation Community	Acres Disturbed Road Surface	Acres Disturbed ROW	Total Acres in Tract	Percentage Disturbed by Road Relocation
Pinyon-juniper woodlands*	2.9	5.1	1,095.1	0.7%
Sagebrush/grassland (treated)	0.3	0.6	289.5	0.3%
Sagebrush/grassland	0.8	1.4	369.1	0.6%
Annual and perennial grasses	1.4	2.4	247.0	1.5%
Mountain brush	0.0	0.0	40.8	0.0%
Riparian	0.1	0.2	54.0	0.6%
Rabbitbrush	0.2	0.3	10.7	4.7%
Meadow	0.0	0.0	0.0	0.0%
Road relocation total	**5.7**	**10.0**	**2,106.2**	**0.7%**

*This association includes areas of pinyon-juniper/mountain brush, pinyon-juniper/sagebrush, and pinyon-juniper/sagebrush/mountain brush communities.

Road relocation alone would not disturb large acreages of land in the tract. The greatest disturbance by percentage (4.7%) would occur in the rabbitbrush vegetation community. No disturbance from road relocation would affect meadow or mountain brush communities. These acreages are less than those under the Proposed Action and Alternative C.

4.15.3.4.5 Increased Risk for Weed Invasion

Because BMPs would be implemented during mining activities, it is assumed that no new weed species would be introduced to the tract. It is also assumed that BMPs would prevent the spread of weeds from the tract to the reasonably foreseeable coal haul transportation route. However, it is possible that weed species currently present in the tract could expand their ranges. Canada thistle, the only state-listed noxious weed in the tract, also tends to spread into disturbed areas (Morishita 1999). Soil and vegetation disturbance associated with mining are planned to occur in areas currently occupied by both these species under this alternative.

A 30-m buffer around all proposed roads, construction facilities, and surface mines was used to calculate the potential for spread of weeds as a result of proposed activities under Alternative K1. The results of these calculations are shown in Table 4.15.15.

Table 4.15.15. Acres of Land at Increased Risk for Weed Invasion under Alternative K1

	Area (acres) or Length (miles)	Additional Area included in 30-m Buffer*	Total Acres at Increased Risk for Weed Invasion
Centralized facilities	35.8	9.5	45.3
Dispersed facilities	92.0	unknown	92.0 (plus unknown buffer)
KFO Route 116 relocation	5.7 (2 miles)	46.3	52.0
Surface mine	868.6	77.9	946.5
Total			**1,135.8**

*Some buffered areas extend into the surrounding nontract area.

The construction and mining activities proposed under Alternative K1 would increase the acres of surface disturbance and land susceptible to weed invasion by 1,136 acres over the No Action Alternative. This includes the mining and construction footprint areas, as well as the 30-m buffers around these disturbances. Mined areas, even though they are to be revegetated at the completion of activities, would still be susceptible to weed invasion. Disturbed soils are generally more susceptible to invasion (DiTomaso 2000); the soils in these areas would be repositioned and regraded and would otherwise be dissimilar to the native soils that existed pre-disturbance.

4.15.3.4.6 Revegetation

Under Alternative K1, recoverable portions of in-place coal reserves would be mined over approximately 16 years using surface and underground mining methods. Reclamation would be concurrent with mining over the course of the estimated 16-year mine life and would be followed by a minimum 10-year reclamation and revegetation monitoring period.

The entire 861 acres affected by surface mining under Alternative K1 would be revegetated. The 128 acres affected by centralized and dispersed facilities construction would also be revegetated as deconstruction occurs. Specific revegetation plans, including target communities for restoration, would be implemented by the lessee in accordance with guidance from the BLM and the DOGM. Wetland revegetation plans would have to be made in accordance with USACE guidelines and mitigation requirements. General methods for revegetation are outlined in Chapter 2.

Revegetation in the mining and development footprint would most likely change the distribution of vegetation communities; mainly as a reduction in pinyon-juniper woodlands and an increase in sagebrush and grassland communities.

4.15.3.4.7 Other Actions

Increased traffic on highways and new roads, construction, and mining would lead to an increase in fugitive dust, which would create short-term, direct negative impacts to vegetation in all communities in the tract and surrounding area. Dust on leaf surfaces inhibits stomatal function and photosynthesis (Hirano et al. 1995) and reduces overall plant health. This effect is likely to be felt by vegetation in the tract and surrounding area for the life of the mine. It is assumed that the coal haul trucks would be covered or otherwise contained, preventing coal dust from escaping and affecting vegetation along the reasonably foreseeable coal haul transportation route.

Increased O_3 pollution from the burning of fossil fuels in coal haul trucks and construction vehicles/equipment would also lead to potential impacts on vegetation communities in the tract and along the reasonably foreseeable coal haul transportation route. Ground-level O_3 causes more damage to plants than all other air pollutants combined (USDA 2012). O_3 enters plants' leaves through their stomata during normal gas exchange. Plants exposed to O_3 can exhibit symptoms such as chlorosis (yellowing of leaves due to reduced production of photosynthetic pigments) and leaf die-off. Other symptoms of O_3 exposure include flecks (irregular, light-tan spots less than 1 mm in diameter), stipples (small, darkly pigmented areas approximately 2–4 mm in diameter), bronzing, and reddening (USDA 2012). The type and severity of the symptoms depend on factors such as the duration and concentration of O_3 exposure, and the symptoms can vary from one species to another (USDA 2012). With constant daily exposure to O_3, flecking, bronzing, and reddening are gradually replaced by yellowing and loss of leaves (USDA 2012).

The effects of vegetation management would be the same in nature as those described under the No Action Alternative. However, because the sage-grouse mitigation plan (see Section 4.18.2.1.2.3) would be applied to any of the action alternatives as a design feature, the level of vegetation management would be greater under Alternative K1 than under the No Action Alternative to compensate for the greater level of surface disturbance.

4.15.3.4.8 Summary of Effects of Management Actions on Vegetation under Alternative K1

The acres of vegetation affected by each type of surface disturbance are shown in Table 4.15.16. Acres affected by underground mining are not shown because they would not result in direct removal of vegetation at the surface.

Table 4.15.16. Acres of Each Vegetation Community to be Removed from Surface-disturbing Activities in the Alton Coal Tract under Alternative K1

Vegetation Community	Total Acres in Tract	Acres Disturbed by:				Total Acres Removed*	Percentage Total to be Disturbed
		Surface Mining	Centralized Facilities Construction	Dispersed Facilities Construction†	KFO Route 116 Relocation		
Meadow	0.0	0.0	0.0	0.0	0.0	0.0	0%
Mountain brush	40.8	0.0	0.0	1.7	0.0	1.7	4.2%
Annual and perennial grasses	247.0	182.2	0.0	10.8	3.8	196.8	79.7%
Pinyon-juniper woodlands‡	1,095.1	414.5	1.4	47.7	8.0	471.6	43.1%
Rabbitbrush	10.7	0.0	0.0	0.5	0.5	1.0	9.3%
Riparian	54.0	3.7	0.0	2.4	0.3	6.4	11.9%
Sagebrush/grassland	369.1	72.9	0.0	16.1	2.2	91.2	24.7%
Sagebrush/grassland (treated)	289.5	188.1	34.3	12.6	0.9	235.9	81.5%
Total	**2,106.2**	**861.4**	**35.7**	**91.8**	**15.7**	**1,004.6**	**47.7%**

* In addition to dispersed facilities to be constructed.

† Specific placement of facilities is unknown at this time; however, acres of vegetation removal were estimated by apportioning total dispersed facility acres across vegetation communities based on their percentage of land in the tract. Additional information on this approach, as well as a more conservative estimate of total potential acreage, is discussed in Section 4.15.3.4.3.

‡ This association includes areas of pinyon-juniper/mountain brush, pinyon-juniper/sagebrush, and pinyon-juniper/sagebrush/mountain brush communities.

Within the total 2,106 acres of land in the tract currently occupied by vegetation, 1,005 acres (48%) would be removed from surface-mining and construction activities (including 92 acres for dispersed facilities). Four percent of the vegetation in the mountain brush community would be removed, approximately 80% of the vegetation in the annual and perennial grasses community would be removed, 43% of the vegetation in the pinyon-juniper woodlands would be removed, 82% of the vegetation in the sagebrush/grassland (treated) community would be removed, and 25% of the vegetation in the sagebrush/grassland community would be removed. Approximately 12% of vegetation in the riparian community would also be removed, and no acres of the meadow community would be removed.

All areas affected by surface mining and facilities and road construction would be revegetated at the completion of mine activities. However, it is assumed that revegetated areas would still be susceptible to weed invasion due to the increased nutrient availability of disturbed soils that favors invasive species colonization (Lowe et al. 2003). A 30-m buffer out from these areas (see rationale in this chapter's Introduction section) leads to 1,136 acres that would become more susceptible to invasion by noxious and invasive weeds because of soil and vegetation disturbance resulting from mining and infrastructure development activities.

Vegetation in the tract and surrounding areas would be negatively impacted by dust from increased travel and construction activities during the life of the mine.

4.15.4 Potential Mitigation Measures

The protective measures for vegetation described above and in the Management and Considerations Common to Each Action Alternative section of Chapter 2 would mitigate and/or minimize impacts to vegetation resources in the tract. These mitigation measures would help to reduce the amount and severity of weed infestations and would help to restore native vegetation communities. No potential mitigation measures are recommended.

4.15.5 Unavoidable Adverse Impacts

Unavoidable adverse impacts would occur where vegetation resources are removed during mining pit disturbance, soil stockpiling, road and infrastructure development, and other mine operations. These impacts would be mitigated by site reclamation and revegetation concurrent with mining that would minimize soil loss or weed invasion in disturbed sites. Unavoidable loss would occur where special status plant species are not detected or identified during surveys and are subsequently lost. Implementation of mitigation and monitoring plans would reduce the risk of loss or destruction of special status plant species. Unavoidable loss of special status plant species due to nondetection or loss of function in native vegetation communities from inadvertent adverse impacts would also occur.

4.15.6 Short-term Uses versus Long-term Productivity

Surface mining and infrastructure development and use during the life of the mine would negatively impact the short-term productivity of vegetation communities. The vegetation communities present in the tract are typically slow to recover from disturbance. Productivity would be limited during reclamation and restoration activities for the time period required for plants to grow to mature size and for the development of functioning vegetation communities. Long-term productivity would be reduced because vegetation communities are unlikely to be fully developed immediately following mining and restoration activities. Until vegetation communities are fully developed, these habitats would be less diverse (Belnap et al. 2001) and less productive (Garcia-Pichel et al. 1996) where ecologically important habitat components such as biological soil crusts have been lost. Effective implementation of the regulatory compliance and mitigation measures outlined in Chapter 2 and enumerated above would minimize impacts to the long-term productivity of vegetation communities.

4.15.7 Irreversible and Irretrievable Commitments of Resources

The protective measures detailed in Chapter 2 and enumerated above require the reclamation of disturbed areas following completion of the management action. Because vegetation resources would be restored or rehabilitated after proposed disturbance and/or development, there would be no anticipated irreversible impacts on vegetation resources associated with the management decisions proposed for the tract. However, there would be irretrievable impacts associated with surface-disturbing activities proposed throughout the tract. The vegetation that would be removed or disturbed to facilitate mining would be irretrievably lost until successful restoration took place.

4.16 Water Resources

This section addresses potential impacts on surface water, groundwater, wetlands and riparian areas, floodplains, and AVFs from the removal of coal from the Alton Coal Tract using primarily surface-mining methods. Direct and indirect effects would consist of 1) surface-water depletions; 2) potential degradation of surface-water quality from increased sediment delivery and subsequent changes in turbidity, dissolved solids, or temperature; 3) groundwater depletions; 4) potential degradation of groundwater quality from increased TDS; 5) disturbance to wetland and riparian areas and floodplains; and 6) indirect impacts to AVFs that may exist adjacent to areas where surface mining would occur (in a reconnaissance-level survey, there were no probable AVFs identified in areas that would be surface mined). Impacts to the quality of deep groundwater are not discussed in the alternatives analysis because no impacts are expected to deep groundwater resources (as described in Section 3.16.2.) under any alternative. Though transportation of coal by truck from the tract to a rail loadout near Cedar City, Utah, represents a risk to surface-water resources near the coal haul transportation route from coal dust and potential accidents, these impacts would be minimized by implementation of spill management planning and best available control measures to minimize and/or eliminate fugitive coal dust.

Under any action alternative, all potential direct and indirect impacts to groundwater resources would occur within the Kanab Creek watershed/shallow aquifer boundary. Under any action alternative, the successful bidder would be required to comply with state and federal mining regulations intended to reduce or eliminate impacts to surface and groundwater resources (see Table 2.6.1 and Section 4.16.1). Hazardous materials contained and used in the tract represent a risk of contamination to near-surface groundwater and surface-water resources from spills. Spills would be contained and mitigated in accordance with applicable state and federal regulations dealing with hazardous materials (see Table 2.6.1 and Section 4.7.1). Potential subsidence in the portion of the tract that would be underground mined could result in changes to surface draining and deterioration of surface-water quality as well as changes to groundwater levels, flow, and quality.

As a part of the process of obtaining a coal mining permit from DOGM, the successful bidder for the Alton Coal Tract would be required to meet all applicable requirements of the Utah coal mining rules (R645 of the UAC). Among these is the requirement that the mine operator monitors the quality and quantity of groundwaters and surface waters during the period of active mining operations and continuing through bond release (R645-301-731.200). Monitoring plans for groundwater and surface water are developed based on a determination of the probable hydrologic consequences of coal mining for the specific mining operation, and on an analysis of all baseline hydrologic, geologic, and other information contained in the permit application. The plans provide for monitoring of parameters that relate to the suitability of the groundwater and surface water for current and approved post-mining land uses and to monitor for potential impacts to the hydrologic balance in the area. Typically, monitoring plans are designed to include the monitoring of all important groundwater and surface-water resources in and adjacent to mining areas.

The specific groundwater and surface-water monitoring plans that would be developed before mining on the tract begins would be designed based on the details of the specific MRP proposed by the successful bidder. Because such information is not usually available during the tract leasing stage, groundwater and surface-water monitoring plans are typically developed during the mine permitting stage when detailed information regarding the proposed mining plan is available. However, it is likely that the groundwater and surface-water monitoring plans for the new tract would be similar to those previously approved by DOGM for the existing Coal Hollow Mine. At the existing Coal Hollow Mine, the water monitoring plan includes 54 monitoring sites that are monitored on a quarterly basis. The monitoring information is submitted to DOGM, which then conducts a quarterly review and analysis of the submitted information. The water monitoring information is freely available for public access through the DOGM on-line coal

water quality database. The water monitoring program at the existing Coal Hollow Mine includes monitoring at 10 stream locations, 12 spring locations, and 32 well monitoring locations. Water quantity parameters (flow rates for streams and springs and water levels for wells) are performed at all 54 monitoring stations. Field water quality measurements including temperature, pH, and specific conductance (and dissolved oxygen concentrations at streams) are performed at 29 monitoring sites. Laboratory water quality analyses are performed on water samples from 20 monitoring locations.

4.16.1 Regulatory Framework

Numerous federal and state regulations shape the management of water resources. Regulations that pertain to water resources and potential impacts from mining and other land uses include the following:

- The Fish and Wildlife Coordination Act (1934), as amended, provides the basic authority for USFWS's involvement in evaluating impacts to fish and wildlife from proposed water resource development projects. The Water Resources Act of 1954, as amended, permits the Secretary of the Interior to give grants to and cooperate with federal, state, and local agencies to undertake research into any water problems related to the DOI's mission.
- The Water Resources Planning Act of 1965, as amended, established the Water Resources Council, which is directed to maintain studies of water supplies and water programs. The chairperson of any river basin commission can request from an agency, and that agency is authorized to furnish, such information as is necessary to carry out its function.
- The Federal Pollution Control Act (with amendments in 1972 and in 1977 as the CWA) has the objective of restoring and maintaining the chemical, physical, and biological integrity of the nation's waters. The CWA of 1987 provides additional authorizations.
- FLPMA requires that public lands be managed in a manner that will protect scientific, environmental, air and atmospheric, and water resource values. It also requires that land use plans be in compliance with applicable pollution control laws, including state and federal air, water, and other pollution standards.
- SMRCA requires federal agencies to gather hydrologic data to ascertain the suitability for mining, and requires that mine operators "minimize disturbances to the prevailing hydrologic balance at the mine-site and in associated off-site areas and to the quality and quantity of water in surface and ground water systems both during and after surface coal mining operations and during reclamation" (30 USC 1265(b)(10)).
- The Safe Drinking Water Act of 1977 protects all public water systems from pollutants or contaminants that would endanger public health and welfare. Activities on public lands in these watersheds must not cause contaminant levels to exceed promulgated standards.
- 40 CFR 434 applies to 1) effluent discharges from any coal mine at which the extraction of coal is taking place or is planned to take place and 2) coal preparation plants and associated areas.
- EO 11988, Floodplain Management, requires federal agencies to take actions that avoid, to the extent possible, the long- and short-term adverse impacts associated with the occupancy and modification of floodplains, and to avoid direct or indirect support of floodplain development wherever there is a practicable alternative.
- EO 11990, Protection of Wetlands, requires federal agencies to avoid, to the extent possible, the long- and short-term adverse impacts associated with the destruction or modification of wetlands and to avoid direct or indirect support of new construction in wetlands wherever there is a practicable alternative.

The KFO RMP, other BLM regulations, and state regulations have provided the framework for other required protection measures. BMPs that may be required to minimize potential water-quality impacts (including sediment control from dispersed facilities) could include silt fences, fiber rolls, mulching, check dams, brush berms, and the use of appropriately placed and installed straw or hay bales (EPA 2013g). Other standards applicable to water resources related to mining the tract include the following:

- UPDES permitting process administered by the Utah Division of Water Quality requires that a water-quality discharge permit be obtained for construction and coal mining operations. UPDES storm water permits require BMPs to mitigate storm water discharge. After August 1, the successful bidder would be required to monitor turbidity in storm water to assure compliance with Effluent Limit Guidelines 280 Nephelometric Turbidity Units (40 CFR 450).
- The Division of Water Rights may require issuance of a permit for the diversion and/or evaporation of water associated with retention ponds.
- Spill prevention, control, and countermeasure regulations apply to any operation with greater than 1,320 gallons of oil storage capacity on-site. Regulated facilities also include those that could reasonably be expected to discharge oil in harmful quantities into the navigable waters of the U.S. or adjoining shorelines.
- The successful bidder for the tract would be required to develop and implement a detailed, site-wide water management plan as part of the mine's MRP administered by DOGM. The DOGM permitting process has multiple provisions for the mitigation of potential impacts to water resources.
- The successful bidder for the tract would be required to build and maintain sediment control ponds or other devices during mining.
- The successful bidder for the tract would be required to monitor storage capacity in sediment ponds.
- The successful bidder for the tract would be required to monitor quality of discharges through the UPDES permit.
- The successful bidder for the tract would be required to restore approximate original drainage patterns during reclamation.
- The successful bidder for the tract would be required to monitor stream flow and water quality and selected springs in and adjacent to the tract.
- The successful bidder for the tract would be required to restore stock ponds and playas during reclamation.
- The successful bidder for the tract would be required to identify all wetlands that would be affected by mining.
- The successful bidder for the tract would be required to identify jurisdictional wetlands, as required by USACE, and replace any that would be disturbed by mining.
- The successful bidder for the tract would be required to replace functional wetlands, as required by surface managing agency, surface landowner, and/or the DOGM.
- The successful bidder for the tract would be required to monitor reclaimed wetlands using the same procedures used to identify pre-mining jurisdictional wetlands.
- The successful bidder for the tract would be required to repair subsidence-related disturbances in accordance with UAC 40-10.

As part of the permitting process, a full analysis of potential impacts associated with underground and/or surface-mining operations would be performed. This would include a determination of the probable hydrologic consequences of the underground and/or surface coal mining activities. Additionally, DOGM has the responsibility to assess the potential for mining impacts both inside and outside permit areas. The cumulative hydrologic impact assessment (CHIA) is a findings document prepared by DOGM that assesses whether existing, proposed, and anticipated coal mining and reclamation operations have been designed to prevent material damage to the hydrologic balance outside the permit area. DOGM cannot

issue a permit to a proposed coal mining operation if the probable anticipated hydrologic impacts will create material damage to the hydrologic balance outside the permit area. The CHIA is not only a determination if coal mining operations are designed to prevent material damage beyond their respective permit boundaries when considered individually, but also if there will be material damage resulting from effects that may be acceptable when each operation is considered individually but are unacceptable when the cumulative impact is assessed (DOGM 2009).

In conjunction with the mine permitting process, hydrologic monitoring plans for surface water and groundwater are implemented. The monitoring information is used to allow DOGM to assess potential impacts to the hydrologic balance. Hydrologic monitoring continues after the completion of mining through bond release. Any discharges of water from the mining operation to surrounding watercourses are regulated through the UPDES program administered by the Utah Division of Water Quality.

4.16.2 Impact Indicators, Thresholds, Area of Analysis, and Assumptions

4.16.2.1 SURFACE WATER

The analysis area for direct and indirect impacts to the drainage condition of streams is the Alton Coal Tract. Impacts to stream channel condition are assessed according to the length of stream altered or realigned and the number of stream crossings required for mining operations. It is assumed that a portion of Robinson Creek would be realigned to allow surface mining to occur. In addition, one or two stream crossings of Kanab Creek would be required.

The tract is in parts of three subdrainages (HUC 12) of Kanab Creek: Reservoir Canyon, Lower Robinson Creek, and Sink Valley Wash. The analysis area for direct and indirect impacts on surface water is the area (40,040 acres) of these three subdrainages (see Map 3.17).

One way that impacts to surface-water hydrology in this section are assessed is by estimating the total annual runoff from the tract that would be collected in ponds. Water collected in ponds would be subject to increased evaporation and infiltration, which would constitute a loss of runoff to surface waters. Impacts to surface-water quality are also assessed by qualitatively describing the risk of impairment of surface waters, as indicated by state water-quality standards, which serve as threshold indicators for surface-water quality impacts. The criteria used for all surface waters are those listed by the State of Utah for Kanab Creek; the creek's most stringent criteria are for the beneficial use as a warm water fishery (3B). Risk of impact measurements under each alternative included the area of each surface use or disturbance, such as roads, graded ROWs, facilities, soil stockpiles, and mine pits. In addition, impacts to surface-water quality are assessed through the linear feet of creek realigned (to indicate the relative magnitude of thermal impacts and increases in dissolved solids and other constituents).

The impact indicators to assess impacts from dust deposition as well as risk of spills associated with the transportation of hazardous materials to surface waters along the reasonably foreseeable coal haul route are the feet (miles) of stream within 100 feet of the transportation route and the number of times this route crosses perennial streams and intermittent drainages.

In the analysis, it is assumed that surface runoff from all pit disturbances and centralized facilities would be captured in sediment retention ponds. The area draining to the ponds is assumed to be the total projected surface disturbance from pits and centralized facilities (1,786 acres under the Proposed Action, 1,490 acres under Alternative C, and 905 acres under Alternative K1). Water would not be released from these ponds; therefore, it is assumed that the ponds would be 100% effective at controlling sediment. Water would be lost only to evaporation or infiltration. Water loss from the ponds is estimated using local

evaporation rates on a per-unit area basis. It is assumed that there would be minor recharge to shallow groundwater systems from pond infiltration due to the low permeability of these aquifers. In either case, the retention ponds represent a 100% loss of surface water from the tract for immediate use by irrigators downstream. Sediment runoff would not be captured in retention ponds from dispersed facilities and the relocation of KFO Route 116. It is assumed that sediment from these areas would be controlled using BMPs such as silt fencing, straw wattles, and matting, as required by UPDES storm water permitting.

Because underground mining activities produce unique risks to surface-water systems, a separate qualitative summary of potential subsidence and hydrologic changes from underground mining is also provided. Additional discussion of subsidence impacts is provided in Section 4.6, Geology and Minerals. The acreage subject to subsidence-related impacts is the same under all action alternatives.

4.16.2.2 GROUNDWATER

The analysis area for direct and indirect impacts to groundwater quality and quantity is the area that would be disturbed from surface mining (1,750 acres under the Proposed Action, 1,454 acres under Alternative C, and 869 acres under Alternative K1). Impacts to groundwater hydrology are assessed according to groundwater losses due to reduced recharge, consumptive use for coal mining activities, and evaporation of groundwater exposed in pits.

Impacts to groundwater quality are assessed by qualitatively describing the risk of impairment of shallow groundwater, as indicated by state surface-water quality standards, for typical underground water uses in the area as identified in the Utah Division of Water Rights database (i.e., irrigation and stock watering). The principal parameter of concern for these groundwater uses is TDS. The Utah TDS standard for irrigation and stock watering is 1,200 mg/L.

The moisture content of coal in the Smirl Coal Zone is 13% and includes moisture that is bound in the organic matter and/or hydrated clays found in the coal zone. It represents an additional groundwater resource separate from mined groundwater that could be lost due to removal of 2 million tons of coal per year under the Proposed Action, Alternative C, and Alternative K1.

As with surface-water resources, underground mining impacts to groundwater from subsidence and hydrology changes are discussed qualitatively as a separate analysis. Additional discussion of subsidence impacts is provided in Section 4.6, Geology and Minerals. The acreage subject to subsidence-related impacts is the same under all action alternatives.

4.16.2.3 WETLANDS, RIPARIAN AREAS, FLOODPLAINS, AND ALLUVIAL VALLEY FLOORS

The area of analysis for wetlands, riparian areas, floodplains, and AVFs is the tract and its immediate surroundings. The impact indicators for these resources are the linear feet of associated waterways and acres of identified wetlands, riparian, floodplains, and AVFs in areas of anticipated surface mining (within the coal zone) and areas of potential dispersed facilities, centralized facilities, and road relocations (outside of the coal zone) in the tract.

A preliminary JD was completed in November 2012 (USACE 2012b). It concludes that 54.0 acres of wetlands in the tract are potential waters of the U.S. regulated under Section 401 of the CWA. In all, 24 individual wetlands areas were identified during the delineation (see Map 2.4). These wetland areas were classified into three habitat types: approximately 18.5 acres are riparian wet meadow wetlands, 31.6 acres are irrigated wet meadow wetlands, and 3.8 acres are mixed riparian scrub-shrub/wet meadow wetlands (Frontier Corporation USA 2012).

With respect to floodplains, it is assumed that any in the tract would be subject to protections and regulations detailed in EO 11988. For the purposes of this analysis, it is further assumed that all waterways in the analysis area support floodplains.

Areas identified as probable AVFs during a reconnaissance-level survey (see Appendix F) are assumed to be AVFs in the analysis. During the permitting process, a more extensive study to determine the presence of AVFs would be required.

4.16.3 Alternative A: No Action

Under the No Action Alternative, ACD's application to lease the coal included in the Alton Coal Tract under the Proposed Action, Alternative C, or Alternative K1 would not be approved, the tract would not be offered for competitive lease sale, and the coal in the tract would not be mined.

No coal-mining activities or infrastructure development would occur under the No Action Alternative, and therefore no surface disturbance would occur in the tract as a function of mining operations (Table 4.16.1). However, existing land uses would continue, including livestock grazing, recreation, and vegetation treatments for wildlife habitat and watershed health.

Table 4.16.1. Surface Disturbance (acres) and Creek Realignment (miles) under all Alternatives

Disturbance Type	Alternative A (No Action)	Alternative B (Proposed Action)	Alternative C (Reduced Tract Acreage and Seasonal Restrictions)	Alternative K1 (Reduced Tract Acreage)
Pit disturbance	0	1,750	1,454	869
Centralized facilities	0	36	36	36
Dispersed facilities	0	160	135	92
Road relocation	0	47 (17 actual road and 30 ROW)	37 (13 actual road and 24 ROW)	16 (6 actual road and 10 ROW)
Total Surface-disturbing activities	**0**	1,993	1,662	1,012
Underground mining	0	613	613	613
Robinson Creek realigned (miles)	0	0.49	0.49	0.49

4.16.3.1 SURFACE WATER

Discussions of site-specific potential for impacts to surface-water systems under the No Action Alternative in specific surface-water drainages are presented in the subsections below. Because there would be no impacts to surface water under the No Action Alternative beyond those impacts from ongoing land uses, the heading/subheading structure of this section differs from the corresponding sections analyzing the impacts under Alternatives B, C, and K1. This section does not have subheadings for surface-water quantity and use, surface-water quality, or drainage conditions.

4.16.3.1.1 Kanab Creek

Under the No Action Alternative, no impacts to surface-water quantity and quality in Kanab Creek beyond those impacts from ongoing land uses would occur. The uses include livestock grazing, vegetation treatments, and recreation. These ongoing impacts may include active erosion along the Kanab Creek stream channels in the tract (Petersen Hydrologic 2007). Because no mining, construction, or additional surface disturbance would occur under the No Action Alternative, there would be no additional impacts to surface-water quality or quantity in Kanab Creek.

Reportedly a result of land management practices in the late 1800s or early 1900s, the creeks in the tract have limited riparian vegetation, in many locations are not stable in their current configurations, are actively eroding their channels during precipitation events, and are deeply incised (Petersen Hydrologic 2007). Under the No Action Alternative, the creek's channels would remain incised and would continue to contribute sediment to the creek during periodic high-flow events.

4.16.3.1.2 Simpson Hollow Creek

Under the No Action Alternative, no impacts to surface-water quantity and quality in Simpson Hollow Creek beyond those from ongoing land uses (livestock grazing, crop irrigation, and vegetation treatments) would occur. Because no mining, construction, or additional surface disturbance would occur under the No Action Alternative, there would be no additional impacts to surface-water quality or quantity in Simpson Hollow Creek.

4.16.3.1.3 Lower Robinson Creek

Under the No Action Alternative, no impacts to surface-water quantity and quality in Lower Robinson Creek beyond those impacts from ongoing land uses would occur. Ongoing impacts to Lower Robinson Creek in the tract would include active erosion along the Lower Robinson Creek stream channel in the tract (Petersen Hydrologic 2007). Because no mining, construction, or additional surface disturbance would occur under the No Action Alternative, there would be no additional impacts to surface-water quality or quantity.

Lower Robinson Creek has limited riparian vegetation. In many locations, it is not stable in its current configuration, is actively eroding its channel during precipitation events, and is deeply incised in most locations (Petersen Hydrologic 2007). The creek's channels would remain incised and would continue to contribute sediment to the creek during periodic high-flow events.

All mine discharges from the Coal Hollow Mine are regulated under a UPDES discharge permit administered by the Utah Division of Water Quality. Any potential impacts to Robinson Creek associated with these non-extractive activities on the tract would continue to occur under the No Action Alternative for the remainder of the life of the Coal Hollow Mine.

4.16.3.1.4 Ephemeral Washes

Under the No Action Alternative, no impacts to surface-water quantity and quality in ephemeral washes in the tract beyond those impacts from ongoing land uses would occur. These ongoing impacts may include active erosion along stream channels in the tract (Petersen Hydrologic 2007). Because no mining, construction, or additional surface disturbance would occur under the No Action Alternative, there would be no additional impacts to surface-water quality or quantity in the ephemeral washes in the tract. Currently, in most locations, the ephemeral washes in the tract are deeply incised and susceptible to erosion during periods of high flows. Under the No Action Alternative, channels would remain incised and would continue to erode and contribute sediment to the washes during periodic high-flow events.

4.16.3.2 GROUNDWATER

Discussions of the potential for site-specific impacts to groundwater under the No Action Alternative in individual portions of the tract are presented in the subsections below. Because there would be no impacts to groundwater under the No Action Alternative beyond those from ongoing land uses, the heading/subheading structure of this section differs from the corresponding sections analyzing the impacts under Alternatives B, C, and K1. This section does not have subheadings for groundwater hydrology or groundwater quality.

4.16.3.2.1 Block C

No impacts to groundwater quantity or quality in Block C would result under the No Action Alternative beyond those existing impacts associated with ongoing land uses. Because no mining, construction, or additional surface disturbance would occur under the No Action Alternative, there would be no additional impacts to groundwater quality or quantity in this block.

4.16.3.2.2 Block NW

No impacts to groundwater quantity or quality in Block NW would result under the No Action Alternative beyond those impacts from ongoing land uses. Because no mining, construction, or additional surface disturbance would occur under the No Action Alternative, there would be no additional impacts to groundwater quality or quantity in this block.

4.16.3.2.3 Blocks CWN and CWS

No impacts to groundwater quantity or quality in Block CWN and CWS would result under the No Action Alternative beyond those impacts from ongoing land uses. Because no mining, construction, or additional surface disturbance would occur under the No Action Alternative, there would be no additional impacts to groundwater quality or quantity in these blocks.

4.16.3.2.4 Blocks S and Sa

No impacts to groundwater quantity or quality in Blocks S and Sa would result under the No Action Alternative beyond those impacts from ongoing land uses. Because no mining, construction, or additional surface disturbance would occur under the No Action Alternative, there would be no additional impacts to groundwater quality or quantity in these blocks.

4.16.3.3 WETLANDS, RIPARIAN AREAS, FLOODPLAINS, AND ALLUVIAL VALLEY FLOORS

Under the No Action Alternative, the wetlands (54.0 acres) present in the tract would not be disturbed from mining the tract; therefore, no impacts are anticipated under this alternative. All the wetlands and riparian areas delineated are on private agricultural lands that are subjected to periodic agricultural disturbances. Under the No Action Alternative, no mine-related disturbance to riparian areas (55.3 acres), floodplains (57.0 acres), or AVFs (57.0 acres) in the tract would occur either.

4.16.4 Alternative B: Proposed Action

Under the Proposed Action, the Alton Coal Tract would be offered for lease at a sealed-bid competitive lease sale, subject to standard and special lease stipulations developed for the tract. The tract boundaries under the Proposed Action (see Map 1.2) would be reasonably consistent with the tract reconfiguration completed by the BLM after ACD's original lease application submittal (see Map 2.7). Approximately 1,993 acres of surface disturbance would occur in the Alton Coal Tract under the Proposed Action (see Table 4.16.1). Similarly, underground mining would occur on 613 acres of land in the tract.

Coal removal by underground mining methods and the withdrawal of water to facilitate mining would result in subsidence as overlying strata settle into mining-produced voids. Subsidence is a natural consequence of underground mining; although, the magnitude and extent vary based on a range of mining and geologic factors, such as surface topography, depth of mining, near-surface geology, and mining method (Society for Mining 1992). In the tract, 613 acres would be affected by subsidence through underground mining. An additional 166 acres outside the tract would be disturbed through ground movement associated with coal removal (areas outside the tract that could be impacted through subsidence would be regulated under a mining permit administered by DOGM).

4.16.4.1 SURFACE WATER

Under the Proposed Action, adverse short-term impacts to surface-water quantity would occur from the implementation of sediment- and erosion-management BMPs. Under this alternative, 1,993 acres of the tract would be disturbed by surface mining, the construction of centralized and dispersed facilities, and road relocation, which is 1,993 acres more than would be disturbed under the No Action Alternative. Runoff from 1,786 acres of pit disturbance and centralized facilities would be diverted and captured in storm water retention ponds to reduce the amount of eroded sediments that is discharged to downstream water bodies such as Kanab Creek and Robinson Creek. Areas where runoff is not captured, such as dispersed facilities and the road relocation ROW, would be treated through the use of silt fencing, check dams (e.g., straw bales), or other BMPs that slow runoff and allow sediments to settle. Because water that is permanently retained in ponds or temporarily slowed or detained is subject to additional infiltration and evaporation, loss of surface water would result.

Under the Proposed Action, approximately 29 acre-feet of water would be captured annually from pits and centralized facilities (Table 4.16.2). These values are estimated as a portion of the flow (equal to the proportion of the tract relative to the watershed area) associated with runoff from precipitation events at the USGS gauge on Kanab Creek downstream of the tract. Storm and snowmelt peaks were identified on the gauge using a simple hydrograph line method (Chow et al. 1988) and checked against climate data for the area (precipitation, snowfall, and temperature) (NCDC Station No. 420086) (Petersen 2014a). Ten years of precipitation data from the Alton NCDC climate station were used in this calculation. Pit disturbance and centralized facilities make up 1.4% of the total drainage area upstream of the USGS gauge. It was assumed that the same percentage of flow at the gauge was generated on those areas of the tract.

Because this water would be captured in retention ponds that would not discharge to downstream water bodies, the full volume of runoff captured from the tract would be lost to increased evaporation or infiltration into the ground. Maximum annual evaporation from standing water in the tract is approximately 35 inches per year. Evaporated water would be lost as a surface-water resource. In the event that water in a retention pond infiltrates (leak) through the bottom of the pond, that water would become part of the groundwater system beneath the pond. If there is an active groundwater flowpath from the groundwater beneath the pond to a surface discharge location (such as a spring or seepage zone), the leaked water could eventually return to the surface flow regime. In the absence of such a flowpath, the groundwater leaked from the pond could be held for a longer period of time in the subsurface and thus become lost from the surface flow regime.

Under the Proposed Action, no direct adverse impacts to surface-water quality are likely. Runoff from disturbed areas on the tract would be captured in retention ponds, which do not release water into downstream receiving waters. Erosion of sediment from dispersed facilities and the relocation of KFO Route 116 would be controlled with silt fences and other sediment-control BMPs. These BMPs are more than 90% effective in capturing sediment when installed and maintained properly (Robichaud et al.). Therefore, most of the sediment and associated contaminants found in surface runoff from the tract would be contained, and would not pose any direct threat to surface waters.

Indirect effects on water quality from the Proposed Action would result from the loss of 29 acre-feet of water to streams associated with diversion of surface-water runoff on the tract into retention ponds (see Table 4.16.2). This loss of water to the surface-water system would reduce flows in Robinson Creek and Kanab Creek, and thereby reduce the dilution of any pollutant (total phosphorus, suspended solids, nitrogen, or dissolved solids) downstream of the tract. This could increase the pollutant's concentration in the surface-water system. However, reduced flow would also reduce instream erosion, and therefore could reduce sediment concentrations in the stream. The primary pollutant that could pose a concern to Kanab Creek is TDS, because current concentrations of TDS in surface water in and around the tract

already exceed the standard of 1,200 mg/L identified by the State of Utah as protective of irrigation water. Water quality data in and around the tract indicate that TDS concentrations are highest under low-flow conditions. Mean TDS concentrations in groundwater in the Sink Valley Wash are 378 mg/L (maximum 623 mg/L); therefore, the use of groundwater for dust suppression would not lead to an increase in TDS concentrations in future surface runoff from the tract. Use of groundwaters or surface waters from other sources in the tract for dust suppression (which generally have appreciably higher TDS concentrations than do waters in Sink Valley) could lead to an increase in TDS concentrations in future surface runoff from the tract. In this case, salt-tolerant plants could be used for revegetation.

Increases in solute concentrations of groundwaters and surface waters can occur when groundwaters and surface waters are allowed to interact with the Tropic Shale or sediments derived from the Tropic Shale (Petersen Hydrologic 2007). When appreciable contact and interaction between groundwaters and surface waters and the Tropic Shale does occur, increases in the concentrations of TDS (and also typically magnesium and sulfate concentrations) would be anticipated. The potential for such increases in the dissolved constituents of groundwaters and surface waters can be minimized through BMPs that limit the potential for such interactions.

There are no perennial or intermittent surface-water drainages present in areas overlying or adjacent to the underground mining areas. Subsidence-related surface-water impacts in no-coal areas may include potential changes to surface drainage and deterioration of surface-water quality. Additionally, subsidence could cause fissures and pits or open cracks, which, if connected to aboveground streams, could lead to partial or complete loss of surface water (i.e., increased recharge to underlying strata) in surrounding areas. Aquifer pumping for underground mining could also interrupt groundwater flow to surface waters, leading to reduced stream flows.

Although the future operator of proposed coal mining operations at the Aton Coal Tract is not known, the fact that some exceedances of UPDES effluent limits for total iron and total suspended sediments concentrations have occurred historically at the nearby Coal Hollow Mine suggests the possibility that such occurrences could occur in the future as a consequence of mining at the Alton Coal Tract. During the period of initial mine startup construction for the Coal Hollow Mine in December 2010, discharges of both surface runoff from the mine area and groundwater intercepted in the mine pit areas to Kanab Creek occurred in response to unusually intense precipitation events. According to permit files at DOGM (2013), at that time the region experienced the 10-year, 24-hour precipitation event, followed immediately by the 100-year, 24-hour precipitation event the following day.

In response to these anomalous precipitation events, discharges of surface-water runoff occurred. In response to continued wetness in early 2011, water was discharged from the mine's sedimentation ponds through the permitted UPDES discharge points. In the six UPDES discharge events that were monitored in 2011, the TDS concentrations of the mine discharge water ranged from 704 to 1,820 mg/L, averaging 1,037 mg/L. The discharge rates at the UPDES discharge points during these events ranged from 1.3 to 15 gpm, averaging 5.4 gpm. The discharges that occurred in 2011 consisted of both surface waters and groundwaters intercepted in the mine pit areas. During these 2011 discharge events, there were the following UPDES effluent limitation exceedances at the Coal Hollow Mine:

- UPDES Serial No. 003 – 3/31/2011: total iron 1.6 mg/L; TSS 48 mg/L
- UPDES Serial No. 005 – 11/30/2011: TSS 55 mg/L; 10/31/2011 TSS 35 mg/L

Under more normal climatic conditions, discharges from the Coal Hollow Mine have been infrequent. The Coal Hollow Mine was designed to contain mine waters (and to use the water for mine operational uses such as dust suppression) such that discharge to the receiving waters would not usually be necessary. There have been no UPDES discharges from the mine operation since November 2011. The discharge of water from mining areas in the tract to surrounding waterways would be regulated through the UPDES

permitting process, which is administered by the Utah Division of Water Quality. Potential impacts to the hydrologic balance that could occur from mine water discharges are also regulated by DOGM.

The EPA indicates that iron in water is not directly associated with adverse health effects (Petersen 2014b). Accordingly, the EPA has not issued a primary drinking water standard for iron. However, because iron in water can be associated with undesirable tastes, odors, discoloration, or other aesthetic conditions, the EPA has issued a secondary maximum contaminant level (SMCL) for iron of 0.3 mg/L. The EPA does not enforce SMCLs, but they are used to assist public water utilities in managing their drinking water for aesthetic considerations. The State of Utah has also set forth a numeric surface-water quality standard in the Kanab Creek drainage for dissolved iron of 1,000 µg/L for the protection of aquatic wildlife (nongame fish and other aquatic wildlife). Although there is the potential for the discharge of mine waters containing iron through UPDES discharge points into the Kanab Creek drainage, the potential impact to downstream water users is low. Water flowing in a well-aerated stream with a near-neutral pH should not contain more than a few ppb of dissolved iron (Hem 1985). Under such conditions (which are generally present in streams throughout the tract and surrounding area), dissolved iron potentially entering a stream as mine water discharge would be converted to a solid precipitate that would settle from the stream. In the event that substantially elevated iron concentrations manifest in mine discharge waters in the tract (such that treatment of the water would be required to meet the applicable water quality effluent limitations), physical and chemical treatment processes would be available, which have been used successfully elsewhere in the Utah coal industry to remove iron from mine discharge waters.

Generally, sediment entering storm water can degrade the quality of the water for drinking, wildlife use, and the land surrounding streams (Mid-America Regional Council 2014). During mining and reclamation activities, storm waters falling on disturbed areas (or areas naturally prone to erosion) can acquire elevated sediment concentrations. To minimize the potential for discharge of sediment into surrounding waterways, and in accordance with applicable state and federal rules and regulations, runoff occurring from precipitation or snowmelt events within a mine permit area would be treated using BMPs (see Section 4.16.8 below).

Potential site-specific impacts to surface-water quantity, use, and quality for individual surface-water drainages are discussed below.

Table 4.16.2. Water Resource Impacts under all Alternatives

Disturbance Type	Alternative A (No Action)	Alternative B (Proposed Action)	Alternative C (Reduced Tract Acreage and Seasonal Restrictions)	Alternative K1 (Reduced Tract Acreage)
Surface Water				
Acre-feet of surface-water runoff from pit disturbance and centralized facilities (annual)	0	29	24	14
Acre-feet of water loss from streams (annual)	0	29	24	14
Total miles of streams within 100 feet of transportation route	0	13.8	13.8	13.8
Total miles of perennial streams within 100 feet of transportation route	0	3	3	3
Number of stream crossings	0	118	118	118

Table 4.16.2. Water Resource Impacts under all Alternatives

Disturbance Type	Alternative A (No Action)	Alternative B (Proposed Action)	Alternative C (Reduced Tract Acreage and Seasonal Restrictions)	Alternative K1 (Reduced Tract Acreage)
Groundwater				
Acre-feet of groundwater lost for dust suppression (life of the mine)	0	625	525	400
Acre-feet of groundwater lost to evaporation (life of the mine)	0	2,900	4,893	1,856
Annual groundwater interception in mine pits in acre-feet (based on average historical inflow rate observed in Coal Hollow Mine pits of about 20 gpm)	0	32.3	32.3	32.3
Wetlands, Riparian Areas, Floodplains, and Alluvial Valley Floors				
Acres of wetland removal	0	32.5	0.3	0.3
Acres of riparian disturbance	0	11.0	10.1	11.4
Acres of floodplain/AVF disturbance	0	8.0	7.4	9.0
Acres subject to potential subsidence	0	613 (+166 outside the tract)	613 (+166 outside the tract)	613 (+166 outside the tract)

4.16.4.1.1 Kanab Creek

4.16.4.1.1.1 Surface-water Quantity and Use

The results of stream discharge measurements in Kanab Creek indicate that the creek does not gain appreciably as it flows across the tract (see Section 3.16.1.1.1), although discharges from Simpson Hollow Creek and Lower Robinson Creek contribute water to Kanab Creek when flows are present in these drainages. (Potential impacts to surface-water hydrology in these drainages are discussed below.) Kanab Creek usually gains flow as it crosses the irrigated agricultural areas in the private fee coal area immediately east of Block NW. The potential for mine-related activities to impact Kanab Creek surface-water hydrology in this area would be evaluated during the permitting of these lands through the DOGM.

In the Alton Coal Tract, the Kanab Creek stream channel is present only in the no-coal zone and consequently would not be directly disturbed by mine pit disturbances. As discussed in Section 4.16.4.1 above, some decreases in surface-water flows in Kanab Creek would be anticipated as a result of local precipitation and snowmelt runoff waters being held in storm water retention ponds rather than running off to Kanab Creek. However, such impacts would likely be short term (while the sediment controls remain in place) and of relatively small magnitude (the disturbed area at any one time would be small relative to the total surface area of the Kanab Creek drainage). Because under existing conditions, there are no appreciable surface-water gains in Kanab Creek in the tract, and because Kanab Creek would not be directly impacted by the mine pit disturbance, the potential for appreciable diminution of flow rates in the drainage as a result of mine-related activities is low.

Because most of the surface flows from the tract in Kanab and Robinson creeks are impounded in irrigation ponds or lost to stream channel infiltration downstream (Petersen Hydrologic 2007), indirect impacts resulting from any loss of surface waters would primarily affect downstream irrigators rather than instream flows. However, these ponds may be bypassed during infrequent high discharges of stream flow, and any depletion would somewhat decrease peak flows downstream in Kanab Creek.

Potential discharge of mine waters could result in increased flows to Kanab Creek. Discharges of mine waters to Kanab Creek would occur under a UPDES permit administered by the Utah Division of Water Quality. Potential impacts to the hydrologic regime associated with the discharge of mine waters would also be regulated by DOGM. Historically, discharges of mine water from the Coal Hollow Mine have been infrequent and of small magnitude (generally less than 15 gpm) (DOGM 2013a). The quantity of mine water that could be intercepted by the mine pits and subsequently discharged to Kanab Creek would be variable and related to the hydrogeologic conditions encountered in the various mining areas (Petersen Hydrologic 2007).

4.16.4.1.1.2 Surface-water Quality

Kanab Creek and its tributaries from the Arizona state line to the irrigation diversion at the confluence with Reservoir Canyon have recently been included on the Utah State 303(d) list of impaired waters based on exceedances of the 1,200-mg/L TDS standard for irrigation water use. Although the TDS concentrations of Kanab Creek waters are naturally degraded as the stream flows across the tract and adjacent area (see Section 3.16.1.1), significant impacts to water quality in Kanab Creek (including elevated TDS concentrations) resulting from mine-related activities in the tract are not anticipated. Mine pit disturbance would not occur in or adjacent to the Kanab Creek stream channel, which is present only in the no-coal zone within the tract. Runoff from disturbed areas adjacent to Kanab Creek would be captured in retention ponds (which do not release water into downstream receiving waters) or treated with silt fences and other sediment-control BMPs that would minimize the potential for sediments to enter the creek.

As required by SMCRA, the currently operating Coal Hollow Mine (which operates on private fee coal adjacent to the tract) is designed to retain a 10-year 24-hour storm event to prevent discharge during such a storm event. In addition, several sediment retention ponds at the mine site have been enlarged to capture any runoff. Historically, discharges of mine waters through UPDES discharge points have been infrequent (no discharges of mine water have occurred since November 2011). It has been the experience at the Coal Hollow Mine that the largest inflows to the mine pits have occurred where saturated alluvial sediments have been intercepted by the mine pits. The combined sum of inflows from intercepted alluvial groundwater sources in the Coal Hollow Mine have generally been less than approximately 25 gpm at any one time. Groundwater inflows from the Tropic Shale have been minimal (generally less than 1 gpm) or absent in the mine pit areas (DOGM 2013a). Minor seepage from the Smirl Coal Zone also sometimes contributes small quantities of groundwater to the mine pits. Appreciable discharge from the underlying Dakota Formation has not been observed in the mine pit areas. In most mining areas within the Alton Coal Tract, appreciable regions with thick alluvial sediments are not present (see Map 3.10). Consequently, because mine pits in these areas would intersect primarily Tropic Shale bedrock in the overburden, groundwater inflows from the highwall into mine pits should be minor, minimizing the potential need to discharge water from the mine pits through the UPDES discharge points to Kanab Creek (or its tributaries).

4.16.4.1.2 Simpson Hollow Creek

4.16.4.1.2.1 Surface-water Quantity and Use

Sustained surface-water flows in Simpson Hollow Creek are supported from seasonal snowmelt and precipitation runoff, from irrigation return flows from adjacent hay fields, and from groundwaters discharging from springs and seeps in the area. During periods of mining in this drainage, surface-water runoff from disturbed areas would be diverted and captured in storm water retention ponds. Because these waters would be retained and would not be discharged from the ponds, these waters would not enter into Simpson Hollow Creek, resulting in diminished flow rates. Runoff from undisturbed, upgradient areas would be routed in ditches around disturbed areas where the waters would subsequently discharge into Simpson Hollow Creek. Excavation of the mine pits in the upper East Fork

of Simpson Hollow Creek (within the coal zone) would remove the stream channel in that area. Obviously, during the period of active mining in that area, surface waters from this tributary would not flow into Simpson Hollow Creek. However, these impacts would be short lived, because after mining in the wash is completed and the land surface is reclaimed to the AOC, surface-water runoff to Simpson Hollow Creek would be restored to near pre-mining conditions. During active mining, the hydrologic connection between the watershed area upstream and downstream from the pits in the East Fork of Simpson Hollow Creek would be retained in a pipe or ditch around the pit areas. This would ensure that runoff from snowmelt and thunderstorms would not impact mining operations. Assuming that irrigation activities on the irrigated fields higher in the drainage are not interrupted during mining operations, irrigation return flows would continue to flow to Simpson Hollow Creek during and after mining operations. If mining activities in the Simpson Hollow Creek resulted in diminution of discharge rates at springs and seeps, this would result in decreased rates of discharge. However, significant impacts to spring discharge rates in this area are not considered likely.

4.16.4.1.2.2 Surface-water Quality

In the pre-mining condition, surface waters in Simpson Hollow Creek, which is a tributary to Kanab Creek, have TDS concentrations that consistently exceed the state irrigation standard (1,200 mg/L), and usually exceed the state stock watering standard (1,200 mg/L) (Petersen Hydrologic 2007). The average TDS concentrations measured at monitoring site SW-15 at the confluence with Kanab Creek in 2012 and 2013 averaged 3,033 mg/L.

The principal sources of water to Simpson Hollow Creek include 1) runoff of snowmelt and precipitation waters from the land surface within the tributary, 2) irrigation return flows (including surface runoff and shallow subsurface interflow runoff) from several large irrigated fields in the drainage area, and 3) groundwater discharge from a series of springs. During the period of mining, surface-water runoff in disturbed areas would be routed into storm water retention ponds and not discharged to the creek, reducing flows in the drainage during periods of snowmelt or intense precipitation. Because the snowmelt and precipitation water would likely be relatively low in TDS, the routing of these waters away from the drainage could result in higher TDS concentrations in the creek. This impact would be short lived because after mining and reclamation in the area are complete, precipitation and snowmelt waters would again flow to the stream. Assuming that irrigation in the upgradient fields continues during mining operations in the drainage at near-current rates, the runoff from these fields would continue to flow to Simpson Hollow Creek, resulting in no significant change in the contribution to TDS from agricultural runoff. Most of the springs in the Simpson Hollow Creek drainage occur in the no-coal zone. Consequently, the potential for impacts to these springs resulting from mining operations is low. However, if impacts to discharge rates at the springs and seeps occurred, the contributions of the impacted spring discharges to the surface-water flows in Simpson Hollow Creek would decrease. Because the TDS concentrations of springs in the Simpson Hollow Creek drainage are variable, this occurrence could result in either an increase or decrease in the TDS concentrations of surface waters in Simpson Hollow Creek, depending on which springs are impacted.

4.16.4.1.3 Lower Robinson Creek

4.16.4.1.3.1 Surface-water Quantity and Use

Coal mining activities in the Lower Robinson Creek drainage could impact surface-water discharge rates in the creek. Surface-water runoff in disturbed areas would be routed into storm water retention ponds and not discharged to the creek, reducing flows in the drainage during periods of snowmelt or intense precipitation. However, because Lower Robinson Creek is ephemeral in the mining areas in the tract, and because water is only rarely present in these reaches of the creek, the magnitude of this potential impact

would be small. This impact would also be temporary because after mining and reclamation of the land are complete, surface-water drainage patterns would be restored to the approximate pre-mining condition, and surface-water runoff would again flow into the creek.

The only persistent flow in Lower Robinson Creek is associated with alluvial groundwater seepage that enters the drainage topographically downstream from potential mining areas in the tract (Petersen Hydrologic 2007). Mine pits in upgradient areas could intercept the source(s) of the alluvial groundwater that seeps into the lower reaches of Lower Robinson Creek. Currently, surface-mining activities that have occurred adjacent to Lower Robinson Creek at the Coal Hollow Mine have not resulted in appreciably diminished flows at the alluvial groundwater seepage zone (DOGM 2013a).

4.16.4.1.3.2 Surface-water Quality

In the tract, potential mining locations are present 1) directly north of the existing Coal Hollow Mine workings and west of the Tropic Shale bedrock ridge, and 2) adjacent to the Coal Hollow Mine permit area east of the Tropic Shale bedrock ridge, including portions of upper Sink Valley (see Map 3.10). Where mining occurs west of the Tropic Shale bedrock ridge, it is anticipated that conditions would be generally similar to those encountered during mining on adjacent lands at the Coal Hollow Mine. The mine pits at the currently operating Coal Hollow Mine in adjacent lands west of the Tropic Shale bedrock ridge have encountered modest quantities of groundwater (generally less than approximately 25 gpm in the mine pits at any one time) where saturated alluvial sediments have been intercepted by the mine pits. Discharges of mine water to Lower Robinson Creek through the mine's UPDES discharge locations have been infrequent and of relatively low volume. In the six UPDES discharge events to Lower Robinson Creek that were monitored in 2011, the TDS concentrations of the mine discharge water ranged from 704 to 1,820 mg/L, averaging 1,037 mg/L. The discharge rates at the UPDES discharge points during these events ranged from 1.3 to 15 gpm, averaging 5.4 gpm. The discharges that occurred in 2011 consisted of both surface waters and groundwaters intercepted in the mine pit areas. There have been no UPDES discharges from the Coal Hollow Mine since November 2011, during which time dryer climatic conditions have generally prevailed in the region.

The Smirl Coal Zone in the tract (in the Lower Robinson Creek drainage east of the Tropic Shale bedrock ridge) is present where overburden thickness exceeds 200 feet. If these areas are surface mined, considerable thicknesses of saturated alluvial sediments in Sink Valley could be intercepted in the mine pit highwalls, potentially resulting in large groundwater inflows into the mine pits. Such large inflows of alluvial groundwater could result in the need to discharge considerable quantities of the intercepted alluvial groundwater through the mine's UPDES discharge permit (DOGM 2013a) (Chapter 7 of Coal Hollow Mine MRP). TDS concentrations of alluvial groundwaters in Sink Valley are generally good (< 500 mg/L TDS) and supportive of use for both irrigation and stock watering (DOGM 2013b). The discharge of intercepted alluvial groundwater of this quality to Lower Robinson Creek through UPDES discharge points would not risk causing increases to surface-water TDS in Lower Robinson Creek that would limit its potential use for irrigation or stock watering.

In potential thick-overburden mining areas further north in Block C, alluvial sediments that could support alluvial groundwater systems are much less prevalent (see Map 3.10), and potential recharge for these less-extensive alluvial sediments is generally lacking (as evidenced by the dry hillside, lack of springs, and lack of major surface-water drainages in adjacent upgradient areas). In these mining areas, the potential for the interception of appreciable saturated alluvial sediments in the mine pits is likely considerably lower than it is in the Sink Valley area.

If areas of the tract in the Lower Robinson Creek drainage east of the Tropic Shale bedrock ridge (with overburden thicknesses exceeding 200 feet) are mined using underground-mining techniques, overlying alluvial groundwater systems would likely not be impacted. This is because the presence of soft, low-permeability Tropic Shale bedrock would hydraulically isolate the overlying alluvial groundwaters from the underlying Smirl Coal Zone that lies directly beneath the Tropic Shale. Consequently, discharges of considerable quantities of mine water from the underground workings in these areas would not be anticipated, and thus no significant impacts to water quality in Lower Robinson Creek would be anticipated.

4.16.4.1.4 Ephemeral Washes

4.16.4.1.4.1 Surface-water Quantity and Use

Surface waters are only present in the ephemeral washes in direct response to snowmelt and intense precipitation events. As the land surface in the watershed of an ephemeral wash is disturbed, snowmelt and precipitation runoff waters that would previously have flowed into the ephemeral wash would be routed to storm water retention ponds and not discharged, resulting in diminished flow rates in that wash. This impact would be short lived, however, because once mining and reclamation of the land in the drainage are complete and the surface drainage restored to approximate pre-mining conditions, surface waters would again report to the ephemeral wash.

4.16.4.1.4.2 Surface-water Quality

Ephemeral washes in the tract are commonly deeply incised and unstable in their current configurations (Petersen Hydrologic 2007). Because of these conditions, appreciable erosion of the ephemeral washes and accompanying sediment transport occur during high-discharge events, resulting in elevated TSS concentrations. Interactions with soluble minerals present in these sediments commonly result in increased TDS concentrations (Petersen Hydrologic 2013). Where surface mining locations intersect the ephemeral wash locations, the washes would be excavated by the mine pits. During reclamation of these areas, the washes would be restored to conditions that would likely be at least as stable as the pre-mining condition. Consequently, significant detrimental impacts to water quality in the ephemeral washes (relative to current conditions) would likely not occur.

4.16.4.1.5 Drainage Conditions

4.16.4.1.5.1 Kanab Creek

All of the reaches of Kanab Creek in the tract are in the no-coal zone. Further, there are no potential mining areas within the 100-foot buffer zone for Kanab Creek. Centralized and dispersed facilities would not be constructed in the DOGM-required 100-foot perennial stream buffer zone for Kanab Creek. Any required stream crossings on Kanab Creek would be constructed in accordance with applicable federal and state regulations, which would minimize the potential for impacts to the Kanab Creek stream channel. Accordingly, no appreciable mine-related impacts to the PFC of Kanab Creek in the tract relative to its current condition would be anticipated.

4.16.4.1.5.2 Simpson Hollow Creek

With the exception of portions of the East Fork of Simpson Hollow Creek and the West Fork of Simpson Hollow Creek, the rest of the Simpson Hollow Creek stream channel in the tract is in the no-coal zone and is also outside the limit of pit disturbance. Thus, disturbance of the Simpson Hollow Creek stream channel in these areas by mine pit disturbance would not occur. Those reaches of the East Fork of Simpson Hollow Creek in the coal zone in Block NW would be disturbed by mine-related activities,

including the excavation of the mine pits. During mine reclamation activities, if the stream is reconstructed with a properly sized and designed channel, the reconstructed channel could result in a channel that is at least as stable as the existing channel, minimizing the potential for increased sediment transport during high flows. The stream reconstruction would establish a functional stream channel, floodplain, and site-appropriate stabilizing riparian vegetation. Any required stream crossings would be constructed in accordance with applicable federal and state regulations, which would minimize the potential for impacts to the PFC of the stream channel. Accordingly, no appreciable mine-related impacts to the PFC of Simpson Hollow Creek in the tract relative to its current condition would be anticipated.

4.16.4.1.5.3 Lower Robinson Creek

Under the Proposed Action, approximately 0.49 mile of Robinson Creek would be relocated from the tract and diverted into a new human-made channel that is constructed with a bioengineered approach similar to those developed by NRCS and others (Federal Interagency Stream Restoration Workgroup 2001) (see Table 4.16.1). The stream reconstruction would establish a functional stream channel, floodplain, and site-appropriate stabilizing riparian vegetation. Ordinarily, the rerouting of a creek would have direct and indirect impacts to stream function and water quality. However, because Robinson Creek is currently ranked as "Functional – At Risk," if the stream is rerouted through a properly sized and designed channel, relocation could result in a more stable channel in many areas and therefore less sediment transport during high flows. Nonetheless, where streamside vegetation is removed or where the new channel has less shading, increases in water temperature would occur. This impact would be limited to the lower section of Robinson Creek, because the upper section of Robinson Creek (above the seepage area) is dry most of the time (Petersen Hydrologic 2007). This impact would be minimal during high-flow periods due to the relatively low residence time of the swiftly moving water. The thermal impact could be mitigated through planting riparian vegetation and using materials that mimic a natural stream channel on the rerouted channel. Removal of vegetation would also reduce stream stability locally because there would no longer be root material to hold streambanks in place.

The relocation of the channel would require a State of Utah Stream Alteration Permit and a CWA Section 404 Permit administered by the Department of the Army. Compensatory mitigation for loss of waters of the U.S., sediment controls, and other mitigation would likely be required under these permits. Any loss of channel function remaining after this mitigation would be long term. However, due to the Functional – At Risk status of the stream channel, the level of function could be maintained or improved during temporary relocation or reclamation, particularly with respect to erosion and downstream sedimentation. The design and construction of the relocated channel would be performed under the direction of DOGM, the USACE, and the BLM to optimize the performance of the relocated channel.

4.16.4.1.5.4 Ephemeral Washes

In their current configurations, many of the ephemeral washes in the tract have stream channels that are deeply incised and prone to appreciable erosion during high-discharge events (Petersen Hydrologic 2007). Under the Proposed Action, ephemeral washes would be intercepted by the excavated mine pit areas. During mine reclamation activities, if the ephemeral washes are reconstructed with properly sized and designed channels, the reconstructed channels could result in channels that are as stable as the existing channels, minimizing the potential for increased sediment transport during high flows. Reconstructed washes would need both horizontal and vertical (streambed/gradient controls) stabilization measures to ensure that erosion is not accelerated. Any required crossings of the ephemeral washes would be constructed in accordance with applicable federal and state regulations, which would minimize the potential for impacts to the PFC of the stream channels. Accordingly, no appreciable mine-related impacts to the PFC of the ephemeral washes in the tract relative to current condition would be anticipated.

4.16.4.2 GROUNDWATER

Under the Proposed Action, adverse short-term impacts to groundwater hydrology would occur from groundwater pumping for dust suppression. Groundwater pooled in mining pits could also be used for dust suppression. Water supplies needed for dust suppression are assumed to originate as groundwater. Assuming all the water used for dust suppression is lost to evaporation, the loss of groundwater would be 25 acre-feet per year. Over the approximate 25-year projected life of the mine under this alternative, 625 acre-feet of groundwater would be lost (625 acre-feet more than would be lost under the No Action Alternative; see Table 4.16.2). Assuming no groundwater recharge, this equates to approximately 6% of the first-order approximation of the groundwater resources available (10,000 acre-feet) in the zone from which groundwater resources would be extracted (Petersen 2010).

As described in Section 3.16.2, an attempt was made in the early 1960s to produce groundwater for industrial use from deep, large-diameter wells screened in the Navajo Sandstone in the tract. The wells did not produce sufficient quantities of groundwater for the attempt to be considered even remotely successful (Doelling et al. 1972). Accordingly, it is considered unlikely that groundwater from the Navajo Sandstone would be used for mining purposes in the tract. Therefore, an analysis of potential impacts resulting from pumping of deep groundwater resources is not provided here. As with any surface mining operation, groundwater systems in mine pit areas would obviously be directly impacted from the excavation of the mine pits. Because aquifer systems are generally not present in the Tropic Shale bedrock that overlies the coal zone in the tract (Petersen Hydrologic 2007), impacts of this nature would generally be limited to groundwater systems present in saturated alluvial sediments (which are of limited extent within most of the tract).

Groundwater could be affected by mine-generated subsidence in underground mining areas through changes to groundwater levels, flow, and quality. Because mining produces voids in the strata, these voids induce groundwater movement from the surrounding saturated rock, leading to nearby rock dewatering while water accumulation occurs in the voids. This water movement is often accompanied by rock fracturing or movement, which can change how water moves through the rock, leading to changes in groundwater level, storage capacity, flow direction, and chemistry (Society for Mining 1992). Other potential hydrological impacts from underground mining include changes to the permeability of rock units, creation of fresh rock surfaces, and water flow between previously unconnected units or between surface and groundwater, leading to decreased evapotranspiration in those areas (Marcus 1997).

The bedrock overburden in the underground mining area in the northeast portion of the tract in Block C consists entirely of Tropic Shale (see Map 3.10), which is known to have poor water-transmitting properties (Section 3.16.2). Along the eastern edge of Block C, the Tropic Shale bedrock is capped by a veneer of landslide deposits reported to range from a few feet to 100 feet or more. Alluvial sediments are also present in and near existing drainages (Tilton 2001). No springs or seeps with measurable discharge have been identified in the underground mining area in Block C (Frontier Corporation USA 2012).

In the absence of appreciable groundwater or surface-water resources in the area, there is no significant potential for the underground mining activities to impact important overlying groundwater or surface-water resources. Because of the presence of thick sequences of low-permeability Tropic Shale bedrock in potential underground mining areas, the potential for the downward migration of recharge waters from the land surface through the Tropic Shale to underlying strata is considered low. Because of the lenticular, discontinuous nature of permeable and impermeable strata in the Dakota Formation, the ability for lateral migration of groundwater for appreciable distances is also considered low (Petersen Hydrologic 2007). Consequently, it is considered unlikely that appreciable groundwater systems would be present in Dakota Formation bedrock beneath the mine coal zone in potential underground mining areas.

Based on estimates provided by Petersen (Petersen 2010), approximately 10,000 acre-feet of groundwater are held in storage in the Sink Valley alluvial groundwater system. Groundwater from the Sink Valley alluvial system could be extracted for use in mining operations on the tract. This is a first-order approximation of the available alluvial groundwater resource in Sink Valley that is based on conservative assumptions, including 1) an aerial extent of approximately 1.5 square miles, 2) an average saturated thickness of approximately 45 feet, and 3) an average effective porosity of approximately 0.25. Although tritium and radiocarbon dating of the alluvial groundwaters in Sink Valley indicate modern (post-1951) recharge (Petersen Hydrologic 2007), the rate at which recharge to the alluvial groundwater system occurs has not been determined.

Extraction of the coal resource would remove any water associated with the mined coal zone itself, including any groundwater present in pore spaces of the coal zone as well as the inherent moisture of the coal itself. Based on the experience at the existing Coal Hollow Mine, where only minor quantities of groundwater have been encountered in the mined coal zone, it is considered likely that only similarly small quantities of groundwater would be removed from the pore spaces in the coal zone during mining operations. The inherent moisture bound to the coal deposits would, of necessity, be removed with the coal during mining operations. With an average projected annual coal production of 2 million tons, the loss of moisture from coal would be 209 acre-feet per year. Most or all of this moisture is physically or chemically bound to the coal itself, and as such, it does not constitute a groundwater resource. Because the inherent coal moisture does not substantively contribute to groundwater or surface-water systems in the area, the extraction of the coal's inherent moisture would not result in any significant impact to the hydrologic balance.

A portion of groundwater pooled in mining pits that is not removed for dust suppression would be lost to evaporation and would represent a groundwater loss. Under the Proposed Action, up to 40 acres of groundwater would be exposed to evaporation at any one time. The average annual evaporation from standing water in the tract is approximately 35 inches (based on evaporation data available for Bryce Canyon National Park from 1971 to 1978). Therefore, the loss of groundwater from mining pits due to evaporation would be up to 116 acre-feet per year. Under this alternative, over the life of the mine, the total loss of groundwater due to evaporation from mining pits would be up to 2,900 acre-feet (2,900 acre-feet more than under the No Action Alternative; see Table 4.16.2). This estimate assumes that there would be one open pit (approximately 40 total acres) for the life of the mine. However, there would be one open pit only for the surface mining portion of the total mine life. For the underground mining portion of the mine life, there would not be any open pits and therefore no exposed groundwater as a result of mining. However, some groundwater would still be lost as a result of groundwater evaporation through underground mine openings.

Assuming that future water use rates for mining operations in the tract are similar to those currently being used at the existing Coal Hollow Mine, it would be anticipated that the use rate would not exceed approximately 25 acre-feet per year. If the source of this water is the Sink Valley alluvial groundwater system, this would represent approximately ¼ of 1% of the 10,000 acre-feet in storage per year. Because the rate of recharge to the alluvial groundwater system is not known, it is not known whether the long-term extraction of 25 acre-feet per year (equal to a continuous extraction rate of 15.5 gpm) would result in significant depletion of the alluvial groundwater storage in Sink Valley. However, based on the relatively small well production rates proposed, this seems unlikely.

The actual source(s) of water that would be used during mining operations at the tract would be determined by the eventual successful bidder for the Alton Coal Tract. Any appropriations of water for such use would be controlled by the Utah Division of Water Rights. Impacts to the hydrologic balance that could result from the use of the designated water source(s) would be evaluated and regulated during the mine permitting process by DOGM. As indicated previously, no appreciable aquifer systems are

believed to be present in the Tropic Shale bedrock in the tract. Thus, because of the absence of aquifers in the Tropic Shale, significant mine-related impacts to groundwater systems in that geologic formation would not be expected. Due to the poor groundwater-transmitting properties of the Dakota Formation (Petersen Hydrologic 2007), it is assumed that no degradation to deeper aquifers would occur.

The town of Alton holds State of Utah–appropriated water rights for municipal use. The water sources associated with these water rights include Birch Springs, located in Birch Canyon approximately 2.5 miles north of the tract; Seegmiller Springs, located more than 2 miles northeast of the tract; and a groundwater well approximately 0.8 mile north of the tract. Birch Springs discharges from the Brian Head Formation in upland areas that are isolated from the tract by the Sevier fault zone (see Section 3.6.3). Seegmiller Springs discharges from hillsides near the base of the Straight Cliffs Formation in the Kanab Creek valley. Because of the appreciable distances of these springs from the tract, and because these springs discharge from strata that are not present in the tract, water quality and water quantity at these springs should not be impacted by the mine-related activities in the tract. The alluvial well is reported to be 100 feet deep and screened in alluvial gravels situated near Kanab Creek (Utah Division of Water Rights 2014). Because the well is a considerable distance upgradient from the tract, and because mining within the Kanab Creek alluvium near the well is not proposed, the potential for impacts to water quantity or water quality at this well would be considered low. There are also no stock-watering wells in the tract, thus, none would be affected.

Due to the appreciable distances between springs used by the town of Alton and the tract, and because these springs discharge from strata that are not present in the tract, water quality and water quantity at these springs should not be impacted by the Proposed Action. The town of Alton's alluvial water well is reported to be 100 feet deep and screened in the alluvial sediments associated with Kanab Creek (Utah Division of Water Rights 2014). Because the well is a considerable distance upgradient from the tract, and because mining in the Kanab Creek alluvium near the well is not proposed, the potential for impacts to water quantity or water quality at this well would be considered very unlikely.

Based on laboratory analysis of samples collected in the Alton area but not directly in the tract, acid-forming and toxic-forming materials that could result in the contamination of groundwater supplies in the tract are generally not present (Petersen Hydrologic 2007). As part of the permitting process, DOGM requires permittees to pre-sample overburden for acid-forming and toxic-forming substances. In the event that either of these is discovered, the permittee would be required to develop a plan to treat these substances to minimize or eliminate impacts to groundwater quality.

Discussions of the potential for impacts to groundwater occurrence, use, hydrology, and quality in individual portions of the tract are presented in the subsections below.

4.16.4.2.1 Block C

4.16.4.2.1.1 Groundwater Occurrence, Use, and Hydrology

Shallow alluvial groundwater systems in Block C are likely recharged primarily by mountain front recharge mechanisms along the western flanks of the Paunsaugunt Plateau. In the southern portion of Block C (near Lower Robinson Creek), the primary recharge areas are in areas that are laterally removed and topographically upgradient of the tract (Petersen Hydrologic 2007). Therefore, no adverse impacts to groundwater quantity would be expected to occur in these areas from reduced recharge associated with the Proposed Action. In the central and northern portions of Block C, the primary mountain front recharge areas for shallow alluvial groundwater systems are in the tract along the eastern edge of Block C. Surface mining in these areas could disrupt the recharge to downgradient alluvial groundwater systems. Natural discharges from the alluvial groundwater systems in Block C are limited to a single seep (SP-39, which discharges at 0.05 gpm or less) and an alluvial groundwater seepage zone in the lower reaches of Lower

Robinson Creek (which commonly discharges at approximately 7 gpm or less). No springs, seeps, or perennial or intermittent stream reaches (other than Kanab Creek) have been identified in the central and northern portions of Block C (Frontier Corporation USA 2012). Where shallow alluvial groundwater systems are present in alluvial sediments in proposed mining areas, these systems would obviously be directly impacted as a result of the excavation of the alluvial sediments by the mine pits. However, other than SP-39 and the Lower Robinson Creek alluvial groundwater seepage zone, no springs or perennial or intermittent stream reaches or other natural expressions of groundwater discharge have been identified in the area. Therefore, the potential for impacts to groundwater resources is not appreciable. Based on stream gain/loss studies performed in Kanab Creek during low-flow conditions (see Figure 3.16.4), there is apparently no appreciable baseflow contribution to flows in Kanab Creek derived from the Block C area (other than the minor seepage sometimes present in Lower Robinson Creek). Accordingly, potential interception of upgradient alluvial groundwater systems in Block C would not result in significant adverse impacts to water quantity in Kanab Creek.

4.16.4.2.1.2 Groundwater Quality

Natural discharges from the alluvial groundwater systems in Block C are limited to a single seep (SP-39, which discharges at 0.05 gpm or less) and an alluvial groundwater seepage zone in the lower reaches of Lower Robinson Creek (which commonly discharges at approximately 7 gpm or less). No springs, seeps, or perennial or intermittent stream reaches (other than Kanab Creek) have been identified in the central and northern portions of Block C (Frontier Corporation USA 2012). Other than the alluvial seepage in Lower Robinson Creek, there is no identified groundwater-derived contribution to the baseflow in Kanab Creek from the Block C area (Section 3.16.2.1.1). Potential mechanisms by which significant impacts to the quality of groundwater resources would be likely have not been identified in Block C. Accordingly; impacts to groundwater quality are not anticipated.

4.16.4.2.2 Block NW

4.16.4.2.2.1 Groundwater Occurrence, Use, and Hydrology

Of the eight springs/seeps monitored in and immediately adjacent to Block NW, all but one (Seep 4) discharge from the no-coal zone. Consequently, the discharge areas for these springs/seeps would not be from mining operations in Block NW. The precise groundwater flow paths that convey the groundwater from recharge areas to the spring locations are not known. Consequently, it is not known whether mining in surrounding areas in Block NW could intercept these groundwater flow paths. If the groundwater flow paths are intercepted, diminished discharge rates at the springs would be anticipated. However, because of the presence of the low-permeability Tropic Shale bedrock that overlies the coal zone in potential mining areas, the potential for vertical recharge to deeper groundwater systems through this formation is considered minimal. Consequently, it is unlikely that the primary recharge areas for these springs would occur in potential mine pits disturbance areas within the coal zone. Thus, the potential for mining operations in Block NW to adversely impact flow rates at these springs is low.

Further investigation of the recharge areas, groundwater flow paths, and discharge mechanisms for these springs would be performed as part of the mine permitting process through DOGM. Seep 2 is a minor seepage area in the Smirl Coal Zone a short distance below adjacent irrigated agricultural fields in Block NW (see Map 3.17). This seep discharges at low rates (< 0.25 gpm) with high TDS concentrations (> 12,000 mg/L) from shallow, weathered Tropic Shale–derived sediments and soils. Because this seep is in the Smirl Coal Zone, the seep could be intercepted by the mine pits during mining in Block NW.

Although springs, seeps, wetlands, and flowing stream reaches are present in the western three-quarters of Block NW, such features are mostly absent in the eastern quarter of Block NW. In the eastern quadrant of Block NW, Tropic Shale bedrock or a thin veneer of alluvial sediments is present at the land surface.

4.16.4.2.2.2 Groundwater Quality

Most springs and seeps in Block NW discharge from the no-coal zone and consequently would not be directly disturbed by mining activities. Because of the low potential for appreciable groundwater flow through the Tropic Shale bedrock, it is unlikely that groundwater recharge or flow path areas would be intercepted by surface-mining operations in the Smirl Coal Zone. Consequently, because it is unlikely that either the primary groundwater recharge areas or the discharge locations would be disturbed by mining operations, the potential for significant impacts to the quality of groundwater in Block NW is low.

4.16.4.2.3 Blocks CWN and CWS

4.16.4.2.3.1 Groundwater Occurrence, Use, and Hydrology

No springs with visible or measurable discharge have been identified in Block CWS. A single seepage area (SP-41) is present in the no-coal zone adjacent to Block CWS. Measurable discharge from SP-41 has not been observed. Similarly, a single seep (Seep 1) has been identified adjacent to Block CWN in the no-coal zone. Measurable discharge at Seep 1 has not been observed, although stagnant puddles are usually present. No perennial or intermittent stream reaches have been identified in either Blocks CWN or CWS. The Alton Mine, which was first operated in the 1960s in Block CWS (and has since been reclaimed), was noted as being a dry mine (Doelling et al. 1972). Because there are no appreciable groundwater or surface-water resources in Blocks CWN and CWS, there is no potential for significant impacts to groundwater or surface-water discharge rates as a result of the Proposed Action.

4.16.4.2.3.2 Groundwater Quality

There are no appreciable groundwater resources identified in Blocks CWN and CWS. Accordingly, there are no anticipated water-quality impacts to groundwater resources.

4.16.4.2.4 Blocks S and Sa

4.16.4.2.4.1 Groundwater Occurrence, Use, and Hydrology

Only one spring has been identified in Blocks S and Sa. SP-38 seeps from weathered clayey sediments in the no-coal zone in Block Sa (see Map 3.17). Measureable discharge from SP-38 is rarely present, and when present is typically less than 1 gpm (Petersen Hydrologic 2013). The quality of the groundwater monitored at SP-38 when it is present (usually in small stagnant pools) has ranged from 4,400 to 14,900 mg/L TDS, limiting its potential for use for irrigation or stock watering. There are no perennial or intermittent stream reaches in Blocks S or Sa. Because there are no appreciable groundwater resources in Blocks S and Sa, the potential for adverse impacts to groundwater discharge rates within these blocks as a result of the Proposed Action is low.

An additional seep (SP-27) discharges from private lands near the border between the private lands and the Block S and Sa area (see Map 3.17). Discharge from SP-27 has only rarely been observed, and the spring area is usually dry (Petersen Hydrologic 2013). On the two occasions when sufficient discharge was present at SP-27 to collect a groundwater sample, the TDS concentrations of the water ranged from 3,780 to 6,550 mg/L, which limits its potential use for stock watering or irrigation purposes. Mining associated with the Proposed Action would intercept the seep area with the mine pits. Additional springs and seeps have been identified in alluvial groundwater systems on private lands in Sink Valley east of Blocks S and Sa (Petersen Hydrologic 2007). The potential for discharge rates from these springs to be impacted by nearby coal mining operations at the existing Coal Hollow Mine has been previously evaluated in conjunction with mine permitting activities at the Coal Hollow Mine (DOGM 2013a).

4.16.4.2.4.2 Groundwater Quality

No appreciable or developable groundwater resources are known to be present in Blocks S and Sa. With the exceptions of SP-38 (with measured TDS concentrations ranging from 4,400 to 14,900 mg/L, and discharge rates of less than 1 gpm) and SP-27 (with measured TDS concentrations ranging from 3,780 to 6,550 mg/L, and discharge rates of less than 1 gpm), no appreciable groundwater discharge (as expressed by springs or seeps) has been observed in Blocks S and Sa. Because of the general lack of groundwaters and the poor water quality of the two seeps, there is expected to be no appreciable risk of impacting the quality of groundwater resources within Blocks S and Sa.

4.16.4.3 WETLANDS, RIPARIAN AREAS, FLOODPLAINS, AND ALLUVIAL VALLEY FLOORS

Under the Proposed Action, approximately 32.5 acres of wetlands in the tract identified in a 2012 delineation report would be removed from surface-mining operations, compared to none under the No Action Alternative (see Table 4.16.2) (Frontier Corporation USA 2012). This is approximately 60% of the total 54.0 acres of wetlands in the tract. Approximately 30.0 acres (92.3%) of the 32.5 acres of wetlands removed are irrigated wet meadow habitat type in Block NW. Approximately 2.4 acres (7.4%) of the 32.5 acres of wetlands removed are riparian wet meadow habitat type in Block NW. Approximately 0.1 acre of riparian wet meadow habitat type would be impacted from the relocation of KFO Route 116 under the Proposed Action. In the short term, the functions performed by these wetlands would be lost with the removal of the wetland areas. Riparian wet meadow areas tend to be heavily grazed. Spring runoff, surface drainage, and a seasonally high water table appear to be the main sources of hydrology for these wetlands. Irrigated wet meadow areas are slope wetlands found in association with drainage coming off irrigated alfalfa fields in Block NW. Irrigation return flows, natural surface drainage, and a seasonally high water table appear to be the main sources of hydrology for these wetlands. Mixed riparian, scrub-shrub/wet meadow areas were identified along the south reach of Kanab Creek. Seasonal flooding and near-surface groundwater associated with the alluvial aquifer appear to be the main sources of hydrology for these wetlands. Reclamation would partially or fully restore the wetland functions lost; however, the precise pre-mining structure, extent, and character of the wetlands would be permanently altered. Assuming these wetlands are jurisdictional, the successful bidder would be required to complete a functional assessment and mitigate wetland impacts in accordance with guidance and directives provided by USACE during the CWA Section 404 permitting process.

Under the Proposed Action, total disturbance to riparian areas would be 11.0 acres (see Table 4.16.2). Of this total, 3.8 acres of disturbance would result from surface mining. Direct impacts from the relocation of KFO Route 116 would be from the removal of 0.5 acre of riparian area. Assuming that impacts from dispersed facilities (160 acres) are proportional to the acreage of riparian areas present in the no-coal zone (where all dispersed facilities are assumed to be located), approximately 6.7 acres of riparian area would be lost from the construction of these facilities. Under the Proposed Action, the total disturbance to riparian areas of 11.0 acres would be 11.0 acres more disturbance than under the No Action Alternative. The impacts from disturbance or removal of riparian areas would depend on the quality of the existing habitat and the reclamation that followed the disturbance. Impacts could include loss of native vegetation, loss of wildlife habitat, destabilization of the associated streambanks, loss of habitat for fish and other aquatic life, lowering of the water table, and erosion.

Under the Proposed Action, all floodplains/terraces (57 acres) and probable AVFs (57 acres) present on the tract occur in the no-coal zone. Though these acreagese would not be directly impacted from pit disturbance, direct impacts would result from construction of dispersed facilities and relocation of KFO Route 116. The floodplains/AVFs make up approximately 5.0% of the total no-coal zone area available for dispersed facilities (1,131 acres) under the Proposed Action. Assuming that impacts from dispersed facilities (160 acres) are proportional to the acreage of floodplains/AVFs present in the no-coal zone,

approximately 8 acres of floodplains/AVFs could be impacted under the Proposed Action (8 acres more disturbance of floodplains/AVFs areas than under the No Action Alternative; see Table 4.16.2). Approximately 60,565 linear feet of ephemeral and intermittent drainages are within the surface mining areas of the coal zone associated with this alternative. Approximately 17,102 linear feet of perennial (including 96 linear feet of Kanab Creek), intermittent, and ephemeral drainages are within the underground mining area. In surface mining areas, any riparian and floodplain character would be lost for the duration of mining. Post-mining restoration of drainages and related success criteria would be determined during the DOGM permitting process in these areas. In the absence of appreciable groundwater or surface-water resources in the area, there is no significant potential for the underground mining activities to impact important overlying surface-water resources.

The requirements to protect AVFs refer to protecting the essential hydrologic function of AVFs as they relate to the ability to conduct farming at the AVF. In the six areas delineated as probable AVFs (including the 8 acres that would be impacted under the Proposed Action), the essential hydrologic function is related to the ability of the land to be irrigated using surface water sourced from either Kanab Creek or Sink Valley Wash. Groundwater availability is not a significant factor in the essential hydrologic functions of any these probable AVFs (there is no groundwater-derived baseflow component of discharge in Sink Valley Wash that flows to the probable AVF in lower Sink Valley Wash) (Petersen Hydrologic 2008). Accordingly, the only reasonably plausible way that the essential hydrologic functions of these AVFs could be impacted would be if impacts to water quantity or water quality in Kanab Creek or lower Sink Valley Wash were to occur (these are discussed above). Because the probable AVFs are in no-coal areas, and thus would not be mined, the physical capability of the land to be irrigated would not be impacted outside of the construction of dispersed facilities and relocation of KFO Route 116 in these areas (approximately 207 acres, and no more than 57 acres, which is the total area of probable AVFs in the tract). Development of floodplains would result in the loss of their functions and values in these areas (approximately 8 acres; see Table 4.16.2). Floodplain functions that could be lost include flood storage and attenuation, riparian habitat (described above), groundwater recharge, water filtration, and erosion prevention.

4.16.5 Alternative C: Reduced Tract Acreage and Seasonal Restrictions

Under Alternative C, the tract would be modified to exclude Block NW (see Map 2.2). Further, certain mining activities in the tract's southern portion (Block S) would be subject to seasonal restrictions to reduce impacts to the local sage-grouse population. Under Alternative C, the modified tract would be offered for lease at a sealed-bid, competitive lease sale, subject to standard and special lease stipulations developed for the tract. The boundaries of the modified tract would be reasonably consistent with the configuration shown in Map 2.2.

Approximately 1,662 acres of surface disturbance would occur in the Alton Coal Tract under Alternative C (see Table 4.16.1). As under the Proposed Action, underground mining would occur on 613 acres of land in the tract under Alternative C.

4.16.5.1 SURFACE WATER

Impacts to surface-water quantity under Alternative C would be of the same nature as those under the Proposed Action, but would be of lesser magnitude. Under this alternative, 1,490 acres of the tract would be disturbed by surface mining and the construction of centralized facilities (1,490 acres more than would be disturbed under the No Action Alternative). Runoff from 1,490 acres (1.3% of the area draining to the USGS gauge) would be diverted and captured in storm water retention ponds to reduce the amount of eroded sediments discharged to downstream water bodies such as Kanab Creek and Robinson Creek.

Under Alternative C, approximately 24 acre-feet of water would be captured from disturbed areas (24 more acre-feet than under the No Action Alternative; see Table 4.16.2). Areas where runoff would not be captured (the road relocation ROW and dispersed facilities) would be treated through the use of silt fencing, check dams (e.g., straw bales), or other BMPs that slow runoff and allow sediments to settle. As discussed for the Proposed Action, this water would be removed from the surface-water system due to infiltration and evaporation.

Impacts to surface-water quality under Alternative C would be of the same nature as those under the Proposed Action, but would be of a lesser magnitude. Under Alternative C, approximately 24 acre-feet of water would be captured from disturbed areas (see Table 4.16.2). This quantity of water would no longer reach receiving waters downstream, resulting in reduced dilution and therefore a potential increase in the concentration of pollutants in associated surface waters compared to the No Action Alternative.

Adverse impacts along the coal haul transportation route would be the same as those described under the Proposed Action, but would occur for approximately 21 years rather than approximately 25 years.

4.16.5.1.1 Kanab Creek, Lower Robinson Creek, and Ephemeral Washes

4.16.5.1.1.1 Surface-water Quantity and Use

Impacts to the hydrology of these drainages would be the same as those under the Proposed Action. However, there would be no impact to the hydrology of ephemeral washes in Block NW, because there would be no mining in Block NW.

4.16.5.1.1.2 Surface-water Quality

Impacts to surface-water quality in these drainages would be the same as those under the Proposed Action. However, there would be no impact to the quality of ephemeral washes in Block NW, because there would be no mining in Block NW.

4.16.5.1.2 Simpson Hollow Creek

4.16.5.1.2.1 Surface-water Quantity and Use

Under Alternative C, no significant impacts to surface-water hydrology in Simpson Hollow Creek would be anticipated. Because mining activities in a headwaters area for Simpson Hollow Creek in Block NW would not occur, no impacts to surface-water hydrology would be anticipated.

4.16.5.1.2.2 Surface-water Quality

Changes to TDS concentrations to Simpson Hollow Creek potentially resulting from decreased flow rates from springs and seeps in Block NW would not occur because the area would not be mined (although the potential for this occurrence is considered low under the No Action Alternative). Loss of surface-water runoff in Simpson Hollow Creek resulting from the impoundment and retention of surface-water runoff within disturbed areas in Block NW would not occur.

4.16.5.1.3 Drainage Condition

4.16.5.1.3.1 Kanab Creek

Impacts to the drainage condition of Kanab Creek under Alternative C would be the same as those under the Proposed Action.

4.16.5.1.3.2 Simpson Hollow Creek

Under Alternative C, the primary source areas for Simpson Hollow Creek would not experience mining. No appreciable impacts to drainage condition would be anticipated as a result of the Proposed Action. Similarly, no appreciable impacts to drainage condition would be anticipated under Alternative C.

4.16.5.1.3.3 Lower Robinson Creek

Under Alternative C, approximately 0.49 mile of Robinson Creek would be relocated from the area that would be surface mined into a new human-made channel hardened with riprap (see Table 4.16.1). This is the same length as would be relocated under the Proposed Action. Thus, Alternative C would have the same direct and indirect impacts to drainage condition and water quality as described under the Proposed Action.

4.16.5.1.3.4 Ephemeral Washes

There would be no change relative to Proposed Action, although any ephemeral washes present in Block NW would not be impacted by mining activities.

4.16.5.2 GROUNDWATER

Impacts to groundwater hydrology under Alternative C would be the same as those under the Proposed Action but would be of a lesser magnitude. Over the approximate 21-year life of the mine under Alternative C, groundwater losses for dust suppression would be approximately 525 acre-feet (525 more acre-feet than under the No Action Alternative; see Table 4.16.2). Assuming no groundwater recharge, this equates to approximately 5% of the estimated groundwater resources available (10,000 acre-feet) in the zone from which groundwater resources would be extracted (Petersen 2010).

Groundwater losses from the removal of coal moisture would also occur under Alternative C, with 3,981 acre-feet of moisture lost (3,981 acre-feet more than would occur under the No Action Alternative) over the life of the mine (see Table 4.16.2). However, as explained in Section 4.16.4.2, most or all of this moisture is physically or chemically bound to the coal itself, and as such, it does not constitute a usable groundwater resource.

Groundwater pooled in mining pits that is not removed for dust suppression would be lost to evaporation and would represent a groundwater loss. Under Alternative C, up to 80 acres of groundwater would be exposed to evaporation at any one time. The maximum annual evaporation from standing water in the tract is approximately 35 inches per year. Therefore, the loss of groundwater from mining pits from evaporation would be up to 233 acre-feet per year. Under this alternative, over the life of the mine, the total loss of groundwater due to evaporation from mining pits would be up to 4,893 acre-feet (4,893 acre-feet more than under the No Action Alternative; see Table 4.16.2). This estimate assumes that there would be two open pits (approximately 80 total acres) for the life of the mine. However, there would be two open pits only for a portion of the total mine life to comply with the timing restrictions of this alternative. Following this time frame, up to 40 acres of groundwater would be exposed as a result of pooling in mining pits (one open pit). Further, for the underground mining

portion of the mine life, there would not be any open pits and therefore no exposed groundwater as a result of mining. However, some groundwater would still be lost as a result of evaporation through underground mine openings. Also, if the underground mine discharges water to a settling pond, then some evaporation would occur there.

Potential degradation to deeper aquifers (and therefore impacts to municipal water supplies) and potential impacts to groundwater resources as a result of acid-forming and toxic-forming materials would be the same under Alternative C as under the Proposed Action.

Subsidence-related water resources impacts from underground mining under Alternative C would be of the same nature and magnitude as those for the Proposed Action, because the area that would be underground mined under Alternative C would also be underground mined under the Proposed Action.

4.16.5.2.1 Blocks C, CWN, CWS, S, and Sa

4.16.5.2.1.1 Groundwater Occurrence, Use, and Hydrology

Impacts to groundwater hydrology under Alternative C would be the same as those under the Proposed Action.

4.16.5.2.1.2 Groundwater Quality

Impacts to groundwater quality under Alternative C would be the same as those under the Proposed Action.

4.16.5.2.2 Block NW

4.16.5.2.2.1 Groundwater Occurrence, Use and Hydrology

There would be no impacts to groundwater hydrology under Alternative C, because there would be no mining in Block NW.

4.16.5.2.2.2 Groundwater Quality

There would be no impacts to groundwater quality under Alternative C, because there would be no mining in Block NW.

4.16.5.3 WETLANDS, RIPARIAN AREAS, FLOODPLAINS, AND ALLUVIAL VALLEY FLOORS

Under Alternative C, the irrigated wet meadow wetlands (30 acres) in Block NW that would be impacted under the Proposed Action would not be disturbed as a function of mining because this portion of the tract would not be included in a lease sale under this alternative (see Table 4.16.2). Approximately 0.03 acre of riparian wet meadow wetlands would be impacted by relocation of KFO Route 116 under Alternative C.

Under the Alternative C, total disturbance to riparian areas would be 10.1 acres (see Table 4.16.2). Of this total, 3.7 acres would be disturbed from surface mining. Direct impacts from the relocation of KFO Route 116 would be from the removal of 0.3 acre of riparian area. Assuming that impacts from dispersed facilities (135 acres) are proportional to the acreage of riparian areas present in the no-coal zone (where all dispersed facilities are assumed to be located), approximately 6.1 acres of riparian area would be disturbed from the construction of these facilities. Under Alternative C, the total disturbance to riparian areas of 10.1 acres would be 10.1 acres more disturbance than under the No Action

Alternative. As under the Proposed Action, the impacts due to disturbance or removal of riparian areas would depend on the quality of the existing habitat and the reclamation that followed the disturbance. Impacts would include loss of native vegetation, loss of wildlife habitat, and destabilization of the associated streambanks.

Under Alternative C, all floodplains/terraces (57 acres) and probable AVFs (57 acres) present on the tract occur in the no-coal zone. Though this acreage would not be directly impacted from pit disturbance, direct impacts would result from construction of dispersed facilities and relocation of KFO Route 116. The nature of these impacts would be the same under Alternative C as under the Proposed Action. The floodplains/AVFs make up approximately 5.5% of the total no-coal zone area available for dispersed facilities (1,034 acres). Assuming that impacts from dispersed facilities (135 acres) are proportional to the acreage of floodplains/AVFs present in the no-coal zone, approximately 7.4 acres of floodplain/AVF area would receive surface disturbance under Alternative C (7.4 acres more disturbance of floodplain/AVF area than under the No Action Alternative; see Table 4.16.2). Approximately 52,660 linear feet of ephemeral and intermittent drainages are within the surface mining areas of the coal zone associated with this alternative. Approximately 17,102 linear feet of intermittent and ephemeral drainages are within the underground mining area. In surface mining areas, any riparian and floodplain character would be lost for the duration of mining. Post-mining restoration of drainages and related success criteria would be determined during the DOGM permitting process in these areas. In the absence of appreciable groundwater or surface-water resources in the area, there is no significant potential for the underground mining activities to impact important overlying surface-water resources.

4.16.6 Alternative K1: Reduced Tract Acreage

Under Alternative K1, the tract would be modified to exclude Block NW and Block S (see Map 2.3). Under Alternative K1, the modified tract would be offered for lease at a sealed-bid, competitive lease sale, subject to standard and special lease stipulations developed for the tract. The boundaries of the modified tract would be reasonably consistent with the configuration shown in Map 2.3.

Approximately 1,012 acres of surface disturbance would occur in the Alton Coal Tract under Alternative K1 (see Table 4.16.1). As under the Proposed Action and Alternative C, underground mining would occur on 613 acres of land in the tract under Alternative K1.

4.16.6.1 SURFACE WATER

Impacts to surface-water quantity under Alternative K1 would be of the same nature as those under the Proposed Action and Alternative C, but would be of lesser magnitude. Under this alternative, 905 acres of the tract would be disturbed by surface mining and the construction of centralized facilities (905 acres more than would be disturbed under the No Action Alternative). Runoff from 905 acres (0.8% of the area draining to the USGS gauge) would be diverted and captured in storm water retention ponds to reduce the amount of eroded sediments that are discharged to downstream water bodies such as Kanab Creek and Robinson Creek. Under Alternative K1, approximately 14 acre-feet of water would be captured from disturbed areas (14 more acre-feet than under the No Action Alternative; see Table 4.16.2). Areas where runoff would not be captured (the road relocation ROW and dispersed facilities) would be treated through the use of silt fencing, check dams (e.g., straw bales), or other BMPs that slow runoff and allow sediments to settle. As discussed for the Proposed Action, this water would be removed from the surface-water system due to infiltration and evaporation.

Impacts to surface-water quality under Alternative K1 would be the same as those under the Proposed Action but would be of a lesser magnitude. Under Alternative K1, approximately 14 acre-feet of water would be captured from disturbed areas (see Table 4.16.2). This quantity of water would no longer reach receiving waters downstream, resulting in reduced dilution and therefore a potential increase in the concentration of pollutants in associated surface waters compared to the No Action Alternative.

Adverse impacts along the coal haul transportation route would be the same as those described under the Proposed Action, but would occur for approximately 16 years rather than approximately 25 years.

4.16.6.1.1 Kanab Creek, Simpson Hollow Creek, and Lower Robinson Creek

4.16.6.1.1.1 Surface-water Quantity and Use

Impacts to surface-water hydrology of Kanab Creek, Simpson Hollow Creek, and Lower Robinson Creek under Alternative K1 would be the same as those under Alternative C.

4.16.6.1.1.2 Surface-water Quality

Impacts to surface-water quality of Kanab Creek, Simpson Hollow Creek, and Lower Robinson Creek under Alternative K1 would be the same as those under Alternative C.

4.16.6.1.2 Ephemeral Washes

4.16.6.1.2.1 Surface-water Quantity and Use

Impacts to surface-water hydrology of ephemeral washes under Alternative K1 would be the same as those under Alternative C.

4.16.6.1.2.2 Surface-water Quality

Impacts to water quality of ephemeral washes under Alternative K1 would be the same as the impacts under Alternative C, except ephemeral washes in Block S would not be impacted because there would be no mining in Block S.

4.16.6.1.3 Drainage Conditions

4.16.6.1.3.1 Kanab Creek, Simpson Hollow Creek, and Lower Robinson Creek

Impacts to PFC of Kanab Creek, Simpson Hollow Creek, and Lower Robinson Creek under Alternative K1 would be the same as those under Alternative C.

4.16.6.1.3.2 Ephemeral Washes

Impacts to the stream channel stability of ephemeral washes under Alternative K1 would be the same as those under Alternative C, except ephemeral washes in Block S would not be impacted because there would be no mining in Block S.

4.16.6.2 GROUNDWATER

Impacts to groundwater hydrology under Alternative K1 would be the same as those under the Proposed Action but would be of a lesser magnitude. Over the approximate 16-year life of the mine under Alternative K1, groundwater losses for dust suppression would be approximately 400 acre-feet (400 more

acre-feet than under the No Action Alternative; see Table 4.16.2). Assuming no groundwater recharge, this equates to approximately 4% of the estimated groundwater resources available (10,000 acre-feet) in the zone from which groundwater resources would be extracted (Petersen 2010).

Groundwater losses from the removal of coal moisture would also occur under Alternative K1, with 3,135 acre-feet of moisture lost (3,135 acre-feet more than would occur under the No Action Alternative) over the life of the mine (see Table 4.16.2). However, as explained in Section 4.16.4.2, most or all of this moisture is physically or chemically bound to the coal itself, and as such, it does not constitute a usable groundwater resource.

Groundwater pooled in mining pits not removed for dust suppression would be lost to evaporation and represents a groundwater loss. Under Alternative K1, up to 40 acres of groundwater would be exposed to evaporation at any one time. The maximum annual evaporation from standing water in the tract is approximately 35 inches per year. Therefore, the loss of groundwater from mining pits due to evaporation would be up to 116 acre-feet per year. Under this alternative, over the life of the mine, the total loss of groundwater due to evaporation from mining pits would be up to 1,856 acre-feet (1,856 acre-feet more than under the No Action Alternative; see Table 4.16.2). This estimate assumes that there would be one open pit (approximately 40 total acres) for the life of the mine. During underground mining, some groundwater would be lost as a result of evaporation through underground mine openings (i.e., evaporation from mine ventilation). If the underground mine discharges water to a settling pond, then some evaporation would occur there.

Potential degradation to deeper aquifers (and therefore impacts to municipal water supplies) and potential impacts to groundwater resources as a result of acid-forming and toxic-forming materials would be the same under Alternative K1 as under the Proposed Action.

Subsidence-related water resources impacts from underground mining under Alternative K1 would be of the same nature and magnitude as those under the Proposed Action, because the area that would be underground mined under Alternative K1 would also be underground mined under the Proposed Action.

4.16.6.2.1 Blocks C, NW, CWN, and CWS

4.16.6.2.1.1 Groundwater Occurrence, Use, and Hydrology

Impacts to groundwater hydrology under Alternative K1 would be the same as those under Alternative C.

4.16.6.2.1.2 Groundwater Quality

Impacts to groundwater quality under Alternative K1 would be the same as those under Alternative C.

4.16.6.2.2 Blocks S and Sa

4.16.6.2.2.1 Groundwater Occurrence, Use, and Hydrology

Impacts to groundwater hydrology under Alternative K1 would be the same as the impacts under Alternative C, except seeps SP-27 and SP-38 would not be disturbed by mining activities.

4.16.6.2.2.2 Groundwater Quality

Impacts to groundwater quality under Alternative K1 would be the same as those under Alternative C, except seeps SP-27 and SP-38 would not be disturbed by mining activities.

4.16.6.3 WETLANDS, RIPARIAN AREAS, FLOODPLAINS, AND ALLUVIAL VALLEY FLOORS

Under Alternative K1, the irrigated wet meadow wetlands (30 acres) in Block NW that would be impacted under the Proposed Action would not be disturbed as a function of mining because this portion of the tract would not be included in a lease sale under this alternative (see Table 4.16.2). Approximately 0.03 acre of riparian wet meadow habitat type would be impacted by the relocation of KFO Route 116 under Alternative K1.

Under Alternative K1, total disturbance to riparian areas would be 11.4 acres (see Table 4.16.2). Of this total, 3.7 acres would be disturbed from surface mining. Direct impacts from the relocation of KFO Route 116 would be from the removal of 0.3 acre of riparian area. Assuming that impacts from dispersed facilities (92 acres) are proportional to the acreage of riparian areas present in the no-coal zone (where all dispersed facilities are assumed to be located), approximately 7.4 acres of riparian area would be disturbed from the construction of these facilities. Under Alternative K1, the total disturbance to riparian areas of 11.4 acres would be 11.4 acres more disturbance than under the No Action Alternative. As under the Proposed Action, the impacts from disturbance or removal of riparian areas would depend on the quality of the existing habitat and the reclamation that followed the disturbance. Impacts would include loss of native vegetation, loss of wildlife habitat, and destabilization of the associated streambanks. Riparian areas that are supported by shallow, near-surface groundwaters could be impacted if water levels in the associated shallow groundwater systems are lowered as a result of proposed mining activities. Similarly, riparian areas that are supported by groundwater discharges from springs could be impacted if discharges from the associated springs are diminished. The potential for such occurrences would be evaluated by DOGM as part of the mine permitting process. Site-specific investigations of riparian systems and the potential for impacts to these systems based on a detailed MRP would be required as part of this process. Additionally, DOGM performs an assessment of the cumulative hydrologic impacts of coal mining for the region (CHIA), which includes an analysis of the potential for impacts to important ecosystems.

Under Alternative K1, all floodplains/terraces (57 acres) and probable AVFs (57 acres) present on the tract occur in the no-coal zone. Though this acreage would not be directly impacted from pit disturbance, direct impacts would result from construction of dispersed facilities and relocation of KFO Route 116. The nature of these impacts is the same under Alternative K1 as under the Proposed Action. The floodplains/AVFs make up approximately 9.7% of the total no-coal zone area available for dispersed facilities (581 acres). Assuming that impacts from dispersed facilities (92 acres) are proportional to the acreage of floodplains/AVFs present in the no-coal zone, approximately 9.0 acres of floodplain/AVF area would receive surface disturbance under Alternative K1 (9.0 acres more disturbance of floodplain/AVF area than under the No Action Alternative; see Table 4.16.2). Approximately 37,161 linear feet of ephemeral and intermittent drainages are within the surface mining areas of the coal zone associated with this alternative. Approximately 17,102 linear feet of intermittent and ephemeral drainages are within the underground mining area. In surface mining areas, any riparian and floodplain character would be lost for the duration of mining. Post-mining restoration of drainages and related success criteria would be determined during the DOGM permitting process in these areas. In the absence of appreciable groundwater or surface-water resources in the area, there is no significant potential for the underground mining activities to impact important overlying surface-water resources.

4.16.7 Reasonably Foreseeable Transportation Route and Coal Loadout

All action alternatives (Proposed Action, Alternative C, and Alternative K1) would incorporate the same reasonably foreseeable 110-mile transportation route between the tract and the coal loadout near Cedar City. Approximately 13.8 miles of perennial and intermittent stream would be within 100 feet of the reasonably foreseeable transportation route. Proceeding north from the tract, approximately 16,093 feet (3.05 miles) of perennial sections of the East Fork of the Virgin River, Sevier River, and Bear Creek, and crossings of Castle Creek, Asay Creek, Mammoth Creek, and Limestone Creek (as they enter the Sevier River) are within 100 feet of the route. Approximately 56,273 feet (10.7 miles) of intermittent drainages also occur within 100 feet of the route. No surface-water features occur within 100 feet of the reasonably foreseeable coal loadout. The route would cross known stream drainages (perennial and intermittent) 118 times (see Table 4.16.2).

Adverse effects common to all action alternatives include potential effects to surface water from the accidental spills of hazardous materials along the coal haul transportation route. The severity of this occurrence would be minimized due to the required implementation of spill prevention, control, and countermeasure plan regulations associated with the transportation and storage of bulk oil products (see the Hazardous Materials section of this chapter). Use of best available control measures to minimize and/or eliminate fugitive coal dust along the transportation route and at the loadout would be installed on all coal haul vehicles and at the facility.

4.16.8 Potential Mitigation Measures

The following measures could be applied to all action alternatives, in addition to required measures, to further reduce or eliminate impacts to water resources identified in the analysis above:

- Water detention ponds (rather than retention) could be used to decrease the amount of water lost to evaporation following its interception and collection.
- Temporarily (life of mine) relocated segments of Robinson Creek could be planted with native vegetation to shade the creek (reducing thermal pollution) and stabilize its banks (reducing sediment pollution).
- Any flow in Robinson Creek could be diverted around the construction area to reduce sediment discharges during construction; construction could take place during a period of zero or low flow.
- Temporarily (life of mine) relocated segments of Robinson Creek could be properly designed to function as a stable, functional channel with 1) a floodplain connected to the stream; 2) the proper width, velocity, and gradient to replace all lost habitat; and 3) the proper form to convey sediment without eroding or aggrading.
- Temporarily (for life of mine) relocated segments of Robinson Creek may avoid capturing groundwater, which could increase the concentration of TDS in the creek. However, the bed and banks could be constructed to avoid use of or contact with the Tropic Shale.
- Construction of dispersed facilities in wetlands, riparian areas, and floodplains/AVFs would be avoided to the maximum extent possible.

4.16.9 Unavoidable Adverse Impacts

The Proposed Action, Alternative C, and Alternative K1 would result in unavoidable adverse impacts to water resources even following implementation of protective measures and following the above potential mitigation measures. Approximately 0.49 mile of Robinson Creek would be unavoidably relocated under the action alternatives, including the removal of its streamside and riparian vegetation. Surface water on the tract would be lost due to evaporation from ponds and infiltration. Loss of

surface-water volume would reduce downstream dilution, and could therefore alter water quality. Some sediment runoff from dispersed facilities and road relocation ROWs would be unavoidable because BMPs are less than 100% effective. The risk of spills or water contamination would be small, but would be unavoidably increased under the action alternatives. Groundwater would also be consumed (depleted) under the action alternatives. Approximately 25 acre-feet per year of groundwater would be lost due to evaporation from pits and dust suppression. The loss of wetland acreage and function on the tract could not be avoided.

4.16.10 Short-term Uses versus Long-term Productivity

No impacts to the long-term productivity of water quantity are expected as a result of the short-term use of the land for coal extraction. Once mining ceases and reclamation is complete, mine-related water use and increased evaporation would cease. The short-term use of the land for coal extraction would result in long-term alteration of wetland and riparian area functions and productivity. Similarly, the short-term use of areas occupied by Robinson Creek would result in the long-term alteration of Robinson Creek.

4.16.11 Irreversible and Irretrievable Commitments of Resources

The following commitments of water resources would be irretrievable until successful reclamation was completed under the action alternatives:

- Loss of Robinson Creek's channel function and riparian vegetation
- Changes to Robinson Creek's discharge volume and water quality resulting from its realignment
- Loss of wetland area and function due to its removal and reconstruction
- Loss of riparian area and function due to its removal along Robinson Creek
- Surface disturbance to floodplains and probable AVFs as a result of the construction of dispersed facilities and relocation of KFO Route 116

4.17 Wildlife: General

This section assesses the environmental consequences of Alternative A (No Action), Alternative B (Proposed Action), Alternative C, and Alternative K1 on wildlife, raptors, and migratory birds with potential to occur on the proposed Alton Coal Tract and the reasonably foreseeable coal haul transportation route. Impacts to wildlife would be avoided to some degree through lease stipulations, and conservation and/or mitigation measures. However, both direct and indirect impacts to wildlife are expected to result from minerals development and construction activities in the tract, as proposed under the action alternatives, and from traffic changes on the reasonably foreseeable coal haul transportation route, both of which could affect individuals, populations, or habitat conditions.

4.17.1 Regulatory Framework and Lease Stipulations

4.17.1.1 REGULATORY FRAMEWORK

Numerous federal and state regulations shape the management of wildlife species. Regulations that pertain to wildlife and potential impacts from mining and other land uses include the following:

- The MBTA of 1929, as amended, establishes federal responsibility to protect international migratory birds and authorizes the Secretary of the Interior, through the USFWS, to regulate hunting of migratory birds. The North American Waterfowl Management Plan, signed in 1986 between Canada and the United States, further sets population goals and how to achieve them.
- The Taylor Grazing Act of 1934, as amended, requires cooperation with states and other groups interested in conservation and propagation of wildlife in established grazing districts. It provides for fishing and hunting in those districts in accordance with applicable laws.
- The Fish and Wildlife Coordination Act of 1958 mandates equal consideration of wildlife conservation with other features of water resource development programs. It requires that damage to fish and wildlife resources be prevented and that these resources be developed and improved.
- The CAA establishes the mechanism for control of air pollution for public health and welfare, recognizing wildlife as one aspect of public welfare.
- The FLPMA recognizes wildlife as a principal land use, requires consideration of wildlife objectives in commodity-oriented programs, and authorizes use of range-betterment funds for enhancement of habitat for fish and wildlife.
- The objective of the Federal Water Pollution Control Act of 1977 is the restoration and maintenance of the chemical, biological, and physical integrity of the nation’s waters at a quality sufficient to protect fish and wildlife and sufficient for recreational use.
- The Public Rangelands Improvement Act of 1978 directs that the condition of the public rangelands be improved so that they become as productive as feasible for wildlife habitat and other rangeland values. The act provides for on-the-ground funding of wildlife habitat protection, improvements, and maintenance projects.
- The North American Wetlands Conservation Act of 1989 is the first act to make federal funds available annually for wetland restoration in the United States, Canada, and Mexico. The act is intended to generate as much as $30 million a year toward the North American Waterfowl Management Plan.
- EO 13186 Responsibilities of Federal Agencies to Protect Migratory Birds directs executive departments and federal agencies to take certain actions to implement the MBTA.
- The DOI BLM and USFWS MOU (2010) to promote the conservation of migratory birds outlines a collaborative approach pursuant to EO 13186.

Other federal laws that could occasionally affect wildlife habitat management actions in the tract are those listed under Section 4.18.1.1.1, the MLA, the Water Resources Planning Act, the Water Pollution Act, the Water Resources Development Act, the Federal Grants and Cooperative Agreements Act, the Safe Drinking Water Act, the Fish and Wildlife Act, and the Soils and Water Resources Conservation Act.

4.17.1.2 DESIGN FEATURES

The KFO RMP and other BLM and state documents provide the framework for the tract's design features, which would be reflected in lease stipulations as part of a lease contract after a ROD. DOGM, a state agency under Utah's Department of Natural Resources (UDNR), would be responsible for ensuring compliance and enforcement of the lease stipulations. The following design features would be applicable to wildlife and would compel mitigation for impacts to wildlife related to mining the tract:

- Conduct baseline and annual wildlife monitoring surveys. If a decrease or negative effect resulting from mining activities is shown, appropriate species-specific mitigation measures would be developed at the permitting stage.
- During mining operations, follow approved raptor mitigation plans such as USFWS's *Utah Field Office Guidelines for Raptor Protection from Human and Land-use Disturbances* (Romin et al. 2002).
- Monitor for BCCs. Exact mitigation measures would be developed at the permitting stage.
- At permitting, develop a migratory bird and raptor conservation plan that outlines avoidance and minimization mitigation measures for impacts to migratory birds, raptors, and their habitat.
- After mining is completed, restore pre-mining topography to the maximum practical and economic extent possible.
- For site restoration, plant a diverse mixture of grasses, forbs, and shrubs in configurations beneficial to wildlife.
- During all operations, design fences to permit wildlife passage.
- Increase habitat diversity by creating rock clusters and shallow depressions on reclaimed land.
- Use appropriate plantings along reclaimed drainages, such as native species as well as species that provide forage for big game (some of which may not be native).
- After mining operations are completed, replace drainages, wetlands, and AVFs disturbed by mining.
- During all operations, operate vehicles at appropriate speed limits to minimize potential for wildlife mortality.
- During all operations, instruct employees not to harass or disturb wildlife.
- Conduct biannual post-reclamation surveys for undesirable invasive plant species.
- Begin vegetation monitoring during the next growing season following fall seeding and planting and monitor biannually to assess reclamation success until goals are achieved.
- Monitor reclamation sites to assess habitat reclamation success.
- Develop a practical and economic blasting plan that is sensitive to noise impacts on wildlife, especially during nesting and breeding seasons.

These design features would help reduce the severity of impacts to wildlife by enhancing and restoring native and suitable non-native vegetation communities in the short term and long term and by defining actions aimed at avoidance and minimization.

4.17.2 Impact Indicators and Thresholds

In this analysis, acres of surface disturbance in or adjacent to wildlife habitats are used as the primary indicator of impacts in the tract. Potential impacts to wildlife, such as changes in habitat quality or quantity, reduced population size, or increased mortality, are also used as impact indicators. Surface disturbance from minerals development and construction activities would occur in the tract as planned

under the action alternatives. Impacts to wildlife species associated with riparian habitats adjacent to the reasonably foreseeable coal haul transportation route are analyzed as acres within a 100-foot buffer on both sides of the route. Impacts to all other wildlife species and their habitats on the reasonably foreseeable coal haul transportation route are analyzed using miles of habitat adjacent to the route. Impacts to wildlife on the reasonably foreseeable coal haul transportation route are analyzed separately from impacts associated with the tract (see Section 4.17.5). The coal haul transportation route that is used for analysis purposes is the most reasonably foreseeable route, but it is impossible to predict the exact route that a successful bidder might choose. For noise analysis, dBA above ambient noise conditions were used as an additional indicator of impacts. For nighttime lighting analysis, lumens—a measurement of the brightness of light as perceived by the human eye—were used. Because organisms perceive light differently, it is difficult to predict how different magnitudes of lumens will affect different species. Research by the International Dark-Sky Association (IDA) suggests that blue-rich white light is more detrimental to most wildlife than amber or redder light (IDA 2010). It can also be assumed that more nighttime light is more detrimental to nocturnal wildlife. For this analysis, it is assumed that the level of impacts would be proportional to the magnitude of lighting output, with impacts increasing as the magnitude of the lighting increases.

As indicated in Section 3.17, wildlife habitat acreages are based on detailed vegetation community surveys in the tract (SWCA 2007a), and on southwest regional land cover data (SWReGAP 2004) along the reasonably foreseeable coal haul transportation route (see Section 3.15 for a detailed description of the vegetation communities present in the tract). The vegetation communities (also referred to as habitat types) discussed for the tract and the reasonably foreseeable coal haul transportation route differ because of differences between the field surveys and SWReGAP datasets, and because different land cover types occur in these areas. Because impacts to the tract and the reasonably foreseeable coal haul transportation route are analyzed separately, land cover types are not directly compared, and differences in cover types are not a limiting factor in the analysis.

Three general categories of habitat impacts are anticipated to be the most influential on wildlife and their habitats: 1) habitat fragmentation and alteration, 2) habitat loss and displacement of both individuals and populations, and 3) habitat improvement. Habitat fragmentation occurs when a contiguous habitat is broken up or fragmented by surface-disturbing activities causing a reduction in usable ranges and a disruption of movement among habitat areas. In addition, habitat fragmentation causes the isolation of less mobile species, a decline in habitat specialists, and facilitates invasion by generalist species (Marvier et al. 2004). Habitat alteration occurs when surface-disturbing activities directly or indirectly change the composition, structure, or functioning of the habitat. Habitat loss is caused by surface-disturbing activities or other activities that degrade or remove habitat. Displacement occurs when land use activities force wildlife to move into other habitats, thereby increasing stress on individual animals and increasing competition for habitat resources. Any surface-disturbing actions could lead to habitat alteration, fragmentation, loss, or wildlife displacement; limit the amount of usable habitat for wildlife; and restrict movement among habitat areas. Habitat improvement results from maintenance, reclamation, revegetation, vegetation treatments, or other management actions that increase the quantity and/or quality of habitat conditions, or is otherwise beneficial to one or more wildlife species. Improvements would mostly take place with the goal of reducing juniper encroachment of sagebrush habitat. Additional categories of impacts to wildlife include 1) loss of individuals, and 2) loss of populations.

4.17.3 Analysis Assumptions

The locations and habitats of some species in the tract and the reasonably foreseeable coal haul transportation route are known; however, the data are neither complete nor comprehensive for all wildlife species occurrences or for all potential habitats that might exist. Both known and potential species and habitat locations are considered in the analysis. The species and potential habitats that could be affected by various actions are assumed to be directly correlated with the degree, nature, and quantity of surface disturbance and other activities. Impacts are quantified wherever possible. In the absence of quantitative data, best professional judgment is used to analyze impacts. This analysis was prepared using the following assumptions:

- Local populations are naturally affected by nonhuman causal factors, such as climate, natural predation, disease, natural fire regimes, and competition with other native species for available habitat.
- Impacts to wildlife and special status species depend on the location, extent, timing, and intensity of the disturbance.
- Impacts to wildlife species with a limited distribution of individuals and habitats and/or a low tolerance for disturbance are likely greater than impacts to common and/or tolerant species.
- Ground-disturbing activities could lead to the fragmentation, alteration (positive or negative), loss, or displacement (short term or long term) of wildlife habitats and/or loss or gain of individuals or populations.
- Disturbance occurring adjacent to wildlife habitat would contribute to habitat fragmentation, alteration, and displacement due to reduced habitat quality or accessibility.
- Changes in air, water, and habitat quality may cause direct and indirect impacts to wildlife and habitats, and may also have cumulative impacts on species survival.
- The existing ambient noise condition on the tract is approximately 40 dB. Wildlife species would be negatively impacted by increasing ambient noise.
- Increased ambient nighttime light (measured in lumens) results in corresponding negative impacts to wildlife.
- Blue-rich lighting is more detrimental to most wildlife.
- Increased ambient nighttime light is more detrimental to nocturnal wildlife.
- If mitigation, habitat maintenance, or habitat improvement actions are demonstrated to be successful, these actions could maintain or improve the condition of vegetation, soils, and other habitat conditions. This would be accomplished through vegetation treatment projects, restrictions on surface-disturbing activities, and site reclamation and restoration.

Impacts to stream and riparian habitats associated with the reasonably foreseeable coal haul transportation route are based on the assumption that the likelihood of a coal spill along the route would be proportional to the occurrence of one accident per year anywhere along the entire reasonably foreseeable route. It is not possible to predict future conditions that could contribute to an accident; nevertheless, the chance of an accident occurring near stream or riparian habitats, which make up a very small portion of the route, would be extremely low.

In addition to conservation and lease notices, the following would apply: species-specific recovery plans and conservation documents that include management plans and strategies to protect wildlife. Applicable documents to the tract and the reasonably foreseeable coal haul transportation route include the *Monitoring Plan for the American Peregrine Falcon* (USFWS 2003), *Utah Field Office Guidelines for Raptor Protection from Human and Land Use Disturbances* (Romin et al. 2002), and *Best Management Practices for Raptors and Their Associated Habitats* (BLM 2008a:Appendix 2). In addition, most native bird species are protected under the MBTA of 1918, which prohibits direct take and destruction of occupied nests, whereby clearing of vegetation during the breeding season could result in loss of eggs or young and would be a violation of the act.

The following analysis assumes (as per the description of the Proposed Action [Section 2.3]) that mining would occur on approximately 120 acres at any one time, with an additional approximately 120 acres or more in some stage of reclamation. Centralized facilities would be located on approximately 36 acres, the exact location of which would move depending on the location of the mining. This process would take place for approximately 25 years, with the exact areas undergoing mining and reclamation changing annually. Impacts are analyzed below based on the concept that 120 acres of active mining could occur at any location throughout the tract, except for those locations prohibited in the lease conditions, and would eventually have occurred at all coal-bearing locations in the tract. Also, this analysis assumes that reclamation would take place on a rolling basis with mining, and that reclamation actions would conform to the standards listed in the lease stipulations and would be successful.

4.17.4 Impacts as a Result of Mining the Tract

4.17.4.1 ALTERNATIVE A: NO ACTION

Under the No Action Alternative, the tract would not be mined, and no coal mining or related activities, infrastructure development, or relocation of KFO Route 116 would occur. Therefore, no acres of wildlife habitat would be disturbed by these activities. However, management under the No Action Alternative would not restrict permitted mining activities on private lands adjacent to the tract. Mine-related activities would occur to a lesser degree than under the Proposed Action, Alternative C, or Alternative K1 because the total acreage of mining activities and the total duration of mining activities would be considerably less than under either of these alternatives.

Management of wildlife habitats on BLM-administered lands in the tract would be conducted as directed under the KFO RMP (BLM 2008b). Under the No Action Alternative, prescribed management on BLM-administered lands would include watershed protections and improvements to wildlife habitats. Vegetation treatment projects to restore sagebrush grasslands that have been invaded by pinyon-juniper woodlands would improve ecosystem functioning and watershed health. Vegetation management would have long-term beneficial effects for upland animal species by removing undesirable vegetation, increasing species and structural diversity, and improving overall habitat quality. Pinyon-juniper tree removal would reduce the amount of foraging, roosting, and nesting habitats available to raptors, bats, and migratory birds. Some vegetation treatments would help reduce soil loss and improve water quality and therefore would likely improve aquatic and riparian habitats and benefit the wildlife species that rely directly or indirectly on these habitats. Erosion control measures would reduce sedimentation of water sources and associated impacts to amphibian species. Vegetation and soil treatments would help to reestablish upland communities, maintain or improve the health of riparian/wetland communities, reestablish seedlings and understory vegetation, and retain soil moisture and nutrients (BLM 2008a).

Table 4.17.1 lists the vegetation communities present in the tract, the wildlife species associated with each community, and the acres of disturbance that would occur to each community under the No Action Alternative, Proposed Action, Alternative C, and Alternative K1.

Table 4.17.1. Acreages and Direct Disturbance in the Alton Coal Tract by Vegetation Community and Associated Wildlife Under the No Action and Action Alternatives

Vegetation Community	Associated Wildlife and Special Status Species[8]	Alternative A (No Action)	Alternative B (Proposed Action)			Alternative C (Reduced Tract Acreage and Seasonal Restrictions)			Alternative K1 (Reduced Tract Acreage)		
		Direct Acres Disturbed	Acres in Tract	Direct Acres Disturbed	Percentage Disturbed	Acres in Tract	Direct Acres Disturbed	Percentage Disturbed	Acres in Tract	Direct Acres Disturbed	Percentage Disturbed
Pinyon-juniper woodland	Elk, Sharp-shinned Hawk, Cooper's Hawk, Black-throated Gray Warbler, Gray Vireo, Loggerhead Shrike, Virginia's Warbler, Black-capped Chickadee, Townsend's solitaire, Pinyon Jay, Red-naped Sapsucker	0.0	1,430.8	694.4	48.6%	1,409.7	680.1	48.2%	1,095.1	471.6	43.1%
Sagebrush/ grassland	Elk, mule deer, Brewer's Sparrow, Sage Sparrow, Mountain Bluebird, Green-tailed Towhee, Sage Thrasher	0.0	860.2	366.5	42.6%	627.8	195.7	31.2%	369.1	91.2	24.7%
Sagebrush/ grassland (treated)	Elk, mule deer, Brewer's Sparrow, Sage Sparrow, Mountain Bluebird, Green-tailed Towhee, Sage Thrasher	0.0	749.1	547.5	73.1%	749.1	546.0	72.9%	289.5	235.9	81.5%
Annual and perennial grasses	Elk, mule deer, Peregrine Falcon, Prairie Falcon, Swainson's Hawk, Rough-legged Hawk (winter), Mountain Bluebird, Bendire's Thrasher	0.0	324.1	278.4	85.9%	247.0	196.5	79.6%	247.0	196.8	79.7%
Mountain brush	Elk, Black-throated Gray Warbler, Gray Vireo, Virginia's Warbler, Spotted Towhee, Gambel's Quail, Black-chinned Sparrow	0.0	62.8	24.9	39.6%	62.8	24.7	39.3%	40.8	1.7	4.2%
Wetland (meadow)	Elk, mule deer, Lesser Goldfinch, Red-winged Blackbird	0.0	62.8	55.5	88.3%	0.0	0.0	0%	0.0	0.0	0%
Riparian	Elk, Northern Harrier, Red-tailed Hawk, Great-horned Owl, Western Screech-Owl, Downy Woodpecker, American Dipper, Yellow-breasted Chat, Yellow Warbler	0.0	55.3	6.7	12.1%	54.0	6.3	11.7%	54.0	6.4	11.9%
Rabbitbrush	Elk, Gambel's Quail, Brewer's Sparrow, Sage Sparrow, Mountain Bluebird, Green-tailed Towhee, Sage Thrasher	0.0	10.7	1.0	9.2%	10.7	1.0	8.0%	10.7	1.0	9.3%
Bedrock, cliff, and canyon	Peregrine Falcon, Prairie Falcon, Rock Wren	0.0	0.0	0.0	0%	0.0	0.0	0%	0.0	0.0	0%
Open water	Mallard, shorebirds, amphibians	0.0	4.1	0.0	0%	0.0	0.0	0%	0.0	0.0	0%
Habitat total		**0**	**3,559.9**	**1,974.8**	**55.5%**	**3,161.6**	**1,650.3**	**52.2%**	**2,106.2**	**1,004.6**	**47.7%**

[8] Scientific names for all wildlife can be found in Chapter 3.

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4.17.4.2 IMPACTS COMMON TO THE ACTION ALTERNATIVES

4.17.4.2.1 Habitat Loss

Under the Proposed Action, Alternative C, and Alternative K1, there would be a short-term loss of all vegetation communities from the clearing of vegetation during the life of the mine and from the construction of centralized and dispersed facilities. Vegetation and soil would be removed from active mining areas (120 acres annually) and stockpiled, with reclamation and revegetation taking place concurrently on previously mined parcels. Long-term fragmentation, alteration, loss, or displacement of wildlife habitats would occur during mining and restoration activities, because some or all reclaimed habitats would not have developed to a mature, structurally, and compositionally diverse condition. Mountain big sagebrush takes approximately 30 years to reestablish following a fire (Ziegenhagen 2003); however, in the BLM's experience with vegetation treatments completed locally, the successional development of a mature sagebrush community in the tract would take approximately 20 years. Because restoration plans include planting sagebrush seedlings instead of seeds, the recovery period for sagebrush would be further reduced to some degree. For the purpose of this document, it is assumed that successional development of a mature sagebrush community would require approximately 20 years, depending on site conditions. During this recovery period, restored sites may have lower habitat quality than fully developed vegetation communities, and would therefore be of less value to most wildlife species, particularly those that require mature sagebrush habitats.

On federal lands, reclamation would involve the reestablishment of native and suitable non-native vegetation communities to resemble sagebrush steppe. On private lands, revegetation would involve the reestablishment of pre-mining agricultural vegetation. Impacts would be partially mitigated by revegetation and habitat treatment plans. There would be displacement of wildlife and interference with movement patterns from areas of active mining and construction. Injury or potential for mortality of smaller and less mobile animals (e.g., rodents, reptiles, and amphibians) could result from individuals being crushed on the ground or in burrows, buried in spoil areas, or trapped in excavated areas and buried. Small animals, such as amphibians, lizards, and small mammals, in mined and developed areas would likely be displaced, injured, or have potential for mortality.

4.17.4.2.2 Avian Breeding Disturbance

Disruption of breeding or loss of nests or young could take place if mining and construction occurs during the nesting season for raptors and other birds. Disruption of breeding would not be avoided, and some individuals could be lost or not return to the area to breed due to ongoing mining activities. These impacts would be decreased by restricting clearing of vegetation to nonbreeding seasons, or by conducting nest surveys and protecting individual nests during breeding periods. Of the habitats in the tract, pinyon-juniper woodlands would likely have the highest diversity of breeding migratory birds, and would be similarly affected under all action alternatives. Riparian and cliff and canyon habitats would have the highest densities of raptor nesting habitats, and would also be similarly affected under all action alternatives. Disturbance to native habitats could also cause degradation of wildlife habitats due to an increased risk of noxious weeds invasion and associated alteration of habitat composition and structure. The level of mining proposed in the Proposed Action may affect individuals, but would not affect populations of migratory birds or raptors.

4.17.4.2.3 Water Loss and Creek Relocation

Under the action alternatives, approximately 8.12 million gallons (25 acre-feet) of water per year would be used for dust suppression and equipment washing. Modifications to Robinson Creek and Kanab Creek in the tract would have negligible impacts on potential habitats for amphibian species due to limited

surface water. The relocation of Robinson Creek would reduce or eliminate any existing flows and connectivity, remove structural habitat features, reduce or eliminate avian and amphibian prey species (i.e., invertebrates), and increase erosion and sedimentation of connected surface waters. Relocation of existing streams would require surface impacts during dredging of a new stream channel and filling of the existing channel, as well as surface disturbance from construction equipment. Wildlife that relies on aquatic and riparian habitats would be displaced from both the original creek bed and replacement creek bed until restoration is completed. Impacts from stream crossing developments on Kanab Creek would be minimal due to limited surface-water flows and associated amphibian habitats.

4.17.4.2.4 Road Relocation and Transportation

Under the action alternatives, portions of KFO Route 116 in the tract would be relocated to allow for mine-related disturbance within 100 feet of the road. KFO Route 116 would be sited to avoid disturbances to wetlands, floodplains, stream channels, and intact sagebrush stands wherever possible. Where it is not possible to avoid disturbances to these areas, site-specific mitigation measures would be prescribed at the permitting stage, when more details are known about the mining sequence. Relocation of KFO Route 116 would be temporary, and the road would be reestablished in the approximate, original roadbed following mining. Two-track roads on private and BLM-administered lands in the tract would be closed during mining operations and replaced following completion of mining and reclamation activities. Temporary two-track roads may be constructed and reclaimed following mining. Surface disturbance from road relocation would impact wildlife by removing and fragmenting existing habitats, and by reducing habitat quality in adjacent habitats due to noise and disturbance associated with road construction and use.

There would be an increased likelihood of mortality of individuals from collisions with mine-related vehicles on KFO Route 116. Approximately 153 truck round-trips per day and worker and service traffic to and from the tract would occur for the duration of the mining operation. Impacts to wildlife from coal truck and other vehicle traffic in the tract would vary according to the size, mobility, and movements of each species. Wildlife groups most susceptible to vehicle-related mortality include groups that are attracted to road habitat (such as reptiles), groups with high mobility (such as big game and cougar), and habitat generalists (such as many species of small mammal) (Foreman et al. 2003). Vehicle-related mortality of raptors and other bird species could also occur from birds scavenging roadkill, and would be proportional to the amount of roadkill that occurs. Scavenging of roadkill would primarily be expected along the paved highways of the proposed haul route, such as US-89 and SR-20.

Roads can also effectively act as a movement barrier to some wildlife species, especially when the road is wide and handles high amounts of traffic, as would occur on the KFO Route 116. Species that are most susceptible to barrier effects are those that tend to avoid roads and also require large tracts of habitat for survival (Forman et al. 2003), such as bobcat, mountain lion, and elk. Other wildlife groups vulnerable to these effects include small mammal and amphibian species. Because of the presence of roads and barrier effects (which reduce landscape connectivity), these species are more susceptible to reduced gene flow and a reduced regional population size. Many wildlife species are therefore at a greater risk of a reduction in the regional population size due to the presence of roads and increased traffic on existing roads.

The mining and haul truck activity on the tract and road, as well as the associated habitat removal, would lead to habitat fragmentation, especially for highly mobile species that occupy large habitat patches, such as big game species. This fragmentation could augment typical wildlife movement patterns, such as seasonal migration and daily use.

Under the Proposed Action, both water and MgCl may be sprayed on haul roads and exposed soils as dust suppressants (see Table 2.6.1). Although MgCl is less harmful to biological systems than many other dust suppressants, it still impacts wildlife (Forman et al. 1998). These impacts are especially harmful in

aquatic systems because the chemical moves easily with water through soils (Piechota et al. 2002). Amphibians and other aquatic species may be killed or have negative physical effects from direct ingestion, and are also sensitive to increased salinity in water systems (Piechota et al. 2004). In terrestrial systems, MgCl has been associated with the browning of trees along roadways and stunted vegetation growth in forest lands (Piechota et al. 2004). This browning and/or stunting would reduce available forage for wildlife species, such as deer, elk, and other herbivores, ultimately reducing the health of the individual by reducing food availability and disrupting normal habitat use patterns. However, these impacts would be limited to vegetation directly adjacent to haul roads and exposed soils, which would be areas of human activity that wildlife would likely avoid in the first place.

4.17.4.2.5 Noise and Lighting Impacts

Under the action alternatives, mining activities would be ongoing 24 hours a day, seven days a week. Noise and ground vibration would occur from blasting, the use of electrical power generators, and coal processing, loading, and transport from centralized facilities. A blasting plan that limits disturbance to wildlife would be completed if the tract is leased and after a successful bidder is chosen. Noise can impact wildlife in several ways, as follows (Lynch et al. 2011):

- Noise can interfere with acoustical awareness by temporarily deafening animals, especially those close to the source, with very loud sounds or by distracting animals with less dramatic noises. Distraction can be especially detrimental if the typical predation or foraging pattern of the animal is altered, such as the coyote being unable to catch a prey item. Repeated distractions can lead to a reduction in individual health and ultimately in the health and success of the population.
- Noise can add to existing sound levels and reduce the range at which signals can be detected, identified, and localized (masking). Masking can increase predation rates for colonial species, such as prairie dogs and ground squirrels, if warnings indicating the presence of a predator are not heard by other individuals.
- Prolonged exposure to noise has been shown to cause some wildlife, such as mule deer and songbirds, to avoid certain areas, reducing already limited potential habitat. Displacement due to noise has also been shown to impact songbirds by reducing pairing success, bird density, and biodiversity of birds in the area.

The ambient noise levels of 40 dBA would be increased by use of heavy equipment, diesel generators, coal haul trucks, equipment related to the centralized facility, and blasting events. A description of the noise levels produced from mining operations by alternative can be found in Section 4.2.2 (Soundscape). The severity of impacts would be greatest near the noise sources, such as the mining and centralized facility locations. Noise levels could range from as low as 48 dBA to over 80 dBA within approximately 1 km of the mining activities. Noise impacts from mining the tract would occur at levels as high as 56 dBA from 1 to 5 km away from mining activities. These impacts would decrease the further one is from the mining activities, with impacts to ambient noise levels from mining ending at distances greater than 5 km from the mining activities. Due to these noise impacts, wildlife could be displaced from an area centered around the mining activity for up to 5 km. Additionally, periodic noise and vibrations from blasting activities would add from 90 to 186 dBA to ambient noise levels, depending on the distance from the blast. These activities would disrupt normal wildlife behavior for brief periods, with a return to normal activity when noise levels return to ambient.

Although noise levels from mining activities would be the same under all action alternatives, the locations and duration of the noise from the mining activities would vary. Mining would not take place in Block NW under Alternative C and mining would not take place in Blocks NW or S under Alternative K1. Thus, wildlife near Blocks NW and S would be less affected by noise impacts under those alternatives. Mine life varies among all of the alternatives as well, with mining lasting 25 years under the Proposed Action, 21 years under Alternative C, and 16 years under Alternative K1. Thus, the duration of noise impacts from mining activities would also vary among the action alternatives.

Under all action alternatives, artificial lighting would be used throughout the night, increasing skyglow. Three types of artificial lighting sources are proposed for use during nighttime operations: 1) portable lighting towers for use at the mine pit during active nighttime mining; 2) fixed light towers to be used for lighting centralized mine facilities; and 3) mobile light sources generated by vehicles, mining equipment, and flashlights. These lighting sources are described in more detail in Section 4.2.4 (Nighttime Lighting and the Extent of Skyglow). Illumination is most often measured in lumens, which expresses the brightness of light as perceived by the human eye. Because organisms perceive light differently, it is difficult to predict how different magnitudes of lumens would affect different species. Research suggests that blue-rich white light is more detrimental to most wildlife than amber or redder light (IDA 2010). However, lighting with the blue-green spectrum would be needed in areas where color rendition is required for safety purposes, as required by MSHA regulations. It can also be assumed that more nighttime light is more detrimental to nocturnal wildlife. For this analysis, it is assumed that the level of impacts would be proportional to the magnitude of lighting output, with impacts increasing as the magnitude of the lighting increases.

Disturbance to or displacement of wildlife would likely occur from an area an unknown distance around the lighting during nighttime operations. Artificial night lighting affects animal foraging behavior, reproduction, movement, and species interactions (such as predator-prey, pollinator-plant, and competition relationships) (Beier 2006; Longcore et al. 2005; Miller 2006). Nocturnal mammals respond to increased nighttime light by reducing or shifting their periods of activity, traveling shorter distances, and consuming less food (Longcore et al. 2005). Diurnal (day-active) and nocturnal wildlife could be displaced from, or attracted to, habitats affected by night lighting, depending on the species. However, night lighting increases the risk of predation for small, nocturnal mammals and decreases food consumption when animals, such as deer and elk, reduce foraging activities to remain concealed in an artificially lit environment (Beier 2005). Night lighting may also increase the risk of animal mortality from vehicle collisions (Longcore et al. 2005).

4.17.4.2.6 Subsidence Impacts

Subsidence from underground mining operations and from the removal of coal would be expected to cause surface cracks, lower the ground surface, and cause the fracture or failure of cliffs (personal communication, J. Smith). Several small areas of the bedrock, cliff, and canyon habitat vegetation community are adjacent and east of the tract, but none occur on or adjacent to the northeast corner of the tract (Block C) where underground mining would be expected to occur. Subsidence would be expected to occur within one year of mining operations and would permanently impact the topography, physiography, and stratigraphy of the area. If subsidence occurs, direct or indirect impacts to wildlife and their habitats would occur from collapse of surface topography, such as rock walls or cliffs, resulting in a potential loss of nesting or roosting habitat.

4.17.4.2.7 Reclamation and Vegetation Treatments

The KFO RMP (BLM 2008b) includes habitat maintenance, vegetation treatment, and species-specific management stipulations. A detailed, site-specific MRP would be applied for reclamation and reestablishment of vegetation, with planned mitigation required before coal mining and coal mine–related activities could occur. Nevertheless, wildlife habitats would be fragmented, altered, or lost in the short term from surface disturbance from coal mining and construction and from associated impacts such as increased susceptibility of disturbed sites to weed invasion, reduced species diversity, and altered habitat structure.

Herbicides would be used to prevent the spread of invasive weeds on the tract. Potential impacts to wildlife from the use of weed treatment herbicides include the following: mortality from toxicity (Shepard et al. 2004); disruption of the development of vital systems such as the endocrine, reproductive, and immune systems (Colborn et al. 1993); and reduction in insect abundance as a source of food for avian species (Taylor et al. 2006). These impacts are most likely to occur in small-bodied animals, such as small mammals, birds, amphibians, and some reptiles. However, according to Tatum (Tatum 2004), the most commonly used herbicides in vegetation management, when used according to label instructions, pose little risk to wildlife. If the tract is leased, the successful bidder would be required to use the commonly used herbicides that pose little risk to wildlife, thereby minimizing potential impacts on wildlife.

Over the long term (longer than the life of the mine), mining reclamation and sagebrush restoration activities are expected to improve crucial big game habitats, restore ecological functioning, and increase forage production of some areas within the tract that are degraded prior to the commencement of mining. In these areas, habitat reclamation and revegetation actions would enhance habitat for wildlife that use sagebrush habitats, such as those listed in Table 3.17.2. The magnitude of beneficial impacts to each species would be related to how dependent the species is on sagebrush habitats as well as how easily each species adapts to habitat changes. Reestablishment of vegetation would serve to mitigate the short-term negative impacts of surface disturbance on vegetation communities by restoring native and desirable non-native species. Immediate site reclamation and restoration of the native vegetation community would reduce the duration of habitat loss and the impacts to wildlife from habitat fragmentation and loss. Habitat restoration actions would be expected to enhance habitat quality in these areas over the long term by restoring native and desirable non-native species to create structurally and compositionally diverse vegetation communities. There would also be a period of habitat loss that would have minor to substantial impacts to wildlife depending on their reliance on the lost habitat.

The regulatory framework and required mitigation measures are described under the action alternatives and in Section 4.17.1.

4.17.4.2.8 Summary of Impacts Common to all Action Alternatives

Direct adverse effects under the action alternatives would include

- direct mortality of individuals due to crushing or burial during mining operations from the operation of mining equipment and vehicles, as well as the removal and storage of dirt and materials from the mining pits;
- alteration or loss of suitable and/or potential habitats due to surface disturbance, noise, ground vibration, or night lighting;
- disruption of breeding, nesting, or roosting activities due to surface disturbance, human presence, increased levels or duration of noise, and night lighting during 24-hour operations;
- disruption of bird migration and habitat use due to mining and associated disturbance and human presence;
- alteration of hydrologic or geologic conditions in or adjacent to the tract due to surface disturbance or subsidence during underground mining; and
- mortality, stress, or effective loss of habitat due to increased vehicle and coal truck traffic.

Indirect adverse impacts would include

- habitat fragmentation and subsequent displacement of individuals or populations due to surface disturbance and development;
- dust and dust-suppressant (MgCl) impacts to habitat quality from increased travel and construction activities during the life of mining operations;
- increased susceptibility of disturbed areas to weed invasion and associated alteration of vegetation communities and habitat structure from surface disturbance;

- potential mortality, disruption of vital systems, or decrease in insect abundance as an avian food source as a result of herbicide use;
- increased mosquito-borne disease transmission to special status species populations due to the presence of standing water in holding ponds or excavated areas;
- increased ambient noise from mining equipment (including coal trucks) and centralized facilities; and
- increased nighttime lighting from centralized facilities, portable facilities, and mobile light sources.

The additive impact of all of these effects combined would likely result in most wildlife species, including big game, migratory birds, and raptors, being displaced from the area of active mining as well as from an unknown buffer distance around the active mining activity (because of increased noise and lighting). Less mobile animals, such as some reptiles and small mammals, would likely be crushed or otherwise killed on-site. After areas are mined and reclaimed, wildlife would likely return to the habitat in the long term; however, successful reclamation may take a prolonged amount of time, and some wildlife species may not return for an extended period. Wildlife that exhibit fidelity to certain exact locations would be the most dramatically impacted, such as nesting raptors, because they often return to previously used nest locations. It is likely that raptor nests and nesting locations would be destroyed or otherwise altered by mining activities, resulting in reduced breeding success and reduced health of the individual and/or population. Typical use and movement patterns of other mobile species would likely be impacted, and local populations of some of these species may experience reduced health.

4.17.4.3 ALTERNATIVE B: PROPOSED ACTION

Under the Proposed Action, the tract would encompass approximately 3,576 acres. Approximately 1,993 acres of surface disturbance from surface mining and infrastructure development would occur in the tract over approximately 25 years. At any one time there would be a single open pit (approximately 120 acres) and an additional 120 acres or more in some stage of reclamation. Reclamation would be concurrent with mining over the course of the estimated 25-year mine life and would be followed by a minimum of 10 years of reclamation and revegetation monitoring. Impacts are reported in terms of total acres of disturbance over the life of the mine; however, note that this disturbance would not all occur at one time.

Under the Proposed Action, approximately 1,975 acres of disturbance would occur in vegetated areas (see Table 4.17.1). Of this, dispersed facilities would be sited to avoid disturbances to wetlands, floodplains, stream channels, and intact sagebrush stands wherever possible, with mitigation measures prescribed where it is not possible to avoid such disturbances. Underground mining would not directly impact overlying vegetation; however, impacts associated with underground mining could include hydrological changes and subsidence. Surface disturbance, consisting of the road and ROW, would occur for the reroute of KFO Route 116 in and outside the tract. Although the entire ROW would not be directly disturbed, for purposes of analysis, it is assumed that these areas would be nonfunctional as habitat for wildlife for the life of the mine. Following mining of the original roadbed, KFO Route 116 would be returned to its original route, and the temporary ROW would be reclaimed and restored. Under the Proposed Action, approximately 55% of the wildlife habitats in the tract would be removed by surface mining and associated disturbance. Reclamation would restore the disturbed areas for wildlife habitat. The timeframe for the restoration of habitat would vary by species, with restoration for species that use sagebrush habitats taking approximately 20 years, according to BLM's experience with vegetation treatments completed locally.

Under this alternative, the activities that would contribute to noise and nighttime light impacts, as described in Section 4.2.5, would occur within the approximately 1,993 acres of surface disturbance and would persist for 25 years (the life of the mine under this alternative). Although the activities contributing to these impacts would occur within a 1,993-acre footprint of surface disturbance, the spatial extent of

noise and lighting impacts would vary and move according to where the lights and noise generators are located within that footprint. A general description of noise and lighting impacts under the action alternatives is provided in Section 4.17.4.2.5.

Water use for dust suppression and the washing of equipment would occur over the 25-year mine life. Water sources would consist of groundwater accumulated in open pits and water pumped from existing wells or from wells established near the mine for coal mining purposes. Direct and indirect impacts to wildlife could result from surface-water depletions or from degradation of surface-water quality due to increased sediment loads from mining operations or spills of petroleum products and other hazardous materials. Direct impacts to wildlife that occupy wetlands or riparian habitats (see Table 4.17.1) would consist of habitat removal during mining and related disturbances. Indirect impacts would consist of loss of habitat and/or reduced habitat functioning (i.e., reduced water quality, reduced prey availability) as a result of water depletions or sedimentation of surface waters. The BLM's *Utah Riparian Management Policy* (IM UT-2005-091) requires that field offices, to the extent practicable, "protect riparian areas through sound management practices and avoid negative impacts to the maximum extent practicable" (BLM 2005a). The policy goes on to state that "[n]o new surface disturbing activities will be allowed within 100 meters of riparian areas unless it can be shown that:

a. there are not practical alternatives or,
b. all long term impacts can be fully mitigated or,
c. the activity will benefit and enhance the riparian area."

This riparian policy would help reduce impacts to riparian areas within the tract. See Section 4.16, Water Resources, for more detailed discussion of water use under the Proposed Action.

4.17.4.3.1 Big Game

The tract contains approximately 3,439 acres of substantial value summer habitat for mule deer and 138 acres of crucial summer habitat for mule deer. The tract also contains approximately 3,506 acres of substantial value summer habitat for elk and 71 acres of year-long substantial value habitat for elk. These big game species are likely to be displaced from crucial and substantial-value habitats on the tract during mining operations and development. In addition to the impacts described above (Section 4.17.4.2), direct impacts would consist of habitat loss, alteration, and fragmentation due to surface disturbance. When examining the effects of oil and gas development, Wilbert et al. (2008) conclude that even lower levels of development can have substantial effects on wildlife, including big game. The relocation of KFO Route 116 and pit disturbance are examples of surface disturbance that would affect mule deer and elk habitat through loss, alteration, and fragmentation. Deer and elk are also more likely to avoid buffer areas around heavily traveled roads, in comparison to lightly traveled roads (Forman et al. 1998). Other impacts would consist of disruption of movement and habitat use due to noise, night lighting, and increased human presence. As discussed in Lutz et al. (2003), mule deer avoided zones approximately 100–400 meters (328–1,312 feet) from roads or human presence, resulting in habitat unavailable to the species for foraging or cover in an area larger than the actual footprint of the disturbance. Disturbed habitat would have reduced forage and cover value until reclamation and restoration actions are complete (approximately 10 years post-mining activity). Reclaimed sites may have limited habitat value in early stages of succession, and may or may not fully return to their original habitat function in late successional stages. Over the life of the mine under the Proposed Action, surface-disturbing activities would ultimately remove 21% of crucial summer mule deer habitat in the tract (0.03% of the HMU), 52% of substantial value summer mule deer habitat in the tract (0.9% of the HMU), 35% of year-long substantial value elk habitat in the tract (2% of the HMU), and 52% of substantial value summer elk habitat in the tract (2% of the HMU) (see Table 4.17.1 and Map 3.20). No designated pronghorn habitats occur in the proposed tract. Impacts are reported in terms of total acres of disturbance over the life of the mine, but note that this disturbance would not all occur at one time.

This reduction in available habitat would also reduce the food sources available to individuals, potentially reducing the health of some individuals. However, because surface-disturbing activities under the Proposed Action would impact less than 1% of crucial summer mule deer habitat and substantial value mule deer habitat within the HMU, there would be adjacent available habitat into which this species could disperse. Likewise, because surface-disturbing activities under the Proposed Action would impact only 2% of year-long substantial value habitat and substantial value summer habitat for elk, there would be adjacent available habitat into which this species could disperse.

Under the Proposed Action, an additional 0.8 acre of mule deer crucial summer, 0.2 acre of elk crucial summer, and 0.6 acre of elk year-long substantial value habitats on BLM-administered land adjacent to the tract would be disturbed to reroute KFO Route 116. The KFO Route 116 relocation would take place inside the tract; the acres of habitat removal are accounted for in Table 4.17.2. Although the new road location, along with increased mine-related traffic, would influence big game species movement patterns (discussed in section 4.17.5.2), the severity of these impacts over existing conditions would not substantially change. This is because the KFO Route 116 currently exists and is already influencing wildlife movement due to the presence of traffic. The KFO Route 116 relocation would, however, increase the impacts of habitat fragmentation on big game over current conditions by creating an additional vector for weeds and increasing edge habitat.

Impacts to big game species along the reasonably foreseeable coal haul transportation route are discussed in Section 4.17.5.2.1. Direct impacts to mule deer and elk habitats in the tract would be greater under the Proposed Action compared to the No Action Alternative. Implementation of the Proposed Action would result in the disturbance of 29 more acres of crucial summer mule deer habitat, 1,803 more acres of substantial value summer mule deer habitat, 1,808 more acres of substantial value summer elk habitat, and 25 more acres of year-long substantial value elk habitat than would occur under the No Action Alternative.

Table 4.17.2. Direct Impacts to Mule Deer and Elk Habitats in the Alton Coal Tract under the No Action and Action Alternatives

	Acres in HMU	Alternative A (No Action)	Alternative B (Proposed Action)			Alternative C (Reduced Tract Acreage and Seasonal Restrictions)			Alternative K1 (Reduced Tract Acreage)		
		Acres Disturbed	Acres in Tract	Acres Disturbed	Percentage Disturbed (tract/HMU)	Acres in Tract	Acres Disturbed	Percentage Disturbed (tract/HMU)	Acres in Tract	Acres Disturbed	Percentage Disturbed (tract/HMU)
Mule deer crucial summer	105,443	0	138.0	29.0	21.0%/0.03%	109.0	0.0	0%/0%	109.0	0.0	0%/0%
Mule deer substantial value summer	207,439	0	3,438.6	1,803.3	52.4%/0.9%	3,063.7	1,526.0	49.8%/0.7%	2,004.8	920.1	45.9%/0.4%
Elk substantial value summer	83,854	0	3,505.5	1,807.5	51.6%/2.2%	3,101.6	1,501.3	48.4%/1.8%	2,113.8	920.1	43.5%/1.1%
Elk year-long substantial value	175,970	0	71.1	24.8	34.9%/0.01%	71.1	24.8	34.9%/0.01%	0.0	0.0	0%/0%

Source: UDWR GIS data updated May 2006.

4.17.4.3.2 Raptors

The Proposed Action would result in direct adverse impacts to foraging and wintering habitats, and to active and inactive nest sites for raptor species. Raptor nesting occurs primarily in riparian habitats on approximately 55 acres (2%) of the tract, 6.7 acres of which would be directly impacted by mining activities under the Proposed Action over the life of the mine. Suitable potential raptor nesting sites would also be reduced by the removal of 694 acres of pinyon-juniper woodland. No bedrock, cliff, or canyon roosting and nesting habitat occurs in the tract, but several small habitat areas are adjacent to the tract's eastern boundary. Impacts are reported in terms of total acres of disturbance over the life of the mine, but note that this disturbance would not all occur at one time. Raptor species are sensitive to human disturbance, especially during breeding periods (Romin et al. 2002). Disturbance from mining activities or human presence near an active nest during breeding season could result in nest abandonment and/or mortality of young from increased vulnerability to predators, temperature extremes, or reduced food intake due to avoidance of the nest site by adult raptors. Impacts to active nesting sites would be mitigated by raptor nest surveys and the resulting avoidance measures. However, if a nest area is disturbed outside the nesting season, there is a likelihood that the raptor would not return to the nest the following nesting season. Indirect impacts to nesting habitat from subsidence would be unlikely because underground mining operations would occur in the northeast corner of the tract, where there is little nesting habitat.

Raptor species would be directly impacted by habitat loss from pit disturbance and construction activities, and by the long-term loss of wooded foraging habitats (e.g., riparian, pinyon-juniper woodland, and mountain brush vegetation communities). They would also be impacted by the removal of perch and roost sites on and off tract, as required by the sage-grouse mitigation plan (see Appendix E) because this could contribute to reduced prey capture and a decreased ability to feed themselves and their chicks. Raptors forage in all habitat types, and the loss of foraging habitats due to direct disturbance or removal would result in the displacement of raptors from these areas until habitats have been successfully restored. Lastly, construction of roadways and mine-related traffic could result in increased mortality from vehicle strikes because many raptor species, especially owls, often forage 3–4 feet off the ground.

Special lease stipulations and BMPs would minimize adverse impacts to raptor species, especially during the breeding season, by providing spatial and seasonal buffers of both occupied and unoccupied nests. Compliance with the BLM Riparian Management Policy (IM UT-2005-091) (BLM 2005a) would help minimize or mitigate for impacts on riparian nesting habitat. Additionally, mitigation actions aimed at reducing corvid species in the area (ravens and crows, as required by the sage-grouse mitigation plan; see Appendix E) would reduce competition for nesting sites for some raptor species, and would reduce the potential for predation of raptor eggs.

Because a large portion of the tract would be disturbed during surface mining and associated activities over the life of the mine, the Proposed Action would result in greater short-term adverse impacts to raptor species and their habitats than would occur under the No Action Alternative. However, because raptors are highly mobile and there is an abundance of suitable habitat in the region surrounding the tract, there would be available habitat into which raptors could disperse.

4.17.4.3.3 Migratory Birds

Under the Proposed Action, direct adverse impacts to migratory birds would occur from the direct removal, alteration, or fragmentation of habitat during surface mining and associated activities. Loss of habitat would reduce forage, cover, perches, and nesting areas for migratory birds. Most surface disturbance under the Proposed Action would occur in sagebrush/grassland and sagebrush/grassland (treated) (914 acres) and pinyon-juniper woodland vegetation communities (694 acres) (Table 4.17.3). Therefore migratory bird species associated with these vegetation communities would be most greatly affected. In addition, 278 acres (86%) of annual and perennial grasses vegetation community would be directly disturbed and effectively lost for migratory bird species associated with this community. Under the Proposed Action, approximately 1,975 acres (56%) of migratory bird habitat would be disturbed by surface mining over the life of the mine. Because a large portion of the tract would be disturbed during surface mining and associated activities, the Proposed Action would result in greater short-term adverse impacts to migratory bird species and their habitats than would occur under the No Action Alternative. Impacts are reported in terms of total acres of disturbance over the life of the mine, but note that this disturbance would not all occur at one time. Because migratory birds are highly mobile and there is an abundance of sagebrush/grassland and pinyon-juniper woodland vegetation communities in the region surrounding the tract, there would be available habitat in which migratory birds could disperse.

Impacts of night lighting on migratory birds are well studied. Impacts of increased lighting at night include altered biorhythms (singing at night), altered feeding patterns, increased exposure to predation, and increased competition with nocturnal species (de Molenaar et al. 2006). For many bird species, the length of the night influences hormones and breeding cues. Artificially increasing day length by the use of nighttime lighting could induce pre-mature breeding condition (de Molenaar et al. 2006). The proposed night lighting could also attract migrating birds and therefore alter the typical migration route, leading to decreased health of the individual and/or flock (Gauthreaux et al. 2006) as well as influencing hormonal cues and potentially prompting migration at the wrong time (de Molenaar et al. 2006). Altered migration timing may lead to species arriving at Arctic breeding sites too early, or conversely, remaining at summer sites too long and attempting migration with reduced fat reserves, ultimately decreasing the health of the individual and/or flock.

The predator control mitigation measure required by the sage-grouse mitigation plan (see Appendix E) would adversely impact ravens, because they would be targeted for removal to reduce predation on sage-grouse eggs. However, the vegetation treatments required in the mitigation plan would be beneficial for local populations of migratory bird species that use sagebrush habitats. This is because the vegetation treatments would create additional breeding and foraging habitat for these species.

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Table 4.17.3. Acreages and Direct Disturbance in the Alton Coal Tract by Vegetation Community and Associated Raptor and Migratory Bird Species Under the Action Alternatives

Vegetation Community	Associated Migratory Bird Species	Alternative B (Proposed Action)			Alternative C (Reduced Tract Acreage and Seasonal Restrictions)			Alternative K1 (Reduced Tract Acreage)		
		Acres in Tract	Acres Disturbed	Percentage Disturbed	Acres in Tract	Acres Disturbed	Percentage Disturbed	Acres in Tract	Acres Disturbed	Percentage Disturbed
Pinyon-juniper woodlands	Sharp-shinned Hawk, Cooper's Hawk, Black-throated Gray Warbler, Gray Vireo, Loggerhead Shrike, Virginia's Warbler, Black-capped Chickadee, Townsend's solitaire, Pinyon Jay, Red-naped Sapsucker	1,430.8	694.4	48.6%	1,410.2	680.1	48.2%	1,095.1	471.6	43.1%
Sagebrush/ grassland	Brewer's Sparrow, Sage Sparrow, Mountain Bluebird, Green-tailed Towhee, Sage Thrasher	860.2	366.5	42.6%	627.8	195.7	31.2%	369.1	91.2	24.7%
Sagebrush/ grassland (treated)	Brewer's Sparrow, Sage Sparrow, Mountain Bluebird, Green-tailed Towhee, Sage Thrasher	749.1	547.5	73%	749.1	546.1	73%	289.5	235.9	77%
Annual and perennial grasses	Peregrine Falcon, Prairie Falcon, Swainson's Hawk, Rough-legged Hawk (winter), Mountain Bluebird, Bendire's Thrasher	324.1	278.4	85.9%	247.0	196.5	76.6%	247.0	196.8	79.7%
Mountain brush	Black-throated Gray Warbler, Gray Vireo, Virginia's Warbler, Spotted Towhee, Gambel's Quail, Black-chinned Sparrow	62.8	24.9	39.6%	62.8	24.7	39.3%	40.8	1.7	4.2%
Wetland (meadow)	Lesser Goldfinch, Red-winged Blackbird	62.8	55.5	88.3%	0.0	0.0	0%	0.0	0.0	0%
Riparian	Northern Harrier, Red-tailed Hawk, Great-horned Owl, Western Screech-Owl, Downy Woodpecker, American Dipper, Yellow-breasted Chat, Yellow Warbler	55.3	6.7	12.1%	54.0	6.3	11.7%	54.0	6.4	11.9%
Rabbitbrush	Gambel's Quail, Brewer's Sparrow, Sage Sparrow, Mountain Bluebird, Green-tailed Towhee, Sage Thrasher	10.7	1.0	9.2%	10.7	1.0	8.0%	10.7	1.0	9.3%
Total		**3,555.8**	**1,974.8**	**55.5%**	**3,161.6**	**1,650.3**	**52.2%**	**2,106.2**	**1,004.6**	**47.7%**

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4.17.4.3.4 Amphibians

Impacts to amphibian species from mining activities include habitat fragmentation and loss, displacement to lower quality habitats, increased exposure to predators from cover removal, crushing and burial of adults and young, toxins (MgCl), possible sedimentation, and attraction to ecological 'traps' such as water holding ponds. Potential habitats for amphibian species in wetland (meadow) and riparian vegetation communities comprise approximately 118 acres (3%) of the tract. Under the Proposed Action, approximately 53% (63 acres) of wetland and riparian habitats would be removed by mining and associated activities (see Table 4.17.1). These impacts would affect individuals, but due to the limited availability of potential habitats on the site, they would not likely affect entire populations of amphibian species. Because a portion of the tract would be disturbed during surface mining and associated activities, the Proposed Action would result in greater short-term adverse impacts to amphibian habitats than would occur under the No Action Alternative. Impacts are reported in terms of total acres of disturbance over the life of the mine, but note that this disturbance would not all occur at one time.

Increased nighttime lighting is known to attract amphibian species to the light source, resulting in altered foraging patterns, increased risk of being struck by vehicles, and changes in behavior (i.e., reproduction and predator-avoidance) (Buchanan 2006). Tadpole behavior also is altered with increased illumination. Sustained nighttime lighting could lead to decreased health of local amphibian populations.

4.17.4.4 ALTERNATIVE C: REDUCED TRACT ACREAGE AND SEASONAL RESTRICTIONS

Under Alternative C, the nature of impacts would be the same as under the Proposed Action, but would differ in the acres of disturbance and timing of mine-related activities. The tract would encompass approximately 3,173 acres due to the exclusion of Block NW. Under Alternative C, approximately 1,650 acres of disturbance would occur in vegetated areas over approximately 21 years (see Table 4.17.1). Dispersed facilities would be sited to avoid disturbances to wetlands, floodplains, stream channels, and intact sagebrush stands wherever possible, with mitigation measures prescribed where it is not possible. Timing restrictions designed to reduce impacts to Greater Sage-Grouse in Block S would be implemented to reduce impacts to the local lek and sage-grouse population that occupies portions of the tract during the nesting and brooding periods. These timing restrictions would alter the timing and distribution of mining activities, and would reduce impacts to other wildlife species that use sagebrush habitats.

Alternative C would require that two pits (totaling approximately 240 acres) are open simultaneously so the selected lessee could comply with the Greater Sage-Grouse timing restrictions by mining outside the lek buffer during the breeding time period. However, only one pit would be active at any one time, and the other pit would sit idle. This alternative would require the use of additional heavy equipment because of the two pits. In addition, a stockpiling area for approximately 40–60 acres of overburden would be required for two simultaneously open pits. At any one time, there would be approximately 240 acres of open surface-mining pits and an additional 240 or more acres in some stage of reclamation. Reclamation would be concurrent with mining over the course of the estimated 21-year mine life and would be followed by an up to 10-year reclamation and revegetation monitoring period, with reclamation activities potentially extended for some pits due to timing restrictions for sage-grouse. Impacts are reported in terms of total acres of disturbance over the life of the mine, but note that this disturbance would not all occur at one time.

Relocation of KFO Route 116 would not be required in Block NW under this alternative because this portion of the tract would not be included (see Map 2.2). Relocation of KFO Route 116 elsewhere in the tract would require approximately 36 acres of surface disturbance, with an additional 0.6 acre of disturbance outside of the tract. As described for the Proposed Action, for purposes of analysis, the entire 36.6 acres is assumed to be nonfunctional as habitat for wildlife for the life of the mine. The reroute

would be cited to avoid disturbances to wetlands, floodplains, stream channels, and intact sagebrush stands wherever possible; the exact location of the reroute would be finalized during the permitting phase of the project. Under Alternative C, approximately 52% of wildlife and special status species habitats in the tract would be directly impacted by surface disturbance. Water use for dust suppression and the washing of equipment would occur over the 21-year mine life. Water sources would consist of groundwater accumulated in open pits and water pumped from existing wells or wells established near the mine for coal mining purposes. Impacts to wildlife would be the same as would occur under the Proposed Action. See Section 4.16 for more detailed discussion of water use.

4.17.4.4.1 Big Game

Under Alternative C, the nature of impacts to wildlife occurring in the tract analysis area would be the same as described for the Proposed Action and in the Impacts Common to the Action Alternatives section. Over the life of the mine, surface-disturbing activities would ultimately impact 1,526 acres (50% of the tract and 0.7% of the HMU) of substantial value summer mule deer habitat, 1,501 acres (48% of the tract and 1.8% of the HMU) of substantial value summer elk habitat, and 25 acres (35% of tract and 0.01% of the HMU) of year-long substantial value elk habitat (see Table 4.17.2 and Map 3.20). An additional 0.6 acre of mule deer crucial summer and 0.6 acre of elk year-long substantial value habitats on BLM-administered land adjacent to the tract would be disturbed for the reroute of KFO Route 116. Noise and nighttime light impacts would be the same as those described in Section 4.2.5 and under the Proposed Action, except that they would occur on 331 fewer acres and for a shorter duration of 21 years (the mine life under this alternative). Direct impacts to mule deer and elk habitats in the tract would be greater under Alternative C compared to the No Action Alternative. No designated pronghorn habitats occur on or adjacent to the tract under Alternative C. Impacts are reported in terms of total acres of disturbance over the life of the mine, but note that this disturbance would not all occur at one time.

Because surface-disturbing activities under Alternative C would impact less than 1% of substantial value mule deer habitat within the HMU, there would be available habitat in which this species could disperse. Likewise, because surface-disturbing activities under Alternative C would impact a total of less than 2% of year-long substantial value habitat and substantial value summer habitat for elk, there would be available habitat in which this species could disperse.

4.17.4.4.2 Raptors

Under Alternative C, raptor species would be directly impacted by habitat loss from pit disturbance and construction activities, and by the long-term loss of wooded foraging habitats (e.g., riparian, pinyon-juniper woodland, and mountain brush vegetation communities). The nature of impacts to raptor species would be the same as described for the Proposed Action. The increased risk of direct mortality of ground-nesting raptor species from pit development and construction equipment would be reduced by the elimination of Block NW and by timing stipulations in Block S. Suitable raptor nesting sites would likely be reduced by the removal of 680 acres of pinyon-juniper woodland. Because a portion of the tract would be disturbed during surface mining and associated activities, Alternative C would result in greater short-term adverse impacts to raptor species and their suitable habitats than would occur under the No Action. As under the Proposed Action, special lease stipulations and BMPs would minimize adverse impacts to raptor species, especially during the breeding season, by providing spatial and seasonal buffers of both occupied and unoccupied nests. Because raptors are highly mobile and there is an abundance of suitable habitat in the region surrounding the tract, there would be available habitat in which raptors could disperse.

4.17.4.4.3 Migratory Birds

Under Alternative C, direct adverse impacts to migratory birds would occur from the direct removal, alteration, or fragmentation of habitat during surface mining and associated activities. The nature of impacts to migratory bird species would be the same as described for the Proposed Action. Most surface disturbance under Alternative C would occur in sagebrush/grassland and sagebrush/grassland (treated) (742 acres) and pinyon-juniper woodland vegetation communities (680 acres) (see Table 4.17.3). Therefore, migratory bird species associated with these vegetation communities would be the most greatly affected. In addition, 197 acres (80%) of annual and perennial grasses would be directly disturbed and effectively lost for migratory bird species associated with this vegetation community. Under Alternative C, approximately 1,650 acres (52%) of suitable migratory bird habitat in the tract would be disturbed by surface mining over the 21-year mine life (see Table 4.17.3). Because a large portion of the tract would be disturbed during surface mining and associated activities, Alternative C would result in greater short-term adverse impacts to migratory bird species and their suitable habitats than would occur under the No Action Alternative. Because migratory birds are highly mobile and there is an abundance of sagebrush/grassland and pinyon-juniper woodland vegetation communities in the region surrounding the tract, there would be available habitat in which migratory birds could disperse.

4.17.4.4.4 Amphibians

Impacts to amphibian species from mining activities include habitat fragmentation and loss, displacement to lower quality habitats, increased exposure to predators from cover removal, crushing and burial of adults and young, and attraction to ecological ‘traps’ such as water holding ponds. The nature of impacts to amphibian species would be the same as described for the Proposed Action. None of the wetland (meadow) vegetation community would be directly disturbed under Alternative C. However, approximately 6 acres of riparian vegetation community would be disturbed under this alternative. Because a portion of the tract would be disturbed during surface mining and associated activities, Alternative C would result in greater short-term adverse impacts to amphibian species’ vegetation communities than would occur under the No Action Alternative. Impacts are reported in terms of total acres of disturbance over the life of the mine, but note that this disturbance would not all occur at one time.

4.17.4.5 ALTERNATIVE K1: REDUCED TRACT ACREAGE

Under Alternative K1, the nature of impacts would be the same as under the Proposed Action and Alternative C, but would differ in the acres of disturbance, or magnitude. Alternative K1 would exclude both Block NW and Block S from mining activities. The tract would encompass approximately 2,114 acres due to the exclusion of Block NW and Block S. Under Alternative K1, approximately 1,012 acres of surface disturbance would occur over approximately 16 years (see Table 4.17.1). Dispersed facilities would be sited to avoid disturbances to wetlands, floodplains, stream channels, and intact sagebrush stands wherever possible, with mitigation measures prescribed where it is not possible. Under Alternative K1, there would be a single open pit (approximately 120 acres), and at any one time there would be approximately 120 acres of open surface-mining pit disturbance and an additional 120 or more acres in some stage of reclamation. Reclamation would be concurrent with mining over the course of the estimated 16-year mine life and would be followed by an up to 10-year reclamation and revegetation monitoring period, with reclamation activities potentially extended for some pits due to timing restrictions for sage-grouse. Impacts are reported in terms of total acres of disturbance over the life of the mine, but note that this disturbance would not all occur at one time.

Relocation of KFO Route 116 would not be required in Block NW under this alternative because this portion of the tract would not be included in the lease (see Map 2.3). Relocation of KFO Route 116 elsewhere in the tract would require approximately 16 acres of surface disturbance. As described for the

Proposed Action, for purposes of analysis, the entire 16 acres are assumed to be nonfunctional as habitat for wildlife for the life of the mine. The reroute would be cited to avoid disturbances to wetlands, floodplains, stream channels, and intact sagebrush stands wherever possible. Under Alternative K1, approximately 48% of wildlife habitats in the tract would be directly impacted by surface disturbance.

Water use for dust suppression and the washing of equipment would occur over the 16-year mine life. Water sources would consist of groundwater accumulated in open pits and water pumped from existing wells or wells established near the mine for coal mining purposes. Impacts to wildlife would be the same as under the Proposed Action and Alternative C. See Section 4.16 for more detailed discussion of water use.

4.17.4.5.1 Big Game

Under Alternative K1, the nature of impacts to big game occurring in the tract analysis area would be the same as described for the Proposed Action, Alternative C, and in the Impacts Common to the Action Alternatives section. Over the life of the mine, surface-disturbing activities would ultimately impact approximately 920 acres (45.9% of the tract and 0.4% of the HMU) of substantial value summer mule deer habitat, and approximately 920 acres (43.5% of the tract and 1.1% of the HMU) of substantial value summer elk habitat (see Table 4.17.2 and Map 3.20). Noise and nighttime light impacts would be the same as those described in Section 4.17.5.2 and under the Proposed Action, except that they would occur on 981 fewer acres and for a shorter duration of 16 years (the life of the mine under this alternative). Direct impacts to mule deer and elk habitats in the tract would be greater under Alternative K1 compared to the No Action Alternative. No designated pronghorn habitats occur on or adjacent to the tract under Alternative K1. Impacts are reported in terms of total acres of disturbance over the life of the mine, but note that this disturbance would not all occur at one time. Because surface-disturbing activities under Alternative K1 would impact less than 1% of substantial value mule deer habitat within the HMU, there would be available habitat into which this species could disperse. Likewise, because surface-disturbing activities under the Proposed Action would impact less than 2% of substantial value summer habitat for elk, there would be available habitat into which this species could disperse.

4.17.4.5.2 Raptors

Under Alternative K1, raptors would be impacted by suitable habitat loss from pit disturbance and construction activities, and by the long-term loss of wooded foraging habitats (e.g., riparian, pinyon-juniper woodland, and mountain brush vegetation communities). The nature of impacts to raptor species would be the same as described for the Proposed Action. The increased risk of direct mortality of ground-nesting raptor species, such as Northern Harrier, from pit development and construction equipment would be reduced by the exclusion of Block NW and Block S from mining activities. Suitable raptor nesting sites would likely be reduced by the removal of 472 acres (43%) of pinyon-juniper woodland. Because a large portion of the tract would be disturbed during surface mining and associated activities, Alternative K1 would result in greater short-term adverse impacts to raptor species and their suitable habitats than would occur under No Action. As under the Proposed Action and Alternative C, special lease stipulations and BMPs would minimize adverse impacts to raptor species, especially during the breeding season, by providing spatial and seasonal buffers of both occupied and unoccupied nests. Because raptors are highly mobile and there is an abundance of suitable habitat in the region surrounding the tract, there would be adequate habitat in which raptors could disperse.

4.17.4.5.3 Migratory Birds

Under Alternative K1, direct adverse impacts to migratory birds would occur from the direct removal, alteration, or fragmentation of suitable habitat during surface mining and associated activities. The nature of impacts to migratory bird species would be the same as described for the Proposed Action and Alternative C. Most surface disturbance under Alternative K1 would occur in sagebrush/grassland and sagebrush/grassland (treated) (327 acres) and pinyon-juniper woodland vegetation communities (472 acres) (see Table 4.17.3). Therefore, migratory bird species associated with these vegetation communities would be most greatly affected. In addition, 197 acres (80%) of annual and perennial grasses would be directly disturbed and effectively lost for migratory bird species associated with this community. Under Alternative K1, approximately 1,005 acres (48%) of migratory bird habitat in the tract would be disturbed by surface mining over the 16-year mine life (see Table 4.17.3). Because a large portion of the tract would be disturbed during surface mining and associated activities, Alternative K1 would result in greater short-term adverse impacts to migratory bird species and their suitable habitats than would occur under the No Action Alternative. Because migratory birds are highly mobile and there is an abundance of sagebrush/grassland and pinyon-juniper woodland vegetation communities in the region surrounding the tract, there would be adequate habitat in which migratory birds could disperse.

4.17.4.5.4 Amphibians

Impacts to amphibian species from mining activities include habitat fragmentation and loss, displacement to lower quality habitats, increased exposure to predators from cover removal, crushing and burial of adults and young, and attraction to ecological 'traps' such as water holding ponds. The nature of impacts to amphibian species would be the same as described for the Proposed Action and Alternative C. None of the wetland (meadow) vegetation community would be directly disturbed under Alternative K1. However, approximately 6.4 acres of the riparian vegetation community would be disturbed under this alternative. Because a portion of the tract would be disturbed during surface mining and associated activities, Alternative K1 would result in greater short-term adverse impacts to amphibian species' vegetation communities than would occur under the No Action Alternative.

4.17.5 Impacts from Coal Hauling

There would be no additional loss of wildlife habitat from the reasonably foreseeable coal haul transportation route. Coal transportation would occur on existing roads and would not necessitate road upgrades. The following analysis focuses on direct and indirect impacts to wildlife from increased rates of traffic.

Wildlife mortality along highways and roads is facilitated by the presence of open foraging areas along the roadside, and by the need for road crossings during daily or seasonal movements (BLM 1995; USDOT 1975). Wildlife mortalities along highways and roads is most likely to occur from dusk to dawn, when wildlife may be more active and motorist visibility is reduced, and during seasonal migrations when wildlife are more likely to cross roads. Impacts from coal truck traffic on wildlife would vary according to the individual's size, mobility, and movements; large, nocturnal species and migratory species such as mule deer, elk, and pronghorn would be at the greatest risk. An increase in vehicle collision mortality of raptors and other bird species could also occur due to birds scavenging roadkill, and would be proportional to the volume of other animal mortalities. The attraction of raptors to any increase in roadkill could also result in an increase in raptor predation of small animal species in habitats adjacent to the reasonably foreseeable coal haul transportation route.

4.17.5.1 ALTERNATIVE A: NO ACTION

Wildlife mortalities along US-89, SR-20, I-15, and SR-56 are likely to increase due to additions of mine-related traffic from existing fee coal mine areas adjacent to the tract that would use existing routes (see Section 4.19). A large portion of the reasonably foreseeable coal haul transportation route would be adjacent to wildlife and special status species habitats (Table 4.17.4). From 2003 to 2005, wildlife-related single-vehicle crashes made up 51% of crashes on US-89, 18% of crashes on US-20, 11% of crashes on I-15, and 41% of crashes on SR-56 (Fehr & Peers Transportation Consultants 2013). Wildlife mortality and associated disruptions in habitat use and migration routes would be expected to occur under both the No Action Alternative and the action alternatives. However, mine-related traffic and associated wildlife impacts would be minimized under the No Action Alternative due to the expected lower volume of truck traffic.

Table 4.17.4. Land Cover Miles Adjacent to the Reasonably Foreseeable Coal Haul Transportation Route and Associated Wildlife Under the No Action and Action Alternatives

Cover Type	Associated Wildlife Species	Miles	Percentage of Route
Sagebrush	Elk, mule deer, pronghorn, Brewer's Sparrow, Sage Sparrow, Green-tailed Towhee, Sage Thrasher	49.4	43.1%
Developed	American Kestrel, Western Kingbird, American Robin, Brown-headed Cowbird, Brewer's Blackbird	41.6	36.3%
Pinyon-juniper woodland	Elk, Sharp-shinned Hawk, Cooper's Hawk, Black-throated Gray Warbler, Gray Vireo, Loggerhead Shrike, Virginia's Warbler, Townsend's Solitaire, Pinyon Jay, Red-naped Sapsucker	11.7	10.2%
Agriculture	Elk, mule deer, pronghorn, Peregrine Falcon, Prairie Falcon, Swainson's Hawk, Say's Phoebe, Western Kingbird	7.3	6.4%
Shrub-steppe	Elk, mule deer, pronghorn, Brewer's Sparrow, Sage Sparrow, Green-tailed Towhee, Sage Thrasher	0.2	0.2%
Woodland-shrubland	Elk, Black-throated Gray Warbler, Gray Vireo, Virginia's Warbler, Ash-throated Flycatcher, Black-capped Chickadee, Spotted Towhee, Black-chinned Sparrow	2.2	1.9%
bedrock, cliff, and canyon	Peregrine Falcon, Prairie Falcon, Rock Wren	1.1	1.0%
Grassland (native and invasive grasses/forbs)	Elk, mule deer, pronghorn, Rough-legged Hawk (Winter), Mountain Bluebird, Bendire's Thrasher	0.2	0.2%
Open water	Mallard, shorebirds, fish, amphibians	< 0.1	< 0.1%
Salt desert scrub	Pronghorn, Bendire's Thrasher, Black-chinned Sparrow, Brewer's Sparrow, Gambel's Quail, Loggerhead Shrike, Lucy's Warbler, Mountain Plover, Northern Harrier, Prairie Falcon, Sage Sparrow, Black-throated Sparrow, Gambel's Quail	< 0.1	< 0.1%
Riparian	Red-tailed Hawk, Great-horned Owl, Western Screech-Owl, Broad-tailed Hummingbird, Gambel's Quail, Lucy's Warbler, Peregrine Falcon, Downy Woodpecker, American Dipper, Yellow-breasted Chat, Yellow Warbler	0.8 40.8 acres*	0.7%
Total		**114.7 miles**	**100.0%**

Notes: Scientific nomenclature for all wildlife species in this EIS is introduced in Chapter 3.

Acres of riparian habitat within 100-feet of the reasonably foreseeable coal haul transportation route are also included to assess potential impacts in the unlikely event of a coal truck accident in close proximity to this cover type.

Land cover miles are the same for all three action alternatives because the reasonably foreseeable coal haul transportation route is the same for all alternatives.

* The analysis area for riparian also includes acres of habitat within a 100-foot buffer of the reasonably foreseeable coal haul transportation route.

4.17.5.2 ALTERNATIVE B (PROPOSED ACTION), ALTERNATIVE C (REDUCED TRACT ACREAGE AND SEASONAL RESTRICTIONS), AND ALTERNATIVE K1 (REDUCED TRACT ACREAGE)

Under the Proposed Action, Alternative C, and Alternative K1, the addition of coal trucks and other mine-related traffic is expected to generate an additional 160 employee round-trips per day on existing roadways, and 153 truck round-trips over each 24-hour period, or six trucks each way per hour, along the reasonably foreseeable transportation route (approximately 115 miles from Alton via US-89 to US-20 to I-15 to SR-56 to Iron Springs). Coal trucks are expected to leave the mine at nine- to 10-minute intervals, with a truck passing any given point along the route approximately every five minutes. The increase in ADT from employee and service round-trips and coal trucks is estimated at 4% on US-89 and 2% on SR-56 compared to the No Action Alternative (see Section 4.14.3). Coal truck traffic would increase average, daily, heavy truck volume of 28%–43% along US-89 and US-20 (Fehr & Peers Transportation Consultants 2013).

Wildlife-related vehicle accidents accounted for 126 (approximately 51%) of single-vehicle accidents on US-89 (from Glendale to junction with SR-20) between 2003 and 2005 (see Appendix H, transportation study). These accidents occurred before mining operations at the Coal Hollow Mine. Wildlife-related vehicle accidents accounted for 12 (approximately 18%) single-vehicle accidents on SR-20 (from I-15 to junction with US-89) between 2003 and 2005. Wildlife-related vehicle accidents accounted for 39 (approximately 11%) single-vehicle accidents on I-15 (from Cedar City to SR-20) between 2003 and 2005. Wildlife-related accidents accounted for 34 (approximately 41%) single vehicle accidents on SR-56 (from Milepost 9.80 to Milepost 61.39) between 2003 and 2005.

There would be an increased risk of wildlife mortality from vehicle collisions along the reasonably foreseeable coal haul transportation route, particularly due to the relative increase in nighttime truck traffic. Wildlife would also be impacted by disruption of diurnal or nocturnal activities from traffic-related noise. Because wildlife habitats occur adjacent to a large portion of the reasonably foreseeable coal haul transportation route (see Table 4.17.4), there would be an increased risk of mortality from vehicle collisions and greater impacts from traffic-related noise due to an increase in coal truck traffic. Ambient noise levels of 40 dBA could increase to 56–68 dBA due to haul truck traffic. There would also be an increased risk of sedimentation or contamination of the Sevier River drainage system from accidental spillage of coal associated with increased coal truck traffic.

Any increase in roadkill could increase raptor activity along the reasonably foreseeable coal haul transportation route. The proportional increase in truck traffic at night would be considerably higher than daily traffic proportional volume increases (BLM 1995) (see Section 4.14). Coal truck traffic would not be reduced by timing restrictions on Block S under Alternative C, because of the operation of a second pit that would allow mining at all times. Direct and indirect impacts to wildlife would be greater under the Proposed Action, Alternative C, and Alternative K1 compared to the No Action Alternative. The duration of the impacts among the action alternatives would differ according to the lengths of mine life. Under the Proposed Action, coal would be transported during a 25-year mine life, Alternative C would transport coal during a 21-year mine life, and Alternative K1 would transport coal during a 16-year mine life.

Roads can also effectively act as a movement barrier to some wildlife species, especially when the road is wide, paved, and handles high amounts of traffic. Traffic would be increased from the presence of coal haul trucks on the reasonably foreseeable coal haul transportation route. Species that are most susceptible to barrier effects are those that tend to avoid roads and also require large tracts of habitat for survival (Forman et al. 2003), such as bobcat, mountain lion, and elk. Other wildlife groups vulnerable to these effects include small mammal and amphibian species. Because of the presence of roads and barrier effects (which reduce landscape connectivity), these species are more susceptible to reduced gene flow and a reduced regional population size. Many wildlife species are therefore at a greater risk of a reduction in the regional population size due to the presence of roads and increased traffic on existing roads.

4.17.5.2.1 Big Game

Mule deer are the primary big game animal affected by highway traffic in the United States, with an estimated 1 million deer-vehicle collisions annually (Conover et al. 1995). As discussed for Alternative A, wildlife accounted for a considerable portion of the vehicle accidents that occurred on the reasonably foreseeable coal haul transportation route from 2003 to 2005 (Fehr & Peers Transportation Consultants 2013). The factors contributing to deer-vehicle collisions are traffic volume, deer density, and higher vehicle speeds (Sullivan et al. 2003). As a result, vehicle-related mortality of mule deer along the reasonably foreseeable coal haul transportation route would be proportional to mule deer density and the speed and volume of traffic relative to deer movements and concentrations. Traffic timing is also a factor; the greatest potential for mule deer fatalities from truck traffic most likely occur during spring and fall migrations and during morning and evening hours, when deer are most active. Traffic impacts to elk and pronghorn would also be proportional to the density of animals, and the timing, speed, and volume of traffic relative to their movements. Under the No Action Alternative, coal transport from the tract along US-89, SR-20, I-15, and SR-56 would not occur as a function of mining because the tract would not be offered for lease sale. However, coal haul traffic from the existing adjacent mine would continue. Under the Proposed Action, Alternative C, and Alternative K1, a large portion of the reasonably foreseeable coal haul transportation route would be adjacent to crucial winter mule deer habitat (81%), crucial winter elk habitat (49%), and crucial year-long pronghorn habitat (49%) (Table 4.17.5). This suggests that impacts to mule deer and elk would be more likely in the winter, and impacts to pronghorn would be probable year-long. Although the estimated increase in ADT is estimated to be from 2% to 4% along the route, there would be a proportionally greater increase in nighttime traffic due to the 24-hour coal truck activity. See Section 4.14 (Transportation) for a more detailed discussion of projected traffic increases.

Table 4.17.5. Miles of Mule Deer, Elk, and Pronghorn Habitats Adjacent to the Reasonably Foreseeable Coal Haul Transportation Route Under the No Action and Action Alternatives

	Miles	Percentage of Route
Mule Deer Habitats		
Crucial winter	21.2	18.4%
Crucial summer	18.6	16.2%
Substantial value year-long	11.7	10.2%
Substantial value winter	10.2	8.9%
Elk Habitats		
Substantial value winter	15.8	13.7%
Substantial value summer	10.4	9.0%
Pronghorn Habitats		
Crucial winter	5.9	5.1%
Crucial year-long	54.0	47.0%

Source: UDWR GIS data updated May 2012

In addition to impacting big game while on their seasonal habitats, there is potential for coal hauling to impact mule deer, elk, and pronghorn when they move between seasonal habitats along established migration routes. All of these species currently follow migration routes that cross the reasonably foreseeable coal transportation route multiple times, as described in Section 3.17.2.1. A broad-scale pattern exists for big game to use the mountainous habitat north of the tract in the summer and desert habitat south of the tract in the winter, especially mule deer and elk. Increasing collision potential during

migration could impact regional big game populations to a greater degree than when the animals are stationary because herds from far-ranging seasonal habitats could be moving through the area. Impacts during migration have potential to reduce population health for herds throughout the region. Furthermore, increased traffic on roads that intersect migration routes increases the magnitude of existing road barrier effects. Road barrier effects refer not only to increased potential for vehicle collisions, but increased potential for migration routes to be altered and high-quality habitats not to be reached because of the tendency to avoid road crossings.

4.17.5.2.2 Raptors

Increased coal truck traffic could result in direct adverse impacts to raptors from vehicle strikes. The increase in traffic volume would likely result in increased roadkills of other wildlife species, which would attract raptors to the reasonably foreseeable coal haul transportation route and increase the likelihood of raptor mortality from vehicle collisions. Raptor foraging and nesting habitats in sagebrush, pinyon-juniper woodland, agriculture, shrub-steppe, woodland-shrubland, grassland, salt desert scrub, and riparian cover types occur adjacent to approximately 72 miles (62%) of the reasonably foreseeable coal haul transportation route (see Table 4.17.4). Under the Proposed Action, Alternative C, and Alternative K1, transportation-related adverse impacts to raptor species would likely be greater than would occur under the No Action Alternative.

4.17.5.2.3 Migratory Birds

Increased coal truck traffic would likely result in limited adverse impacts to migratory bird species adjacent to the reasonably foreseeable coal haul transportation route. Nevertheless, increased traffic volume could result in increased mortality from vehicle strikes. Foraging and nesting habitats for migratory bird species in sagebrush, pinyon-juniper woodland, agriculture, shrub-steppe, woodland-shrubland, grassland, and salt desert scrub cover types occur adjacent to approximately 71 miles (62%) of the reasonably foreseeable coal haul transportation route (see Tables 4.17.3 and 4.17.4). Under the Proposed Action, Alternative C, and Alternative K1, transportation-related adverse impacts to migratory bird species would likely be greater than would occur under the No Action Alternative.

4.17.5.2.4 Amphibian Species

Increased coal truck traffic would likely result in limited adverse impacts to amphibian species occurring along the reasonably foreseeable coal haul transportation route. Nevertheless, increased traffic volume could result in increased mortality from vehicle strikes. Amphibian habitat in pinyon-juniper woodlands occur adjacent to approximately 12 miles (10%) of the reasonably foreseeable coal haul transportation route (see Table 4.17.4). Under the Proposed Action, Alternative C, and Alternative K1, transportation-related adverse impacts to amphibians would likely be slightly greater than would occur under the No Action Alternative.

4.17.5.2.5 Fish

Fish, primarily trout species, occur in habitats adjacent to the reasonably foreseeable coal haul transportation route. Due to the expected increase in the volume of coal truck traffic associated with mining operations, there is increased potential for accidental coal spills to stream habitats along the reasonably foreseeable coal haul transportation route. Approximately 0.8 mile (0.7%) of the reasonably foreseeable coal haul transportation route transects stream habitats where there is the potential for a coal truck spill into the waterway. Stream and riparian habitats occur on 40.8 acres of riparian habitat within 100 feet of the reasonably foreseeable coal haul transportation route. Although the risk of a spill to this small portion of the route is negligible, the introduction of coal, petroleum products, or other hazardous materials from a coal truck spill could directly or indirectly adversely impact fish species and their habitats by causing mortality of individual fish or prey species from poisoning, or from loss of habitat due to reduced water quality or other habitat features.

4.17.6 Potential Mitigation Measures

Protective measures for wildlife species described above and in Management and Considerations Common to Each Action Alternative in Chapter 2 would mitigate and/or minimize impacts to wildlife resources in the tract. Potential mitigation measures for wildlife species include those listed below. BLM will incorporate selected mitigation measures into the ROD for this EIS.

- Install fencing and/or netting or other protective features around evaporation and production pits to reduce mortality of wildlife (e.g., migratory birds, raptors, and bats) due to drowning or entrapment.
- Design fences proposed in big game habitat to reduce impacts to big game movement. BLM would consult with UDWR on the design and location of new fences and in rebuilding old fence lines.
- Cooperate with UDWR to contribute funds to big game habitat improvement projects in the Paunsaugunt Management Unit by improving 4 acres of habitat for every acre of habitat disturbed.
- Cooperate with UDWR to contribute funds to local conservation easements that benefit wildlife.

To reduce road and haul truck impacts on wildlife, potential mitigation measures include the following:

- Install deer 'whistles' on coal haul trucks to reduce potential wildlife mortality.
- Install solar-powered flashing signs at critical crossings during hazardous seasons (i.e., migration and winter) for deer and elk.
- If practical and economic, do not conduct coal hauling one hour before sunrise, one hour after sunrise, one hour before sunset, and one hour after sunset to avoid crepuscular periods.
- Work with BLM, UDWR, and UDOT to ensure wildlife fencing, ramps, and crosswalks are installed at appropriate locations throughout the transportation route.
- Work with UDOT to seed plant species unpalatable by big game species in road ROWs to reduce big game/vehicle collisions.
- Cooperate with UDWR to contribute funds to help fund wildlife crossing projects along the haul route.
- Cooperate with UDWR to contribute funds to efforts to monitor or research wildlife highway mortalities along the haul route.

To reduce nighttime lighting impacts on wildlife, measures include the following:

- Place shields on all lights to focus light downward and reduce light scatter.
- Implement dust control measures. See the Air Resources section of Chapter 4 for specific measures.
- Limit the use of blue-rich white light where practical (in compliance with MSHA regulations), because research suggests blue-rich white light can heighten response in species (IDA 2010).

To reduce noise impacts on wildlife, measures include the following:

- If practical and economic, use equipment with lower sound power levels than the ones that were modeled.
- If practical and economic, reduce nighttime hours of operation in certain areas of the mine.
- If practical and economic, build a noise attenuating wall.

4.17.7 Unavoidable Adverse Impacts

Unavoidable adverse impacts would occur where the loss of wildlife occurs during mining pit disturbance, soil stockpiling, road and infrastructure development, or regular mine operations. Unavoidable loss could occur where wildlife are not detected or identified during surveys. Unavoidable loss of wildlife due to nondetection or inadvertent adverse impacts would also occur. There would also be unavoidable, short-term loss of wildlife habitats and individuals as a result of mining operations.

4.17.8 Short-term Uses versus Long-term Productivity

The short-term use of the tract for coal extraction would result in reduced structural and compositional diversity and reduced long-term productivity of wildlife habitats. The habitats present in the proposed tract are typically slow to recover from disturbance and productivity would be limited during reclamation and restoration activities. Long-term productivity would be reduced because vegetation communities would not develop immediately following mining and restoration activities. Until they are fully developed, these habitats would be less diverse and less productive, particularly if critical habitat components such as biological soil crusts and other soil properties have been lost. Effective implementation of the mitigation measures outlined above would minimize impacts to the long-term productivity of these vegetation communities and the wildlife that rely on them.

4.17.9 Irreversible and Irretrievable Commitments of Resources

Under the Proposed Action, Alternative C, and Alternative K1, the vegetation communities relied on as wildlife forage and cover that would be removed for surface mining would be irretrievably altered during the life of the mine. Once impacted by surface mining, dispersed and centralized facilities, roads, and ROWs, the productivity of vegetation communities would be irretrievably removed or reduced until reclamation and restoration have been completed. The loss of wildlife from mining and associated activities and from coal truck strikes along the reasonably foreseeable coal haul transportation route would constitute an irreversible commitment of the resource because these individuals would be permanently lost.

4.18 Wildlife: Special Status Species

This section assesses the environmental consequences of Alternative A (No Action), Alternative B (Proposed Action), Alternative C, and Alternative K1 on one federally endangered species, one federally threatened species, one federal candidate species, and 23 State of Utah/BLM sensitive species with potential to occur on the proposed Alton Coal Tract and the reasonably foreseeable coal haul transportation route. Collectively, these species are referred to as *special status species*. Special status species have limited distributions or numbers, and they generally have specific habitat requirements. If these species are lost, displaced, or if their habitat is altered, there is limited potential for relocation or reestablishment elsewhere. As a result, impacts to special status species must be assessed according to factors that are most important for their maintenance or recovery, or to prevent their listing as threatened or endangered. Impacts to special status wildlife species would be avoided to some degree through conservation and/or mitigation measures. However, both direct and indirect impacts to special status species are expected to result from minerals development and construction activities in the tract, as proposed under the action alternatives, and from traffic changes on the reasonably foreseeable coal haul transportation route, both of which could affect individuals, populations, or habitat conditions.

This section is divided into two distinct subsections. The first provides impacts analysis for all special status wildlife species except Greater Sage-Grouse (4.18.1). The second provides analysis only for the Greater Sage-Grouse (4.18.2). The intent of separating out the sage-grouse discussion is to prevent confusion or misunderstanding surrounding impacts on this species by providing all relevant information on the species in an organized and readable fashion. In this section, *short term* refers to the period when the development of the mine and the mining of coal would occur. *Long term* refers to impacts that occur and remain during coal mining and impacts that continue into the period following the reclamation and monitoring period.

4.18.1 Special Status Species (except Greater Sage-Grouse)

4.18.1.1 REGULATORY FRAMEWORK AND ADDITIONAL DESIGN FEATURES

4.18.1.1.1 Regulatory Framework

Numerous federal and state regulations shape the management of special status wildlife species. Regulations that pertain to special status species and potential impacts from mining and other land uses include, but are not limited to, the following:

- The Bald Eagle Protection Act of 1940, as amended, establishes penalties for taking, possessing, selling, purchasing, or bartering bald and golden eagles. It also provides for cancellation of the lease, license, or other federal land use authorization for anyone convicted of violating the act or any of its implementing regulations or permits.
- The Fish and Wildlife Coordination Act of 1958 mandates equal consideration of wildlife conservation with other features of water resource development programs. It requires that damage to fish and wildlife resources be prevented and that these resources be developed and improved.
- The ESA of 1973, as amended, requires the BLM to ensure that proposed actions do not jeopardize the continued existence of a threatened or endangered species and do not cause its critical habitat to be modified or destroyed.
- FLPMA of 1976 recognizes wildlife as a principal land use, requires consideration of wildlife objectives in commodity-oriented programs, and authorizes use of range-betterment funds for enhancement of habitat for fish and wildlife.
- The Fish and Wildlife Improvement Act of 1978 authorizes the Secretary of the Interior to permit the taking of golden eagle nests that interfere with resource development or recovery operations.

Other federal laws that could occasionally affect wildlife habitat management actions in the tract are those listed under Section 4.17.1.1 of the Wildlife section, the MLA, the Water Resources Planning Act, the Water Pollution Act, the Water Resources Development Act, the Federal Grants and Cooperative Agreements Act, the Safe Drinking Water Act, the Fish and Wildlife Act, and the Soils and Water Resources Conservation Act.

4.18.1.1.2 Design Features

The KFO RMP and other BLM and state documents provide the framework for the tract's design features, which would be reflected in lease stipulations as part of a lease contract after a ROD. DOGM, a state agency under the UDNR, would be responsible for ensuring compliance and enforcement of the lease stipulations. The following standards would be applicable to special status species and would compel mitigation for impacts to special status species related to mining the tract.

- Survey for threatened, endangered, proposed, and candidate species and their habitats. Site-specific mitigation and avoidance measures would be determined at the permitting stage.
- Avoid disturbance to individuals, populations, and habitats of threatened, endangered, proposed, and candidate species during mining.
- After mining is completed in an area, restore habitat for threatened, endangered, proposed, and candidate species in disturbed areas.
- During all operations, enforce appropriate vehicle speed limits to minimize potential for wildlife mortality.
- During all operations, instruct employees not to harass or disturb wildlife.
- Monitor reclamation sites to assess habitat reclamation success.
- Develop a practical and economic blasting plan that is sensitive to noise impacts on special status species, especially during nesting and breeding seasons.

These design features would help reduce the severity of impacts to special status wildlife species by enhancing and restoring native and suitable non-native vegetation communities in the short term and long term.

4.18.1.2 IMPACT INDICATORS

In this analysis, acres of surface disturbance in or adjacent to special status species habitats are used as the primary indicator of impacts in the tract. For noise analysis, dBA above ambient noise conditions was used as an additional indicator of impacts. For nighttime lighting analysis, lumens (a measurement of the brightness of light as perceived by the human eye) were used. Because organisms perceive light differently, it is difficult to predict how different magnitudes of lumens would affect different species. Research suggests that blue-rich white light is more detrimental to most wildlife than amber or redder light (IDA 2010). Potential impacts to special status species, such as changes in habitat quality or quantity, reduced population size, or increased mortality, are also used as impact indicators. Surface disturbance from minerals development and construction activities would occur in the tract as planned under the action alternatives.

On the reasonably foreseeable coal haul transportation route, impacts to the Utah prairie dog and its habitats adjacent to the route are analyzed as acres within a 350-foot buffer on both sides of the route. Impacts to special status species associated with riparian habitats adjacent to the reasonably foreseeable coal haul transportation route are analyzed as acres within a 100-foot buffer on both sides of the route. Impacts to all other special status species and their habitats on the reasonably foreseeable coal haul transportation route are analyzed using miles of habitat adjacent to the route. Impacts to special status species on the reasonably foreseeable coal haul transportation route are analyzed separately from impacts associated with the tract (see Section 4.18.1.5). The coal haul transportation route that is used for analysis purposes is the most reasonably foreseeable route, but it is impossible to predict the exact route that a successful bidder might choose.

As indicated in Section 3.18, special status species habitat acreages are based on detailed vegetation community surveys in the tract (SWCA 2007a), and on southwest regional land cover data (SWReGAP 2004) along the reasonably foreseeable coal haul transportation route (see Section 3.15 for a detailed description of the vegetation communities present in the tract). The vegetation communities (also referred to as habitat types) discussed for the tract and the reasonably foreseeable coal haul transportation route differ because of differences between the field surveys and SWReGAP datasets, and because different land cover types occur in these areas. Because impacts to the tract and the reasonably foreseeable coal haul transportation route are analyzed separately, land cover types are not directly compared, and differences in cover types are not a limiting factor in the analysis.

Three general categories of habitat impacts are anticipated to be the most influential on special status species and their habitats: 1) habitat fragmentation and alteration, 2) habitat loss and displacement of both individuals and populations, and 3) habitat improvements. Habitat fragmentation occurs when a contiguous habitat is broken up or fragmented by surface-disturbing activities causing a reduction in usable ranges and a disruption of movement among habitat areas. In addition, habitat fragmentation causes the isolation of less mobile species, a decline in habitat specialists, and facilitates invasion by generalist species (Marvier et al. 2004). Habitat alteration occurs when surface-disturbing activities directly or indirectly change the composition, structure, or functioning of the habitat. Habitat loss is caused by surface-disturbing activities or other activities that degrade or remove habitat. Habitat displacement occurs when land use activities force special status species to move into other habitats, thereby increasing stress on individual animals and increasing competition for habitat resources. Any surface-disturbing actions could lead to habitat alteration, fragmentation, displacement, or loss; limit the amount of usable habitat for special status species; and restrict movement among habitat areas. Habitat improvement results from maintenance, reclamation, revegetation, vegetation treatments, or other management actions that increase the quantity and/or quality of habitat conditions, or is otherwise beneficial to one or more special status species. Improvements would mostly take place with the goal of reducing juniper encroachment of sagebrush habitat.

4.18.1.3 ANALYSIS ASSUMPTIONS

The locations and habitats of some species in the tract and the reasonably foreseeable coal haul transportation route are known; however, the data are neither complete nor comprehensive for all special status species occurrences or for all potential habitats that might exist. Both known and potential special status species and habitat locations are considered in the analysis. The species and potential habitats that could be affected by various actions are assumed to be directly correlated with the degree, nature, and quantity of surface disturbance and other activities. Impacts are quantified wherever possible. In the absence of quantitative data, best professional judgment is used to analyze impacts. This analysis was prepared using the following assumptions:

- Local populations are naturally affected by nonhuman causal factors such as climate, natural predation, disease, natural fire regimes, and competition with other native species for available habitat.
- Impacts to special status species depend on the location, extent, timing, and intensity of the disturbance.
- Impacts to special status species are likely greater than impacts to species that are not special status due to the limited distribution of individuals and habitats and/or a low tolerance for disturbance.
- Ground-disturbing activities could lead to the fragmentation, alteration (positive or negative), loss, or displacement (short-term or long-term) of special status species habitats and/or loss or gain of individuals or populations.

- Disturbance occurring adjacent to special status species habitat would contribute to habitat fragmentation, alteration, and displacement due to reduced habitat quality or accessibility.
- Changes in air, water, and habitat quality may cause direct and indirect impacts to special status species and habitats, and may also have cumulative impacts on species survival.
- The existing ambient noise condition on the tract is approximately 40 dBA. Special status wildlife species would be negatively impacted by increasing ambient noise.
- Increased ambient nighttime light (measured in lumens) results in corresponding negative impacts to special status wildlife species.
- Blue-rich lighting is more detrimental to most wildlife.
- Increased ambient nighttime light is more detrimental to nocturnal wildlife.
- If mitigation, habitat maintenance, or habitat improvement actions are demonstrated to be successful, these actions could maintain or improve the condition of vegetation, soils, and other habitat conditions through vegetation treatments, restrictions on surface-disturbing activities, and site reclamation and restoration.

Impacts to stream and riparian habitats associated with the reasonably foreseeable coal haul transportation route are based on the assumption that the likelihood of a coal spill along the route would be proportional to the occurrence of one accident per year anywhere along the entire reasonably foreseeable route. It is not possible to predict future conditions that could contribute to an accident; nevertheless, the chance of an accident occurring near stream or riparian habitats, which make up a very small portion of the route, would be extremely low.

In addition to conservation and lease notices, the following would apply: species-specific recovery plans and conservation documents that include management plans and strategies to protect special status species. Applicable documents to the tract and the reasonably foreseeable coal haul transportation route include, but are not limited to the BGEPA, *the Utah Prairie Dog Recovery Plan* (USFWS and Utah Prairie Dog Recovery Team 2012), *The Utah Prairie Dog Interim Conservation Strategy* (1997), *The Northern Goshawk Conservation Agreement* (1998), *Utah Field Office Guidelines for Raptor Protection from Human and Land Use Disturbances* (Romin et al. 2002), and *Best Management Practices for Raptors and Their Associated Habitats* (BLM 2008b:Appendix 2).

4.18.1.4 IMPACTS FROM MINING THE TRACT

4.18.1.4.1 Alternative A: No Action

Under the No Action Alternative, the tract would not be mined, and no coal mining or related activities, infrastructure development, or relocation of KFO Route 116 would occur. Therefore, no acres of special status species habitat would be disturbed by these activities. However, management under the No Action Alternative would not restrict permitted mining activities on private lands adjacent to the tract. Mine-related activities would occur to a lesser degree than under the Proposed Action, Alternative C, or Alternative K1 because the total acreage of mining activities and the total duration of mining activities would be considerably less than under either of these alternatives.

Management of special status species habitats on BLM-administered lands in the tract would be conducted as directed under the KFO RMP (BLM 2008b). Under the No Action Alternative, prescribed management on BLM-administered lands would include watershed protections and improvements to special status species habitats. Vegetation management to restore sagebrush grasslands that have been invaded by pinyon-juniper woodlands would improve ecosystem functioning and watershed health. Vegetation management would have long-term, beneficial effects for upland animal species by removing undesirable vegetation, increasing species and structural diversity, and improving overall habitat quality. Pinyon-juniper tree removal would reduce the amount of foraging, roosting, and nesting habitats available

to raptors, bats, and migratory birds. Vegetation treatments that would help reduce soil loss and improve water quality would likely improve aquatic and riparian habitats and benefit the special status species that rely directly or indirectly on these habitats. Erosion control measures would reduce sedimentation of water sources and associated impacts to special status amphibian species. Vegetation and soil treatments would help to reestablish upland communities, maintain or improve the health of riparian/wetland communities, reestablish seedlings and understory vegetation, and retain soil moisture and nutrients (BLM 2008b).

Table 4.18.1 lists the vegetation communities present in the tract, the special status species associated with each community, and the acres of disturbance that would occur to each community under the No Action Alternative, Proposed Action, Alternative C, and Alternative K1.

Table 4.18.1. Acreages and Direct Disturbance in the Alton Coal Tract by Vegetation Community and Associated Special Status Species Under the No Action and Action Alternatives

Vegetation Community	Associated Special Status Species[9]	Alternative A (No Action)	Alternative B (Proposed Action)			Alternative C (Reduced Tract Acreage and Seasonal Restrictions)			Alternative K1 (Reduced Tract Acreage)		
		Direct Acres Disturbed	Acres in Tract	Direct Acres Disturbed	Percentage Disturbed	Acres in Tract	Direct Acres Disturbed	Percentage Disturbed	Acres in Tract	Direct Acres Disturbed	Percentage Disturbed
Pinyon-juniper woodland	Allen's big-eared bat, Arizona toad, Ferruginous Hawk, Lewis's Woodpecker, Townsend's big-eared bat	0.0	1,430.8	694.4	48.6%	1,409.7	680.1	48.2%	1,095.1	471.6	43.1%
Sagebrush/ grassland	Burrowing Owl, Ferruginous Hawk, fringed myotis, Golden Eagle, Greater Sage-Grouse, kit fox, Long-billed Curlew, pygmy rabbit, Short-eared Owl, spotted bat, Townsend's big-eared bat	0.0	860.2	366.5	42.6%	627.8	195.7	31.2%	369.1	91.2	24.7%
Sagebrush/ grassland (treated)	Burrowing Owl, Ferruginous Hawk, fringed myotis, Golden Eagle, Greater Sage-Grouse, kit fox, Long-billed Curlew, pygmy rabbit, Short-eared Owl, spotted bat, Townsend's big-eared bat	0.0	749.1	547.5	73.1%	749.1	546.0	72.9%	289.5	235.9	81.5%
Annual and perennial grasses	Ferruginous Hawk, Long-billed Curlew, Short-eared Owl	0.0	324.1	278.4	85.9%	247.0	196.5	79.6%	247.0	196.8	79.7%
Mountain brush	Ferruginous Hawk, Lewis's Woodpecker	0.0	62.8	24.9	39.6%	62.8	24.7	39.3%	40.8	1.7	4.2%
Wetland (meadow)	Western toad	0.0	62.8	55.5	88.3%	0.0	0.0	0%	0.0	0.0	0%
Riparian	Allen's big-eared bat, Arizona toad, Bald Eagle, big free-tailed bat, Lewis's Woodpecker, Northern Goshawk, western toad	0.0	55.3	6.7	12.1%	54.0	6.3	11.7%	54.0	6.4	11.9%
Rabbitbrush	Burrowing Owl, Ferruginous Hawk, Golden Eagle, Greater Sage-Grouse, kit fox, pygmy rabbit, Short-eared Owl, spotted bat	0.0	10.7	1.0	9.2%	10.7	1.0	8.0%	10.7	1.0	9.3%
Bedrock, cliff, and canyon	Allen's big-eared bat, Black Swift, big free-tailed bat, Golden Eagle, fringed myotis, spotted bat, Townsend's big-eared bat	0.0	0.0	0.0	0%	0.0	0.0	0%	0.0	0.0	0%
Open water	Black Swift	0.0	4.1	0.0	0%	0.0	0.0	0%	0.0	0.0	0%
Habitat total		**0**	**3,559.9**	**1,974.8**	**55.5%**	**3,161.6**	**1,650.3**	**52.2%**	**2,106.2**	**1,004.6**	**47.7%**

[9] Scientific names for all wildlife and special status species can be found in Chapter 3.

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4.18.1.4.2 Impacts Common to the Action Alternatives

Under the action alternatives reasonably foreseeable mining development would occur on approximately 120 acres at any one time, with an additional approximately 120 acres or more in some stage of reclamation. Centralized facilities would be located for the life of the mine on approximately 36 acres, and dispersed facilities would be moved on a regular basis based on the mining sequence and would result in approximately 160 acres of active disturbance. This process would take place for approximately 25 years. Impacts are analyzed below based on the concept that this 120-acre mining disturbance could occur in any location throughout the tract, except for those locations prohibited in the lease conditions, and would eventually have occurred at all coal-bearing locations in the tract. Also, concurrent reclamation would take place on a rolling basis with mining, and that reclamation actions would conform to the standards listed in the lease stipulations.

Impacts to special status wildlife species common to all action alternatives would be identical to those described for wildlife (Section 4.17.4.2) except for the following.

The mining and haul truck activity on the tract and road, as well as the associated habitat removal, would lead to habitat fragmentation, especially for highly mobile species that occupy large habitat patches, such as kit fox. This fragmentation could augment typical wildlife movement patterns such as seasonal migration and daily use. Because of the presence of roads and the associated barrier effects (which reduce landscape connectivity), these species are more susceptible to reduced gene flow and a reduced regional population size. Many wildlife species are therefore at a greater risk of a reduction in the regional population size due to the presence of roads and increased traffic on existing roads. For the pygmy rabbit, large tracts of sagebrush habitat are necessary to support metapopulations and genetic mixing between the populations. For this species, habitat fragmentation and limiting genetic mixing would contribute to the further isolation of local populations.

Disturbance to or displacement of wildlife would likely occur from lighting during nighttime operations. Artificial night lighting affects animal foraging behavior, reproduction, movement, and species interactions (such as predator-prey, pollinator-plant, and competition relationships) (Beier 2006; Longcore et al. 2005, 2004; Miller 2006). Bats respond to increased nighttime light by reducing or shifting their periods of activity, traveling shorter distances, and consuming less food (Longcore and Rich 2005) (discussed in more detail in section 4.17.4.2.5). Bat species are likely to be attracted to insect activity around lights and could benefit from concentrated prey. Diurnal (day-active) and nocturnal special status species could be displaced from, or attracted to, habitats affected by night lighting. However, night lighting increases the risk of predation for small, nocturnal mammals and decreases food consumption when animals reduce foraging activities to remain concealed in an artificially lit environment (Beier 2006).

Mined sites will be reclaimed into functioning sagebrush communities. From observations of other reclaimed projects in the KFO, it is expected that reclamation will be successful within approximately 20 years of completion (Petersen 2013b). During this recovery period, reclaimed sites may have lower habitat quality than fully developed vegetation communities, and would therefore be of less value to special status species, particularly those that require mature sagebrush habitats such as pygmy rabbits.

Disturbance to native habitats could also cause degradation of special status species habitats due to an increased risk of noxious weeds invasion and associated alteration of habitat composition and structure.

4.18.1.4.3 Alternative B: Proposed Action

Impacts to special status wildlife species under Alternative B: Proposed Action would be identical to those described for wildlife (Section 4.17.4.3) except for the following.

4.18.1.4.3.1 Pygmy Rabbit

Threats to the pygmy rabbit are primarily from habitat loss across its limited range in the Inter-mountain West (Crowther 2013). In Utah, the pygmy rabbit occurs in the west half of the state, primarily in the Bonneville Basin (Crowther 2013). Similar to the Greater Sage-Grouse, this species is largely dependent on sagebrush for both food and cover. Approximately 914 acres (57%) of suitable potential habitat for pygmy rabbit, including sagebrush/grassland and sagebrush/grassland (treated) vegetation communities, would be removed under the Proposed Action (see Table 4.18.1). These impacts are reported in terms of total acres of disturbance over the life of the mine, but note that this disturbance would not all occur at one time. If pre-construction surveys find pygmy rabbits are present on the tract, direct impacts to individuals would occur during surface disturbance. Pygmy rabbits have small home ranges. Like most burrowing mammals, they retreat into their burrows for protection from disturbance. Because of this, it is more likely that they would be crushed or buried in their burrows during mining activities than for them to leave and be displaced. If pygmy rabbits successfully flee the area, they would be displaced from these habitat resources until reclamation and successful restoration have been completed. Because pygmy rabbit presence is closely tied with the availability of soil types in which they can establish burrows, it is unknown whether the conditions of successful reclamation would provide habitat for the species' return to the tract. It is possible that the soils would be too compact to provide burrowing habitat. However, because reclamation actions would target the restoration of sagebrush habitat, as described in Section 4.18.2.1.2.1 (Sage-grouse, lease stipulations), if pygmy rabbits are able to recolonize the reclaimed areas, they would benefit from the increase availability of sagebrush habitat in the long term. If the soil conditions of the reclaimed areas prevent the return of the species, the population would not return to the habitat of the tract. The loss of this local population would reduce the health of surrounding populations by decreasing accessible genetic diversity.

Pygmy rabbit populations are typically limited by sufficient burrowing sites, so displaced individuals may not find an appropriate recolonization site outside of the actively mined area. If displaced individuals are able to disperse, they would benefit from the vegetation treatments required by the sage-grouse mitigation plan (see Appendix E), because the treatments could create more habitat for the species through the increased availability of large and connected sagebrush habitat (if the soils were appropriate for burrow colonization, as described above). The Proposed Action would result in greater short-term and long-term direct adverse impacts to pygmy rabbit and its habitats than would occur under the No Action Alternative.

4.18.1.4.3.2 Kit Fox

The kit fox is widely distributed in Utah, but may be declining (UDWR 2005). Its distribution in the tract analysis area is not known. Habitat loss, displacement by competitors, and indiscriminant predator poisoning are the primary threats to the species (Crowther 2013). Indirect impacts can result from reduced abundance of small mammal prey due to habitat alteration. Approximately 914 acres (57%) of kit fox sagebrush/grassland and sagebrush/grassland (treated) vegetation communities would be removed under the Proposed Action (see Table 4.18.1), which equates to approximately one third (34%) the size of one kit fox home range, as described in Section 3.18.2.3. In addition to direct impacts to individuals that may occur during surface disturbance and mining, kit fox would be displaced due to the removal of its habitat until reclamation and successful restoration have been completed. Because a large portion of the tract would be disturbed during surface mining and associated activities, the Proposed Action would result in greater short-term direct adverse impacts to kit fox and its habitats than would occur under the No Action Alternative. Individuals would benefit from the vegetation treatments required by the sage-grouse mitigation plan (see Appendix E) through the creation of additional sagebrush habitat in the analysis area. They would also benefit from the predator control efforts required by the sage-grouse mitigation plan, because they would reduce competition for food and other resources from red fox. Impacts are reported in terms of total acres of disturbance over the life of the mine, but note that this disturbance would not all occur at one time.

4.18.1.4.3.3 Bat Species

Most of the vegetation communities in the tract are used as foraging habitat by one or more special status bat species (see Table 4.18.1). Potential bat roosting habitats occur adjacent to the tract. Adverse impacts to Allen's big-eared bat, big free-tailed bat, fringed myotis, spotted bat, and Townsend's big-eared bat would include the direct loss of foraging habitat in the tract; potential displacement from roosting and foraging habitats adjacent to the tract due to increased noise, human presence, and surface-disturbing activities; and habitat fragmentation and alteration. Decreased productivity of individuals or populations could result from the loss of, or displacement from, foraging habitats in or adjacent to the tract. Night lighting could disrupt roost emergence timing, predator avoidance, and foraging behaviors (Briggs 2004; Navarra et al. 2007). The potential impacts from artificial lighting are described in more detail in the following paragraph. The bedrock, cliff, or canyon vegetation community does not occur in the tract, but several small areas of this community are adjacent to the tract's eastern boundary. However, indirect impacts to these vegetation communities from subsidence would be unlikely because underground mining operations would only occur in the northeast corner of the tract. Because a large portion of the tract would be disturbed during surface mining and associated activities, the Proposed Action would result in greater short-term adverse impacts to bat species and their habitats than would occur under the No Action Alternative.

Various species of bat often forage for food in areas that are artificially lighted. Generally, this is because many species of insects are attracted to light. Bats' foraging can benefit from artificial light sources because of the high concentration of insects found at these light sources. However, bats' foraging can also be negatively impacted by artificial light sources, such as creating a greater risk of bats being exposed to predators, decreasing the prey base through insect mortality, and shifting natural insect prey to items that are easily caught at light sources (Rydell 2006). Some bats, such as the spotted bat (*Euderma maculatum*), do not forage in artificially lighted areas and are rarely seen in illuminated areas. Thus, artificial lighting also creates an imbalanced competition between bats that forage in artificial lighting and bats that avoid artificial lighting as well as intense competition at the light source (Longcore et al. 2004; Rydell 2006) (Longcore and Rich 2004; Rydell 2006). When bats' roosting sites are exposed to artificial lighting, it can delay bats' evening emergence time, shortening their feeding time. Roosts exposed to artificial lighting can also experience decreases in colony size and can lead to desertion of the roost (Patriarca et al. 2010).

Increased artificial light can also draw insects away from water, where they are normally encountered, which requires bats to make separate flights to drink. In general, drinking is a highly energetic process for bats; it consists of ingesting one drop of water with each pass over flat water or licking smaller drops (decreased in size and number with length of commute) off their fur upon returning to the safety of a roost. Artificial lighting can also concentrate prey far away from roosts and nurseries. Increased time and energy cost of longer distance commutes between nursery and insect swarms could lead to decreased nursing frequency and milk production, which could reduce the overall health of the individual, leading to a decreased resistance to communicable diseases (such as white-nose fungus).

4.18.1.4.3.4 Raptor Species

The Proposed Action would result in direct adverse impacts to foraging and wintering habitats, and active and inactive nest sites of sensitive raptor species using the tract. Raptor species are sensitive to human disturbance (Romin et al. 2002). Disturbance from mining activities or human presence near an active nest during breeding season could result in nest abandonment and/or mortality of young from increased vulnerability to predators, or reduced food intake due to avoidance of the nest site by adult raptors. Raptor species would be directly impacted by habitat loss from pit disturbance and construction activities, and by the long-term loss of wooded foraging habitats (e.g., riparian, pinyon-juniper woodland, and mountain brush vegetation communities). They would also be impacted by the removal of perch and roost sites on- and off-tract, as required by the sage-grouse mitigation plan (see Appendix E). Construction of roadways and mine-related traffic could result in increased mortality from vehicle strikes. There is an increased risk of direct

mortality of ground-nesting raptor species, particularly the Burrowing Owl, from pit development and construction equipment, which could crush or bury adults, nestlings, or eggs in burrows; however, this species is not currently known to breed on the tract. Impacts to active nesting sites would be mitigated by raptor nest surveys and avoidance measures. However, if a nest area is disturbed outside of the nesting season, there is a likelihood that the raptor would not return to the nest the following nesting season. Raptors forage in all habitat types, and the loss of foraging habitats due to direct disturbance or removal would result in the displacement of raptors from these areas until habitats have been successfully restored. Suitable raptor nesting sites would likely be reduced by the removal of 694 acres of pinyon-juniper woodland. No bedrock, cliff, or canyon roosting and nesting habitat occurs in the tract, but several small habitat areas are adjacent to the tract's eastern boundary. However, indirect impacts to these habitat areas from subsidence would be unlikely because underground mining operations would occur in the northeast corner of the tract. Because a large portion of the tract would be disturbed during surface mining and associated activities, the Proposed Action would result in greater short-term adverse impacts to raptor species and their habitats than would occur under the No Action Alternative. Impacts are reported in terms of total acres of disturbance over the life of the mine, but note that this disturbance would not all occur at one time.

Special lease stipulations and BMPs would minimize adverse impacts to raptor species, especially during the breeding season, by providing spatial and seasonal buffers of both occupied and unoccupied nests. Additionally, mitigation actions aimed at reducing corvid species in the area (as required by the sage-grouse mitigation plan; see Appendix E) would reduce competition for nesting sites for some raptor species, and would reduce the potential for predation of raptor eggs by corvids.

4.18.1.4.3.5 Migratory Bird Species

The Proposed Action would result in direct adverse impacts to the Black Swift, Lewis' Woodpecker, Long-billed Curlew, and Three-toed Woodpecker breeding, nesting, and wintering habitats. Loss of habitat due to removal of vegetation and surface disturbance and associated activities would reduce foraging and nesting habitats, cover, and roosting and nesting sites. Most surface disturbance under the Proposed Action would occur in sagebrush/grassland and sagebrush/grassland (treated) (914 acres) and pinyon-juniper woodland vegetation communities (694 acres). Therefore, Long-billed Curlew and Lewis's Woodpecker habitats, respectively associated with these vegetation communities, would be most greatly affected. Habitat fragmentation, alteration, displacement, and loss for ground-nesting species would result from pit disturbance and construction activities. These species would be at increased risk of direct mortality from excavation and construction due to potential for crushing or burial of adults, nestlings, and eggs on the ground. Increased mine-related traffic could also result in increased mortality from vehicle strikes. Impacts to active nesting sites would be mitigated by nest surveys and avoidance measures. Impacts are reported in terms of total acres of disturbance over the life of the mine, but note that this disturbance would not all occur at one time.

The loss of foraging habitats due to direct disturbance or removal would result in the displacement of special status bird species from these areas until habitats have been successfully restored. Woodpecker nesting habitat in the tract would be reduced by the removal of 49% of pinyon-juniper woodland vegetation communities in the tract. Because of the large portion of the tract that would be disturbed during surface-mining and associated activities, the Proposed Action would result in greater short-term adverse impacts to special status bird species and their habitats than would occur under the No Action Alternative. Special lease stipulations and BMPs would minimize adverse impacts, especially during the breeding season, by requiring surveys for and avoidance of nest sites.

Table 4.18.2. Acreages and Direct Disturbance in the Alton Coal Tract by Vegetation Community and Associated Sensitive Species Under the Action Alternatives

Vegetation Community	Associated Sensitive Species	Alternative B (Proposed Action)			Alternative C (Reduced Tract Acreage and Seasonal Restrictions)			Alternative K1 (Reduced Tract Acreage)		
		Acres in Tract	Acres Disturbed	Percentage Disturbed	Acres in Tract	Acres Disturbed	Percentage Disturbed	Acres in Tract	Acres Disturbed	Percentage Disturbed
Pinyon-juniper woodlands	Allen's big-eared bat, Arizona toad, Ferruginous Hawk, Lewis's Woodpecker, Townsend's big-eared bat	1,430.8	694.4	48.6%	1,410.2	680.1	48.2%	1,095.1	471.6	43.1%
Sagebrush/ grassland	Burrowing Owl, Ferruginous Hawk, fringed myotis, Golden Eagle, Greater Sage-Grouse, kit fox, Long-billed Curlew, pygmy rabbit, Short-eared Owl, spotted bat, Townsend's big-eared bat	860.2	366.5	42.6%	627.8	195.7	31.2%	369.1	91.2	24.7%
Sagebrush/ grassland (treated)	Burrowing Owl, Ferruginous Hawk, fringed myotis, Golden Eagle, Greater Sage-Grouse, kit fox, Long-billed Curlew, pygmy rabbit, Short-eared Owl, spotted bat, Townsend's big-eared bat	749.1	547.5	73%	749.1	546.1	73%	289.5	235.9	77%
Annual and perennial grasses	Ferruginous Hawk, Long-billed Curlew, Short-eared Owl	324.1	278.4	85.9%	247.0	196.5	76.6%	247.0	196.8	79.7%
Mountain brush	Ferruginous Hawk, Lewis's Woodpecker	62.8	24.9	39.6%	62.8	24.7	39.3%	40.8	1.7	4.2%
Wetland (meadow)	Western toad	62.8	55.5	88.3%	0.0	0.0	0%	0.0	0.0	0%
Riparian	Allen's big-eared bat, Arizona toad, Bald Eagle, big free-tailed bat, Lewis's Woodpecker, Northern Goshawk, western toad	55.3	6.7	12.1%	54.0	6.3	11.7%	54.0	6.4	11.9%
Rabbitbrush	Burrowing Owl, Ferruginous Hawk, Golden Eagle, Greater Sage-Grouse, kit fox, pygmy rabbit, Short-eared Owl, spotted bat	10.7	1.0	9.2%	10.7	1.0	8.0%	10.7	1.0	9.3%
Total		**3,555.8**	**1,974.8**	**55.5%**	**3,161.6**	**1,650.3**	**52.2%**	**2,106.2**	**1,004.6**	**47.7%**

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4.18.1.4.3.6 Amphibian Species

Impacts to amphibian species from mining are identical to those described for common amphibian species (Section 4.17.4.3.4). Potential habitats for the Arizona toad in pinyon-juniper woodlands near water comprise up to approximately 1,431 acres of the tract. Under the Proposed Action, 49% (694 acres) of the pinyon-juniper woodland vegetation community would be directly disturbed by mining and associated activities (see Table 4.18.1). Because reclamation actions would be directed toward establishing a post-mining sagebrush community, the habitat used by this species would be permanently lost, and displaced individuals would not return to the tract. This displacement, in combination with the limited distribution of the species, could impact the abundance of the local population.

Potential habitats for the western toad in wetland (meadow) and riparian vegetation communities comprise approximately 118 acres (3%) of the tract. Under the Proposed Action, approximately 53% (63 acres) of wetland and riparian habitats would be removed by mining and associated activities (see Table 4.18.1). As stated in Section 3.18, the BLM's *Riparian Management Policy* (IM UT-2005-091) would be followed, which would limit riparian habitat removal on the tract. Compliance with this IM would help to minimize impacts on individuals of this species, and ensure that entire populations are not impacted. Because a portion of the tract would be disturbed during surface mining and associated activities, the Proposed Action would result in greater short-term adverse impacts to amphibian habitats than would occur under the No Action Alternative. Impacts are reported in terms of total acres of disturbance over the life of the mine, but note that this disturbance would not all occur at one time.

4.18.1.4.4 Alternative C: Reduced Tract Acreage and Seasonal Restrictions

Under Alternative C, the nature of impacts would be the same as under the Proposed Action, but would differ in the acres of disturbance and timing of mine-related activities. Impacts on special status wildlife species under Alternative C would be identical to those described for wildlife (Section 4.17.4.4) except for the following.

Under Alternative C, the nature of impacts to special status species occurring in the tract analysis area would be the same as described for the Proposed Action and under the Impacts Common to the Action Alternatives section. Noise and nighttime light impacts would be the same as those described in section 4.17.5.2 and under the Proposed Action, except that they would occur on 331 fewer acres and for a shorter duration of 21 years (the mine life under this alternative). Impacts are reported in terms of total acres of disturbance over the life of the mine, but note that this disturbance would not all occur at one time.

4.18.1.4.4.1 Pygmy Rabbit

Approximately 742 acres (54%) of potential suitable habitat for pygmy rabbit, including sagebrush/grassland and sagebrush/grassland (treated) vegetation communities, in the tract would be removed under Alternative C (see Table 4.18.1). In addition to direct impacts that may occur during surface disturbance and mining if it found to occur on the tract, the pygmy rabbit would be temporarily displaced from these habitat resources. However, it is unknown whether successful reclamation would be able to recreate soil conditions necessary for pygmy rabbit burrowing, so the displacement may be permanent. Alternative C would result in greater short-term adverse impacts to the pygmy rabbit and its habitat than would occur under the No Action Alternative.

4.18.1.4.4.2 Kit Fox

Approximately 742 acres (54%) of suitable habitat for kit fox, including sagebrush/grassland and sagebrush/grassland (treated) vegetation communities, would be removed under Alternative C (see Table 4.18.1), which equates to less than one third (27%) the size of one kit fox home range, as described in Section 3.18.2.3. In addition to direct impacts that may occur during surface disturbance and mining, the kit

fox would be displaced from these habitat resources until reclamation and successful restoration have been completed. Because a large portion of the tract would be disturbed during surface mining and associated activities, Alternative C would result in greater short-term adverse impacts to the kit fox and its habitats than would occur under the No Action Alternative.

4.18.1.4.4.3 Bat Species

Under Alternative C, impacts to Allen's big-eared bat, big free-tailed bat, fringed myotis, spotted bat, and Townsend's big-eared bat would include the loss of suitable roosting and foraging habitat; displacement from suitable habitat due to increased noise, human presence, and surface-disturbing activities; and habitat fragmentation and alteration (see Table 4.18.1). Impacts due to night lighting and 24-hour mine operations would be reduced by timing restrictions on mining in Block S. No bedrock, cliff, or canyon roosting vegetation community occurs in the tract, but several small areas of this community are adjacent to the tract's eastern boundary. However, indirect impacts to these areas from subsidence would be unlikely because underground mining operations would only occur in the northeast corner of the tract. Because a large portion of the tract would be disturbed during surface mining and associated activities, Alternative C would result in greater short-term adverse impacts to bat species and their suitable habitats than would occur under the No Action Alternative.

4.18.1.4.4.4 Raptor Species

Alternative C would result in direct adverse impacts to foraging and wintering habitats, and active and inactive nest sites of sensitive raptor species using the tract due to loss of suitable habitat from pit disturbance and construction activities, and by the long-term loss of wooded foraging habitats (e.g., riparian, pinyon-juniper woodland, and mountain brush vegetation communities). The nature of impacts to raptor species would be the same as described for the Proposed Action. The increased risk of direct mortality of ground-nesting raptor species from pit development and construction equipment would be reduced by the elimination of the Block NW and by timing stipulations in Block S. Suitable raptor nesting sites would likely be reduced by the removal of 680 acres of pinyon-juniper woodland. Because a large portion of the tract would be disturbed during surface mining and associated activities, Alternative C would result in greater short-term adverse impacts to raptor species and their suitable habitats than would occur under No Action. As under the Proposed Action, special lease stipulations and BMPs would minimize adverse impacts to raptor species, especially during the breeding season, by providing spatial and seasonal buffers of both occupied and unoccupied nests.

4.18.1.4.4.5 Migratory Bird Species

Under Alternative C, Black Swift, Lewis' Woodpecker, Long-billed Curlew, and Three-toed Woodpecker suitable foraging and nesting habitats, cover, and suitable roosting and nesting sites would be directly impacted by surface disturbance and associated activities. The nature of impacts to these bird species would be the same as described for the Proposed Action. Most surface disturbance under Alternative C would occur in sagebrush/grassland and sagebrush/grassland (treated) (742 acres) and pinyon-juniper woodland vegetation communities (680 acres). Long-billed Curlew and Lewis's Woodpecker habitats, respectively associated with these vegetation communities, would be most greatly affected. Ground-nesting and foraging species would be directly impacted by pit disturbance and construction activities, and would be at increased risk of direct mortality from excavation and construction due to potential for crushing or burial of adults, nestlings, and eggs on the ground. Increased mine-related traffic could result in increased mortality from vehicle strikes. Impacts to active nesting sites would be mitigated by nest surveys and avoidance measures. The loss of suitable foraging habitats due to direct disturbance or removal would result in the displacement of special status bird species from these areas until suitable habitats have been successfully restored. Woodpecker suitable nesting habitat would be reduced by the removal of 680 acres of pinyon-juniper woodland. Because of the large portion of the tract that would be disturbed during surface mining and associated activities, Alternative C

would result in greater short-term adverse impacts to special status bird species and their suitable habitats than would occur under the No Action Alternative. Special lease stipulations and BMPs would minimize adverse impacts, especially during the breeding season, by requiring surveys for and avoidance of nesting sites.

4.18.1.4.4.6 Amphibian Species

Impacts to amphibian species from mining activities include habitat fragmentation and loss, displacement to lower quality habitats, increased exposure to predators from cover removal, crushing and burial of adults and young, and attraction to ecological 'traps' such as water holding ponds. The nature of impacts to amphibian species would be the same as described for the Proposed Action. The Arizona toad's pinyon-juniper woodland vegetation community makes up 1,410 acres in the tract under Alternative C. Under this alternative, 48% (680 acres) of pinyon-juniper woodland would be directly disturbed by mining and associated activities (see Table 4.18.1). None of the western toad's wetland (meadow) vegetation community would be directly disturbed under Alternative C. However, approximately 6 acres of the western toad's riparian vegetation community would be disturbed under this alternative. Because a portion of the tract would be disturbed during surface mining and associated activities, Alternative C would result in greater short-term adverse impacts to amphibian species' vegetation communities than would occur under the No Action Alternative. Impacts are reported in terms of total acres of disturbance over the life of the mine, but note that this disturbance would not all occur at one time.

4.18.1.4.5 Alternative K1: Reduced Tract Acreage

Under Alternative K1, the nature of impacts would be the same as under the Proposed Action, Alternative C, and Impacts Common to the Action Alternatives, but they would differ in the acres of disturbance, or magnitude. Impacts to special status wildlife species under Alternative K1 would be identical to those described for wildlife (Section 4.17.4.5) except for the following. Noise and nighttime light impacts would be the same as those described in Section 4.17.4.2 and under the Proposed Action, except that they would occur on 981 fewer acres and for a shorter duration of 16 years (the life of the mine under this alternative). Impacts are reported in terms of total acres of disturbance over the life of the mine, but note that this disturbance would not all occur at one time.

4.18.1.4.5.1 Pygmy Rabbit

Approximately 327 acres (50%) of potential suitable habitat for pygmy rabbit, including sagebrush/grassland and sagebrush/grassland (treated) vegetation communities, in the tract would be removed under Alternative K1 (see Table 4.18.1). In addition to direct impacts that may occur during surface disturbance and mining if the pygmy rabbit is found on the tract, the pygmy rabbit would be temporarily displaced from these habitat resources. However, it is unknown whether successful reclamation would be able to recreate soil conditions necessary for pygmy rabbit burrowing, so the displacement may be permanent. Alternative K1 would result in greater short-term adverse impacts to the pygmy rabbit and its suitable habitat than would occur under the No Action Alternative.

4.18.1.4.5.2 Kit Fox

Approximately 327 acres (50%) of suitable habitat for kit fox, including sagebrush/grassland and sagebrush/grassland (treated) vegetation communities, would be removed under Alternative K1 (see Table 4.18.1), which equates to approximately one tenth (12%) of the size of one kit fox home range, as described in Section 3.18.2.3. In addition to direct impacts that may occur during surface disturbance and mining, the kit fox would be displaced from these habitat resources until reclamation and successful restoration have been completed. Impacts to vegetation communities would be reduced by the exclusion of Block NW and Block S from mining activities. Because a large portion of the tract would be disturbed during surface mining and associated activities, Alternative K1 would result in greater short-term adverse impacts to the kit fox and its suitable habitats than would occur under the No Action Alternative.

4.18.1.4.5.3 Bat Species

Under Alternative K1, impacts to Allen's big-eared bat, big free-tailed bat, fringed myotis, spotted bat, and Townsend's big-eared bat would include the loss of suitable roosting and foraging habitat; displacement from suitable habitat due to increased noise, human presence, and surface-disturbing activities; and habitat fragmentation and alteration (see Table 4.18.1). Impacts to suitable habitat would be reduced by the exclusion of Block NW and Block S from mining activities. No bedrock, cliff, or canyon roosting vegetation community occurs in the tract, but several small areas of this community are adjacent to the tract's eastern boundary. However, indirect impacts to these areas from subsidence would be unlikely because underground mining operations would only occur in the northeast corner of the tract. Because a large portion of the tract would be disturbed during surface mining and associated activities, Alternative K1 would result in greater short-term adverse impacts to bat species and their suitable habitats than would occur under the No Action Alternative.

4.18.1.4.5.4 Raptor Species

Alternative K1 would result in direct adverse impacts to 1) raptor foraging and wintering habitats and 2) active and inactive nest sites of sensitive raptor species using the tract from loss of suitable habitat from pit disturbance and construction activities. This alternative would also result in the long-term loss of wooded foraging habitats (e.g., riparian, pinyon-juniper woodland, and mountain brush vegetation communities). The nature of impacts to raptor species would be the same as those described for the Proposed Action. The increased risk of direct mortality of ground-nesting raptor species from pit development and construction equipment would be reduced by the exclusion of Block NW and Block S from mining activities. Suitable raptor nesting sites would likely be reduced by the removal of 472 acres (43%) of pinyon-juniper woodland. Because a large portion of the tract would be disturbed during surface-mining and associated activities, Alternative K1 would result in greater short-term adverse impacts to raptor species and their suitable habitats than would occur under the No Action. As under the Proposed Action and Alternative C, special lease stipulations and BMPs would minimize adverse impacts to raptor species, especially during the breeding season, by providing spatial and seasonal buffers of both occupied and unoccupied nests.

4.18.1.4.5.5 Migratory Bird Species

Under Alternative K1, Black Swift, Lewis' Woodpecker, Long-billed Curlew, and Three-toed Woodpecker suitable foraging and nesting habitats, cover, and suitable roosting and nesting sites would be directly impacted by surface disturbance and associated activities. The nature of impacts to these bird species would be the same as described for the Proposed Action and Alternative C. Most surface disturbance under Alternative K1 would occur in sagebrush/grassland and sagebrush/grassland (treated) (327 acres) and pinyon-juniper woodland vegetation communities (472 acres). Long-billed Curlew and Lewis's Woodpecker habitats, respectively associated with these vegetation communities, would be most greatly affected. Ground-nesting and foraging species would be directly impacted by pit disturbance and construction activities, and would be at increased risk of direct mortality from excavation and construction due to potential for crushing or burial of adults, nestlings, and eggs on the ground. Increased mine-related traffic could result in increased mortality from vehicle strikes. Impacts to active nesting sites would be mitigated by nest surveys and avoidance measures. The loss of foraging habitats due to direct disturbance or removal would result in the displacement of special status bird species from these areas until suitable habitats have been successfully restored. Woodpecker nesting habitat would be reduced by the removal of 472 acres of suitable nesting habitat, including pinyon-juniper woodland. Because of the large portion of the tract that would be disturbed during surface-mining and associated activities, Alternative K1 would result in greater short-term adverse impacts to special status bird species and their suitable habitats than would occur under the No Action Alternative. Special lease stipulations and BMPs would minimize adverse impacts, especially during the breeding season, by requiring surveys for and avoidance of nesting sites.

4.18.1.4.5.6 Amphibian Species

Impacts to amphibian species from mining activities include habitat fragmentation and loss, displacement to lower quality habitats, increased exposure to predators from cover removal, crushing and burial of adults and young, and attraction to ecological 'traps' such as water holding ponds. The nature of impacts to amphibian species would be the same as described for the Proposed Action and Alternative C. The Arizona toad's pinyon-juniper woodland vegetation community makes up 1,095 acres in the tract under Alternative K1. Under this alternative, 43% (472 acres) of pinyon-juniper woodland would be directly disturbed by mining and associated activities (see Table 4.18.1). None of the western toad's wetland (meadow) vegetation community would be directly disturbed under Alternative K1. However, approximately 6.4 acres of the western toad's riparian vegetation community would be disturbed under this alternative. Because a portion of the tract would be disturbed during surface-mining and associated activities, Alternative K1 would result in greater short-term adverse impacts to amphibian species' vegetation communities than would occur under the No Action Alternative.

4.18.1.5 IMPACTS FROM COAL HAULING

There would be no additional loss of special status species habitat from the reasonably foreseeable coal haul transportation route. Coal transportation would occur on existing roads and would not necessitate road upgrades. Impacts to special status species are identical to those described for wildlife (Section 4.17.5) except for the following analysis, which focuses on direct and indirect impacts to special status species from increased rates of traffic.

4.18.1.5.1 Alternative A: No Action

Wildlife mortalities along US-89, SR-20, I-15, and SR-56 are likely to increase due to additions of mine-related traffic from existing fee coal mine areas adjacent to the tract that would use existing routes (see Section 4.19). A large portion of the reasonably foreseeable coal haul transportation route would be adjacent to special status species habitats (Table 4.18.3). From 2003 to 2005, wildlife-related single-vehicle crashes made up 51% of crashes on US-89, 18% of crashes on US-20, 11% of crashes on I-15, and 41% of crashes on SR-56 (Fehr & Peers Transportation Consultants 2013). Wildlife mortality and associated disruptions in habitat use would be expected to occur under both the No Action Alternative and the action alternatives. However, mine-related traffic and associated wildlife impacts would be minimized under the No Action Alternative due to the expected lower volume of truck traffic.

Table 4.18.3. Land Cover Miles Adjacent to the Reasonably Foreseeable Coal Haul Transportation Route and Associated Special Status Wildlife Species Under the No Action and Action Alternatives

Cover Type	Associated Special Status Animal Species	Miles	Percentage of Route
Sagebrush	Burrowing Owl, Ferruginous Hawk, fringed myotis, Golden Eagle, Greater Sage-Grouse, kit fox, pygmy rabbit, Short-eared Owl, spotted bat, Townsend's big-eared bat	49.4	43.1%
Developed	None	41.6	36.3%
Pinyon-juniper woodland	Allen's big-eared bat, Arizona toad, Ferruginous Hawk, Lewis's Woodpecker, Townsend's big-eared bat	11.7	10.2%
Agriculture	Ferruginous Hawk, Long-billed Curlew, Short-eared Owl	7.3	6.4%
Shrub-steppe	Burrowing Owl, Ferruginous Hawk, Golden Eagle, Greater Sage-Grouse, kit fox, Long-billed Curlew, pygmy rabbit, Short-eared Owl, spotted bat, Townsend's big-eared bat, Utah prairie dog	0.2	0.2%

Table 4.18.3. Land Cover Miles Adjacent to the Reasonably Foreseeable Coal Haul Transportation Route and Associated Special Status Wildlife Species Under the No Action and Action Alternatives

Cover Type	Associated Special Status Animal Species	Miles	Percentage of Route
Woodland-shrubland	Black Swift, elk, Ferruginous Hawk, Lewis's Woodpecker, Three-toed Woodpecker	2.2	1.9%
Bedrock, cliff, and canyon	California Condor, Allen's big-eared bat, black swift, big free-tailed bat, fringed myotis, spotted bat, Townsend's big-eared bat	1.1	1.0%
Grassland (native and invasive grasses/forbs)	Burrowing Owl, elk, Ferruginous Hawk, fringed myotis, Long-billed Curlew, Short-eared Owl, Utah prairie dog	0.2	0.2%
Open water	Black Swift, Bonneville cutthroat trout	< 0.1	< 0.1%
Salt desert scrub	Big free-tailed bat, Burrowing Owl, Ferruginous Hawk, Golden Eagle, kit fox, long-billed Curlew, Short-eared Owl, spotted bat	< 0.1	< 0.1%
Riparian	Allen's big-eared bat, Arizona toad, Bald Eagle, big free-tailed bat, Lewis's Woodpecker, Northern Goshawk, Western toad	0.8 40.8 acres*	0.7%
	Total	**114.7 miles**	**100.0%**

Notes: Scientific nomenclature for all wildlife species in this EIS is introduced in Chapter 3.

Acres of riparian habitat within 100-feet of the reasonably foreseeable coal haul transportation route are also included to assess potential impacts in the unlikely event of a coal truck accident in close proximity to this cover type.

Land cover miles are the same for all three action alternatives because the reasonably foreseeable coal haul transportation route is the same for all alternatives.

* The analysis area for riparian also includes acres of habitat within a 100-foot buffer of the reasonably foreseeable coal haul transportation route.

4.18.1.5.2 Alternative B (Proposed Action), Alternative C (Reduced Tract Acreage and Seasonal Restrictions), and Alternative K1 (Reduced Tract Acreage)

Impacts to special status species under the Proposed Action, Alternative C, and Alternative K1 are identical to those described for wildlife (Section 4.17.5.2) with the following exceptions.

Any increase in roadkill could increase raptor activity along the reasonably foreseeable coal haul transportation route, which could result in increased predation on sage-grouse, pygmy rabbit, or other special status animals occupying habitats adjacent to the route.

4.18.1.5.2.1 Pygmy Rabbit

Impacts to the pygmy rabbit along the reasonably foreseeable coal haul transportation route would consist of increased loss of individuals from vehicle collisions and from increased predator abundance along roadways, which is a likely result of increased traffic-related roadkills. Increased traffic would also increase road barrier effects, thereby increasing fragmentation in and among populations. Suitable habitat for this species (sagebrush and shrub-steppe) occurs adjacent to approximately 50 miles (43%) of the reasonably foreseeable coal haul transportation route (see Table 4.18.3). Under the Proposed Action, Alternative C, and Alternative K1, transportation-related adverse impacts to the pygmy rabbit and its habitats would likely be greater than would occur under the No Action Alternative.

4.18.1.5.2.2 Utah Prairie-dog

There is limited information on road-related impacts to the prairie-dog and other small mammals. Impacts associated with increased vehicle traffic likely include greater loss of individuals from vehicle collisions and from increased predator abundance along roadways, a likely result of increased traffic-related

roadkills. It is not known if traffic noise interferes with predator warning calls or with other communication in prairie-dog colonies. Utah prairie-dog habitats occur adjacent to 28.3 miles (26%) of the reasonably foreseeable coal haul transportation route (UDWR GIS data updated May 2007). The USFWS has established a 350-foot buffer as the range within which normal behavior of individual Utah prairie dogs may be disrupted by noise or human presence. Known Utah prairie dog colonies occur within 350 feet of the reasonably foreseeable coal haul transportation route on 673 acres. These colonies are estimated to contain 1,768[10] prairie dogs, or approximately 24.4% of the total estimated Utah prairie dog population (Crowther 2013). Under the Proposed Action, Alternative C, and Alternative K1, traffic and noise-related adverse impacts to the Utah prairie-dog and its habitats would likely be greater than would occur under the No Action Alternative.

4.18.1.5.2.3 Kit Fox

Impacts to the kit fox from increased vehicle traffic would likely include loss of individuals from vehicle collisions. Kit fox sagebrush, shrub-steppe, and salt desert scrub habitats occur adjacent to approximately 50 miles (43%) of the reasonably foreseeable coal haul transportation route (see Table 4.18.3). Impacts associated with an increase in vehicle traffic would likely include an increased loss of individuals from vehicle collisions, particularly due to increased nighttime traffic when the species is active. Under the Proposed Action, Alternative C, and Alternative K1, transportation-related adverse impacts to the kit fox and its habitats would likely be greater than would occur under the No Action Alternative.

4.18.1.5.2.4 Bat Species

Potential foraging and roosting bat habitats occur adjacent to the reasonably foreseeable coal haul transportation route (see Table 4.18.3). Traffic-related impacts to Allen's big-eared bat, big free-tailed bat, fringed myotis, spotted bat, and Townsend's big-eared bat would likely consist of displacement from habitat due to 1) increased noise and 2) disruption of roosting or foraging behaviors in habitats adjacent to the route resulting from an increase in nighttime vehicle traffic. Special status bat habitats in sagebrush, pinyon-juniper woodland, shrub-steppe, grassland, salt desert scrub, cliff and canyon, and riparian cover types occur adjacent to approximately 63 miles (55%) of the reasonably foreseeable coal haul transportation route (see Table 4.18.3). Riparian habitats occur on 40.8 acres within a 100-foot buffer of the reasonably foreseeable coal haul transportation route. Under the Proposed Action, Alternative C, and Alternative K1, transportation-related adverse impacts to bat species and their habitats would likely be greater than would occur under the No Action Alternative.

4.18.1.5.2.5 Raptor Species

Increased coal truck traffic would likely result in direct adverse impacts to bald eagle, burrowing owl, California condor, ferruginous hawk, golden eagle, northern goshawk, and short-eared owl from vehicle strikes. The increase in traffic volume would likely result in increased roadkills, which would attract raptor species to the reasonably foreseeable coal haul transportation route and increase the likelihood of raptor mortality from vehicle collisions. Raptor foraging and nesting habitats in sagebrush, pinyon-juniper woodland, agriculture, shrub-steppe, woodland-shrubland, grassland, salt desert scrub, and riparian cover types occur adjacent to approximately 72 miles (62%) of the reasonably foreseeable coal haul transportation route (see Table 4.18.3). Additionally, there is a possibility that as the California condor population increases, individual birds could migrate into the area of mining and coal-hauling activities and be attracted to the increased roadkill, resulting in mortality from vehicle collisions. Potential habitats for the northern goshawk occur in 40.8 acres of riparian habitat within 100 feet of the reasonably foreseeable coal haul transportation route. These

[10] Many prairie dog colonies straddle the buffer, with portions inside and portions outside. Thus, it is impossible to know how many individuals in these colonies are inside or outside the buffer. For the purpose of this analysis, it is assumed that all individuals in the colonies that straddle the buffer are within the buffer area.

riparian habitats contain two known occupied goshawk habitat areas (UDWR 2010). Under the Proposed Action, Alternative C, and Alternative K1, transportation-related adverse impacts to raptor species would likely be greater than would occur under the No Action Alternative.

4.18.1.5.2.6 Migratory Bird Species

Increased coal truck traffic would likely result in limited adverse impacts to the Black Swift, Lewis' Woodpecker, Long-billed Curlew, and Three-toed Woodpecker and their habitats. Nevertheless, increased traffic volume could result in increased mortality from vehicle strikes. Foraging and nesting habitats for special status bird species in agriculture, shrub-steppe, woodland-shrubland, cliff and canyon, grassland and salt desert scrub cover types occur adjacent to approximately 11 miles (10%) of the reasonably foreseeable coal haul transportation route (see Table 4.18.3). Under the Proposed Action, Alternative C, and Alternative K1, transportation-related adverse impacts to these bird species would likely be greater than would occur under the No Action Alternative.

4.18.1.5.2.7 Amphibian Species

Increased coal truck traffic would likely result in limited adverse impacts to the Arizona toad and western toad along the reasonably foreseeable coal haul transportation route. Nevertheless, increased traffic volume could result in increased mortality from vehicle strikes. Amphibian habitat in pinyon-juniper woodlands occur adjacent to approximately 12 miles (10%) of the reasonably foreseeable coal haul transportation route (see Table 4.18.3). Under the Proposed Action, Alternative C, and Alternative K1, transportation-related adverse impacts to amphibians would likely be slightly greater than would occur under the No Action Alternative.

4.18.1.5.2.8 Fish Species

The Bonneville cutthroat trout is known to occur in Threemile Creek, which would be intersected by the reasonably foreseeable coal haul transportation route. Due to the expected increase in the volume of coal truck traffic associated with mining operations, there is increased potential for accidental coal spills to stream habitats along the reasonably foreseeable coal haul transportation route. Approximately 0.8 mile (0.7%) of the reasonably foreseeable coal haul transportation route transects stream habitats where there is the potential for a coal truck spill into the waterway. Stream and riparian habitats occur on 40.8 acres of riparian habitat within 100 feet of the reasonably foreseeable coal haul transportation route. Although the risk of a spill to this small portion of the route is negligible, the introduction of coal, petroleum products, or other hazardous materials from a coal truck spill could directly or indirectly adversely impact Bonneville cutthroat trout and their habitats by causing mortality of individual fish or prey species from poisoning, or from loss of habitat due to reduced water quality or other habitat features.

4.18.2 Greater Sage-Grouse

4.18.2.1 REGULATORY FRAMEWORK AND ADDITIONAL DESIGN FEATURES

4.18.2.1.1 Regulatory Framework

Numerous federal and state regulations shape the management of Greater Sage-Grouse. Regulations that pertain specifically to sage-grouse include the following:

- The Washington Office IM 2012-043 (BLM 2011b) identifies the need to "cumulatively maintain or enhance sage-grouse habitat." The IM also provides interim conservation policies and procedures to BLM field officials to be applied to ongoing and proposed authorizations and activities that affect the sage-grouse and its habitat. Under this IM, the BLM has the authority to condition the lease with a requirement for off-site mitigation (refer to IM 2008-204, Off-Site Mitigation; BLM 2008g).

- In Utah, UDWR biologists are managing sage-grouse populations per the sage-grouse conservation plan (UDWR 2013). The sage-grouse conservation plan reflects sage-grouse recommendations that were provided to the Governor of Utah by a multidisciplinary group of stakeholders in early 2012. Sage-grouse seasonal habitats and use designations associated with the plan are reported in the SDEIS because they are used for management by UDWR and are considered the best available data except where more site-specific information is available.
- The BLM is currently revising land use plans for field offices statewide to ensure proper protection of sage-grouse populations. Land use plan revisions are being conducted to prevent the listing of Greater Sage-Grouse as a threatened or endangered species under the ESA. The land use planning process is ongoing and will not be completed until approximately the end of 2014. One of the alternatives included in the analysis (Alternative E) is the sage-grouse conservation plan (UDWR 2013), discussed below. See Section 1.7.1.1 for a detailed description of this process and its effect on the decision to lease the tract.
- All federal lands must be screened to determine which are acceptable for further consideration for coal leasing. One screening procedure requires the BLM to apply 20 unsuitability criteria (as listed in 43 CFR 3461.5) to each LBA tract to determine if the area being considered for leasing is suitable for surface mining or surface effects from underground mining. Unsuitability Criterion 15 states that the following shall be considered unsuitable for surface mining or surface effects from underground mining: federal lands that the surface management agency and the state jointly agree are habitat for resident species of fish, wildlife, and plant species also of high interest to the state and that are essential for maintaining these high-interest species, such as active dancing and strutting grounds (lek) for sage-grouse. The sage-grouse mitigation plan (see Appendix E) is intended to address Unsuitability Criterion 15 to ensure that sage-grouse, as a high-interest species, is maintained.
- Although not a regulatory document, the *Greater Sage-grouse (*Centrocercus urophasianus*) Conservation Objectives: Final Report* (USFWS 2013a) includes specific information on the Panguitch population of grouse.

As described in Section 1.7.1.2.2 (Application of Unsuitability Criteria), four decisions in the KFO RMP (BLM 2008b) pertain to sage-grouse management (SSS-54, SSS-55, SSS-56, and SSS-57) and detail temporal and spatial buffers for leks and winter habitat within which no surface-disturbing activity may occur. SSS-57 states that an exemption, waiver, or modification may be granted for each RMP decision on a case-by-case basis[11]. As a result of decisions SSS-54, SSS-55, and SSS-56, a decision to lease would not be in conformance with the KFO RMP. However, for the purpose of analysis in this EIS, it is assumed that an exception, modification, or waiver would be granted in the event of a lease per decision SSS-57. Appendix 3 of the KFO RMP describes the mechanisms by which exceptions, waivers, or modifications would occur (Table 1.7.1). In the ROD following this EIS, it remains within the BLM's decision space not to except, waive, or modify the RMP decisions based on the analyses conducted.

[11] The BLM Field Manager is responsible for approving any exception, modification, or waiver. For SSS-54, the operator must submit a plan that demonstrates that impacts from the proposed action can be adequately mitigated. For SSS-54, the Field Manager may modify the boundaries of the stipulation area if (1) portions of the area do not include lek sites, (2) the lek site(s) have been completely abandoned or destroyed, or (3) occupied lek site(s) occur outside the current defined area, as determined by the BLM. For SSS-54, the Field Manager may grant a waiver if there are no active lek site(s) in the leasehold and it is determined the site(s) have been completely abandoned or destroyed or occur outside current defined area, as determined by the BLM. For SSS-55 and SSS-56, the operator must submit a plan that demonstrates that impacts from the proposed action can be avoided, sufficiently minimized, or adequately mitigated for an exception to be granted. For SSS-55 and SSS-56, the Field Manager may modify the boundaries of the stipulation area if portions of the area do not include habitat or are outside the current defined area, as determined by the BLM. For SSS-55 and SSS-56, the Field Manager may grant a waiver if it is determined the habitat no longer exists or has been destroyed. There is no formal public input into these decisions.

4.18.2.1.2 Design Features

The KFO RMP and other BLM and state documents provide the framework for the tract's design features, which would be reflected in lease stipulations as part of a lease contract after a ROD. DOGM, a state agency under UDNR, would be responsible for ensuring compliance and enforcement of the lease stipulations. The standards described in the sage-grouse mitigation plan (see Section 4.18.2.1.2.3 and Appendix E) would also be applicable as design features and would compel mitigation for impacts to wildlife related to mining the tract.

This section first provides a summary of the results anticipated from the successful completion of all design features. This is provided up front to give the reader a holistic view of the way the design features would ultimately work together to cumulatively maintain and enhance the amount and quality of sage-grouse habitat available in the analysis area. Following the summary, individual design features are listed and described in detail. They are broken into four distinct categories: 1) *pre-mining vegetation treatments*, or the treatment of areas on the tract to decrease conifer encroachment and increase the quality of the vegetation as Greater Sage-Grouse habitat; 2) *on-tract mitigation*, or required avoidance and minimization measures; 3) *reclamation*, or the restoration of habitat disturbed during mining operations to pre-mining conditions; and 4) *off-tract mitigation*, or requirements to take place off the tract as detailed in the sage-grouse mitigation plan. The off-tract mitigation measures are described in the larger context of the sage-grouse mitigation plan (see Appendix E). Note that exact reclamation standards and the success of completed reclamation actions are determined under SMCRA with the oversight of DOGM under a separate permitting process.

4.18.2.1.2.1 Anticipated Results from Enforcement of Pre-mining Vegetation Treatment, Reclamation, and On- and Off-tract Mitigation Measures

The required pre-mining vegetation treatment, reclamation, and mitigation measures detailed below and listed in the design features, as well as in the sage-grouse mitigation plan comply with the IM 2012-043 requirement to "cumulatively maintain and enhance Greater Sage-Grouse habitat" by instituting the following requirements:

- Habitat avoidance through the designation of limited-touch areas in sagebrush habitats in the tract
- Conducting vegetation treatment on Block Sa (comprising 186.3 acres) to reduce conifer encroachment before mining activities start
- Requiring that Blocks S and NW not be mined simultaneously, allowing one to provide a refuge while the other is experiencing disturbances due to mining
- Reclaiming in-tract sagebrush habitats to vegetation standards that would provide sage-grouse habitat in the long term
- 4:1 ratio of disturbance to off-tract mitigation acres to increase available habitat in the analysis area in the short term
- Prioritizing off-tract vegetation treatments in areas where conifer removal can be done from an intact sagebrush understory in locations immediately adjacent to habitat occupied by sage-grouse, such as those areas analyzed in the BLM's *South Canyon Vegetation Enhancement Project Environmental Assessment* (BLM 2010c) and Upper *Kanab Creek Watershed Improvement Project Environmental Assessment* (BLM 2011d), as shown in Map 3.23.
- Requiring that off-tract vegetation treatment mitigation projects intended to comply with the 4:1 mitigation ratio are completed no more than one year after the corresponding on-tract surface disturbance occurs.

The anticipated results from the combined pre-mining vegetation treatment, reclamation, and mitigation actions are based on observations from previously conducted telemetry observations, reclamation projects, and vegetation treatments in the KFO, as described in Section 3.18.3. These observations indicate the following:

1. Sage-grouse would occupy vegetation treatment areas, consisting of juniper removal from an intact sagebrush understory (both on- and off-tract), shortly after the vegetation treatment, and in many cases within the following year (Frey 2013; Frey et al. 2013a), especially when the treated areas are adjacent to already occupied habitat. Use by sage-grouse of previously completed vegetation treatment area is described in detail in Section 3.18.3.4.2.
2. An analysis of habitat use from telemetry data collected from 2005 to 2009 documented birds using both Blocks NW and S year-round (Frey et al. 2013b), indicating that Block NW could serve as a refuge while mining activities are conducted on Block S, and vice versa.
3. Successfully reclaimed areas would function as sage-grouse habitat within approximately 15–20 years from the date of completion (Petersen 2013b).
4. Off-tract vegetation treatments would enhance habitat availability and connectivity in the long term, thereby contributing to the genetic resilience of the population.

It is anticipated that sage-grouse would continue to use the limited-touch areas of the tract, Block Sa, and habitat adjacent to but outside of the tract while mining takes place. Pre-mining vegetation treatment of Block Sa would create an initial increase in available habitat. Because sage-grouse currently use the habitat of both Blocks NW and S year-round, it is anticipated that Block NW would serve as a refuge and be used by grouse year-round while portions of Block S are experiencing mine-related disturbances, and vice versa. As the vegetation in reclaimed areas becomes established and begins to resemble sage-grouse habitat, individuals are expected to use these parcels. Successful reclamation would represent an increase in available habitat for the species in the long term because many of these areas are currently degraded and underused by sage-grouse due to juniper encroachment. And finally, the requirement for off-site vegetation treatments at a ratio of 4 acres for every 1 acre disturbed would increase available habitat for the Panguitch population as a whole, as well as increase connectivity and genetic flow among the population breeding groups. The requirement that the off-site projects are completed no more than one year following the corresponding disturbance in combination with the initial increase in available habitat from treating Block Sa would ensure that the amount of available habitat is maintained throughout the life of the mine.

Compliance with these requirements would ensure there would be no net loss of habitat for Greater Sage-Grouse, and would lead to a net increase of available habitat for the population as a whole in both the short and long term. Many of the locations that would be enhanced, reclaimed, and treated may not otherwise be completed without the funding made available by mining activities. In the long term, the enhanced habitats of the tract, mined areas reclaimed to sagebrush, and increased availability of habitat population-wide would further BLM's objectives of maintaining and enhancing habitat for Greater Sage-Grouse, and would thereby aid in the stabilization or increase of the Panguitch population. The ability to increase habitat availability and connectivity between breeding groups would increase the health and resiliency of the group breeding near the tract, as well as increase the capacity for the population as a whole to increase.

Success of the on- and off-tract vegetation treatments would not be dependent on whether sage-grouse are documented using the treated habitat. Use is not required for two reasons:

1. It is highly likely that treatments would be successful because of the requirement (as listed above) to prioritize off-tract vegetation treatments in areas where conifer removal can be done from an intact sagebrush understory in locations immediately adjacent to habitat occupied by sage-grouse, such as those areas analyzed in the BLM's *South Canyon Vegetation Enhancement Project Environmental Assessment* (BLM 2010) and *Upper Kanab Creek Watershed Improvement Project Environmental Assessment* (BLM 2011). Vegetation treatments meeting this requirement are highly likely to quickly increase the availability of sage-grouse habitat (Baruch-Mordo et al. 2013; Commons et al. 1999).
2. Unpredictable environmental events, such as extreme drought or very harsh winter conditions, may preclude grouse individuals from using certain habitat, even if it meets all biological needs. It is unreasonable to hold the selected lessee to a success criterion that may be out of its control.

4.18.2.1.2.2 Detailed Project Design Features

This section summarizes the required sage-grouse–related mitigation, pre-mining vegetation treament, and reclamation actions listed in Table 2.6.1 of this document and in the sage-grouse mitigation plan (see Appendix E). These actions would be required under all action alternatives except where not applicable based on the tract configuration under any given alternative (e.g., Alternative K1 excludes Blocks S and Sa). The anticipated impacts of completing these actions are included in the impacts analysis below. All of the actions listed are intended to address the need for sage-grouse to have refugia (or an area of suitable habitat to which sage-grouse individuals can retreat when other habitats have been disturbed) available during mining activities. Compliance with these actions would lead to the desired results as summarized above.

Pre-mining Vegetation Treatment

- In coordination with BLM and DOGM, conduct vegetation treatments on sage-grouse nesting, brood-rearing, and wintering habitat on public lands in Block Sa (see Map 1.2) and on the limited-touch areas of Block S where treatments have not already been accomplished (described below) before any mine-related ground disturbance takes place. Treatment would consist of actions to reduce conifer encroachment in areas with established sagebrush understories. The particulars of these habitat improvements would be contingent upon the results of pre-disturbance vegetation surveys and an analysis of data.

In the short term (life of the mine), pre-mining vegetation treatments in Blocks S and Sa would improve conditions for sage-grouse by removing overstory pinyon and juniper (due to encroachment), establishing native and desirable non-native grasses and forbs, and allowing the existing sagebrush canopy cover to increase. This would improve the structural and compositional diversity of sage-grouse habitat compared to current conditions (BLM 2008b) in areas currently occupied year-round by sage-grouse (Frey et al. 2013b). Vegetation treatment activities in Block Sa before mining starts would ensure that the net balance of occupied sage-grouse habitat would remain positive and a refuge area would be created. Conifer removal treatments would quickly create sage-grouse refugia in the short term. Sage-grouse have been documented using Block Sa year-round (Map 3.26); therefore, it is likely they would continue to use this habitat and possibly increase use in Block Sa after treatments are completed (Frey et al. 2013b; Frey 2008).

On-tract Mitigation

- To the extent possible, avoid disturbance to individuals, populations, and habitats of threatened, endangered, proposed, and candidate species during mining.
- Monitor grouse populations (currently within the Alton area) throughout the year to assess bird survival, nest site and nest success, brood-rearing sites, and key winter habitat areas.

- Avoid using intact sagebrush stands for storing mining-generated spoil and topsoil stockpiles. Where practicable, these spoil and topsoil stockpile sites would avoid nesting habitat. Coal-processing equipment would be located in areas that create the least possible disturbance to sage-grouse and sage-grouse habitat.
- Conduct mosquito abatement in holding ponds and standing water to reduce the potential for transmission of West Nile virus to sage-grouse.
- Designate limited-touch areas in sagebrush habitats in the tract. The term limited-touch area is used in this document to describe no-coal areas within the tract that have intact or restored sagebrush habitats that are required to provide adequate refugia throughout the life of the mine (see Map 3.24). Surface-disturbing activities in these limited-touch areas would be avoided if possible. However, these areas could be used to access mining blocks that would otherwise be inaccessible. Limited-touch areas would be enforced, which would incorporate the following conditions:
  - Surface-disturbing activities in portions of the tract in the no-coal zone (e.g., intact, native sagebrush stands in Block S of the tract) would be prohibited.
  - Mine-related surface-disturbing activities would be prohibited in portions of the tract in the no-coal zone where on-site vegetation treatment actions would be required by special lease stipulations (e.g., Block Sa of the tract).
  - New surface-disturbing activities in Blocks S or NW of the tract would be temporarily prohibited until successful reclamation (as determined on a case-by-case basis by DOGM) has occurred on an equal area of a previously disturbed portion of the tract in either of these blocks (i.e., planning the mining sequence so that Block S or NW is reclaimed and provides functioning sage-grouse habitat prior to initiating new surface-disturbing activities on the other block).
- Do not mine Blocks NW and S at the same time; mining would likely begin in Block S (although the exact mining sequence is not known at this time). Because Sage-grouse currently use both blocks year-round, this would allow Block NW to serve as a refugia during Block S mining operations. Avoidance of the enhanced sagebrush habitats in Block Sa would be required to provide adequate refugia throughout the life of the mine.
- Apply the following short- and medium-term mitigation measures on Block S (and other locations in the tract as appropriate) to enhance habitat for Greater Sage-Grouse:
  - Avoid sagebrush stands in no-coal zones as habitat to the extent practicable and economically feasible.
  - Locate centralized facilities (i.e., office, maintenance shop, equipment wash bay, oil and fuel storage tanks, oil and fuel storage containment, truck unloading and coal sizing area, coal stockpile area, and truck loadout area) and dispersed facilities (i.e., temporary light-use roads and haul roads, electrical poles and lines, various temporary ponds and water-control structures, temporary topsoil and overburden stockpiles, and temporary berms and screens) to create the least possible practical and economic disturbance to sage-grouse and sage-grouse habitat.

The reclamation and off-site vegetation treatment actions described in this section that would take place concurrently with mining would be designed to improve habitat conditions for sage-grouse in the long term. However, retention of the Alton sage-grouse population would require that year-round, suitable habitats are continuously available to provide refugia while removal and restoration of other habitat areas are taking place. This would require the avoidance of 1) intact sagebrush stands and other seasonal sage-grouse habitats, such as the agricultural and wet meadow habitats in Block NW that are used year-round; and 2) sagebrush nesting, and brood-rearing habitats (limited-touch areas) in Block S. It would also require that vegetation treatment in Block Sa is completed before mining starts so birds in the adjacent habitats of Block S would have habitat in which to move.

Tract Reclamation

- Remove juniper and pinyon seedlings found in reclaimed areas until full release of the reclamation bond.
- Conduct post-reclamation surveys for undesirable/invasive plant species on biannual basis (spring and fall).
- Begin vegetation monitoring in the next growing season after fall seeding/planting and monitor until reclamation goals are achieved.
- Monitor reclamation sites until bond release to assess habitat reclamation success.
- As practical and economically feasible, reclaim to AOC and seed with similar plant species and composition to approximate pre-mining, original community on Block S.
- On Block S (and other locations in the tract as appropriate), apply the following long-term habitat reclamation measures to enhance habitat for Greater Sage-Grouse:
    - Reclaim to create range sites based on approved ecological site descriptions (conditions for the growth of grasses, forbs, and sagebrush).
    - Plant bare root or potted sagebrush and bitterbrush in identified sites to accelerate shrub reestablishment.
    - Seed and plant in the fall.

Exact reclamation standards and the success of completed reclamation actions are determined under SMCRA with the oversight of DOGM under a separate permitting process. The habitat reclamation and restoration activities that would follow mining disturbance would be designed to create habitat for the Greater Sage-Grouse and ensure that year-round habitat is available for use during mining activities. Successful habitat reclamation would require that restored sagebrush communities achieve maturity and the structural diversity required to support Greater Sage-Grouse. In the BLM's experience with vegetation treatments completed locally, development of a mature sagebrush community requires approximately 15–20 years (personal communication, Petersen 2013). On the tract, sagebrush communities would presumably require a similar time period to recover on reclaimed soils. Recovery time would depend on numerous ecological variables such as local topography, soil reclamation success, soil type, variations in local and regional climate, colonization of the site by soil-building fungi and bacteria, and other site features that cannot be predicted or easily quantified. The reclamation plan to plant sagebrush seedlings would be designed to accelerate sagebrush reestablishment and to accelerate the successional development of mature sagebrush communities.

Over the long term, reclamation of disturbed areas and successful restoration of diverse sagebrush habitat on the tract would contribute to the creation of contiguous sagebrush vegetation necessary for the long-term persistence of the Alton sage-grouse population. The analysis presented here assumes that habitat reclamation actions would be successful, and that these actions would lead to the establishment of self-sustaining and self-propagating mature sagebrush communities. Mitigation and pre-mining vegetation treatment projects would create habitat in the short term.

4.18.2.1.2.3 Off-Tract Mitigation: Greater Sage-Grouse Mitigation Plan

The BLM initiated a stakeholder process to develop a mitigation plan to describe the strategy for avoiding and reducing impacts, where possible, to sage-grouse potentially affected by leasing and mining the tract and by identifying on- and off-site mitigation opportunities. The Color Country Adaptive Resource Management Local Working Group (CoCARM)—the local sage-grouse working group—comprises agency and government officials with knowledge of the current land uses and quality of habitat in the local area needed to develop an effective and appropriate mitigation plan that identifies on- and off-site potential mitigation projects and locations. This group includes members that represent the UDWR, BLM, USFS, USFWS, DOGM, affected private landowners, and local public officials. As such, this group was identified as a representative stakeholder group for initial discussions about off-site mitigation.

The requirements of the sage-grouse mitigation plan would be applicable to all action alternatives except where the configuration of the action alternative makes certain requirements of the plan unnecessary. If the BLM's decision following the EIS process is to offer the tract for competitive leasing, the requirements of the mitigation plan would be incorporated as design features appropriate to the alternative selected. The mitigation plan can be found in Appendix E.

All mitigation activities would be conducted in the mitigation plan area, which corresponds to the analysis area used for sage-grouse in this document (see Map 3.21) (State of Utah 2013). The mitigation plan/analysis area includes public, state, and private land. The mitigation plan was developed in response to concerns expressed by the public and agencies through the comments submitted on the DEIS. The mitigation plan is also a result of the regulatory framework listed in Section 4.18.2.1.1.

The goals of the mitigation plan are summarized as follows:

- Offset habitat impacts of mining to sage-grouse habitat within the tract, as identified through the EIS process, by implementing habitat management and off-tract vegetation treatment projects in the analysis area.
- Identify opportunities that mitigate for impacts to the Panguitch population from threats under the five listing factors used by the USFWS to assess the status of ESA-listed and candidate species. A detailed discussion of these factors can be found in Endangered and Threatened Wildlife and Plants; 12-month Findings for Petitions to List the Greater Sage-Grouse (Centrocercus urophasianus) as Threatened or Endangered; Proposed Rule (50 CFR 17, *Federal Register* 75:13910–14014).
- Identify mitigation projects based on the availability of existing site-specific sage-grouse population information (e.g., lek counts and telemetry locations) and ecological condition information (e.g., habitat location and size, opportunity locations, and completed vegetation treatment locations), including data gathered for the adjacent Coal Hollow Mine, which has been in operation since 2010.

Off-tract Mitigation Requirements

Off-tract mitigation requirements refer to vegetation treatment and mitigation actions that would be required on lands off the tract but in the analysis area. The following off-tract mitigation requirements are also described in detail in the sage-grouse mitigation plan:

- Vegetation treatments (including water availability/riparian habitat improvement projects) at a ratio of 4:1 per acre of directly disturbed sage-grouse habitat. Research pertaining to and concurrent with the vegetation treatments (e.g., telemetry or other survey type to document grouse habitat use, sagebrush canopy measurements) is necessary to ensure appropriate and successful treatments.
- The marking or removal of all fences that occur within 2 miles of an active lek.
- Because coal trucks comprise approximately 4% of the traffic on nearby roads, the proponent would be responsible for funding up to 4% of the UDOT's roadkill carcass removal on the coal transportation haul route in coordination with UDOT, DOGM, UDWR, and BLM. Enforcement would be based on a cooperative agreement between these entities.
- A nearby mine approximately half the size of the tract has contracted with USDA Wildlife Services to spend approximately $6,000 every five years for local predator control. Under this lease agreement, the selected lessee will provide $12,000[12] (ACD 2009)every five years to UDSA Wildlife Services to fund predator control actions in the mitigation plan area (analysis area), focusing on corvid species, red fox, and other potential predators.

[12] This amount is based on a doubling of the amount that ACD has contracted with USDA Wildlife Services to spend on predator control from 2011 to 2016 as partial mitigation fulfillment for the Coal Hollow permit (see Appendix B of Appendix 3-5 of the MRP [ACD 2009]).

The exact acres of required vegetation treatments would be based on the UDWR occupied habitat polygon (99% of the tract), but would also incorporate the most accurate and recent site-specific habitat information. The selected lessee would not be required to mitigate for disturbance of nonhabitat. As a result of the vegetation treatment ratio, between 3,656 and 7,258 acres of the analysis area would be enhanced for Greater Sage-Grouse use. The exact amount of treated habitat would depend on the alternative chosen for implementation and the amount of nonhabitat occurring on the tract. Off-site vegetation treatments would be completed no more than one year after the corresponding on-tract surface disturbance occurs. The exact timing of mitigation projects would be determined at the permitting stage, when more detailed knowledge of the mining sequence and level of disturbance are known.

Off-tract vegetation treatments to fulfill mitigation requirements would be prioritized in areas where conifer removal could be done from an intact sagebrush understory in locations immediately adjacent to habitat occupied by sage-grouse, such as those areas analyzed in the BLM's *South Canyon Vegetation Enhancement Project Environmental Assessment* (BLM 2010) and *Upper Kanab Creek Watershed Improvement Project Environmental Assessment* (BLM 2011), as shown in Map 3.23. Due to inadequate funding, without mining vegetation treatment, projects in these areas would likely be completed over the course of decades. With funding from the selected lessee, projects in these areas could be conducted within a short timeframe and make a large amount of habitat available to local sage-grouse within the timeframe of the life of the mine (which varies under each alternative). Areas covered by these environmental assessments could undergo vegetation treatments immediately, without having to delay the mitigation process for additional analysis and/or permitting.

Exact reclamation standards and the success of completed reclamation actions are determined under SMCRA with the oversight of DOGM under a separate permitting process. For the purpose of this analysis, lands that have been disturbed by mining and reclaimed to the standards listed in the lease stipulations would not be considered as mitigation, and so would not contribute to the tally of mitigated acres required by the 4:1 ratio. As described above, reclamation would be done with the intent of creating sagebrush habitat in the long term. Mitigation projects would create habitat in the short term.

4.18.2.2 IMPACT INDICATORS

Impact indicators for Greater Sage-Grouse are identical to those described for all other special status species (Section 4.18.1.2).

4.18.2.3 ANALYSIS ASSUMPTIONS

Analysis assumptions for Greater Sage-Grouse are identical to those listed for all special status wildlife species in Section 4.18.1.3, with the following additions. To analyze and disclose the effects to Greater Sage-Grouse from coal mining associated with the Proposed Action, Alternative C, and Alternative K1, it is assumed that 1) mining would occur and that there would be an exemption, waiver, or modification of the KFO RMP surface stipulations SSS-54, SSS-55, and SSS 55 regarding Greater Sage-Grouse (BLM 2008b), and that 2) surface disturbance would be allowed within a 0.5-mile radius of a Greater Sage-Grouse lek and within a 2.0-mile radius of a Greater Sage-Grouse lek in occupied habitat from March 15 to July 15. Without an exemption, waiver, or modification to surface stipulations, mining would not be permitted on most of the tract.

The regulatory authorities and responsibilities of this lease are described in detail in Section 1.5 of this document. The permits, actions, and plans required for mining to occur on the tract are listed in Table 1.5.1. This is important to note because leasing—the decision to be made by this document—is done at a programmatic scale. Detailed knowledge regarding the exact timing and sequence of mining is not developed until the permitting stage, and it will be subject to approval by BLM and DOGM. For this analysis, it is assumed that additional site-specific measures regarding 1) avoidance of sage-grouse, 2) on- and off-tract vegetation treatments for sage-grouse, 3) mitigation for sage-grouse, and 4) and reclamation

for sage-grouse would be developed during the permitting stage once more detailed operations information is known. A mining plan with specific details about mining methods, sequence, and mitigation would be available for review by cooperating agencies and the public at the permitting stage. The lease stipulations listed above would apply to the lease unconditionally.

4.18.2.4 IMPACTS FROM MINING THE TRACT

The nature of impacts common to all action alternatives would be identical to those described for wildlife (Section 4.17.4.2) and special status species (Section 4.18.1.4.2). The following sections highlight impacts specific to Greater Sage-Grouse under each alternative. The elements of disturbance would be the same as those described for special status species (Section 4.18.1.4.2).

4.18.2.4.1 Alternative A: No Action

Impacts to Greater Sage-Grouse from the No Action Alternative would be identical to those described for all other special status species (Section 4.18.1.4.1) with the following addition. The encroachment of pinyon pine and Utah juniper into sagebrush habitats, and the lack of contiguous sagebrush habitats for nesting, brood-rearing, and wintering sage-grouse have been limiting factors in the size and distribution of the Alton sage-grouse population in the past. Tree removal and seeding to restore sagebrush habitats on 1,700 acres in the Alton–Sink Valley by the BLM in 2005 resulted in increased forb and grass cover and increased use of the treated areas by sage-grouse (Curtis et al. 2007). Ongoing management to improve the distribution, abundance, and connectivity of suitable habitats would have beneficial impacts on the species.

4.18.2.4.2 Alternative B: Proposed Action

Impacts to Greater Sage-Grouse under the Proposed Action would be identical to those described for all other special status species (Section 4.18.1.4.3) except what is described in the following sections.

4.18.2.4.2.1 Habitat Loss and Displacement

The Proposed Action would result in more direct adverse impacts to the Alton sage-grouse population and currently occupied habitat than would occur under the No Action Alternative. Implementation of the Proposed Action would result in the disturbance of approximately 1,992 more acres (56% of the tract and 0.7% of the analysis area over the life of the mine) of occupied sage-grouse habitat than would occur under the No Action Alternative. *Occupied* habitat denotes habitat that may be used throughout the year, although not all habitat is used year-round. Habitat types that would be removed include breeding, brood rearing, and wintering. According to locally collected telemetry data (Frey et al. 2013), impacts from the Proposed Action would result in disturbance to 1,503.8 acres of breeding habitat (21.8% of available habitat and 42.3% of the tract), 1,723.2 acres of brood-rearing habitat (19.5% of available habitat and 48.5% of the tract), 1,416.3 acres of late season brood-rearing habitat (38.8% of available habitat and 39.9% of the tract), and 1,490.0 acres of wintering habitat (37.4% of available habitat and 42.0% of the tract). Note that these habitat types overlap and do not add to a comprehensive total. Impacts are reported in terms of total acres of disturbance over the life of the mine, but it should also be noted that this disturbance would not all occur at one time.

As described in Section 1.7.1.2.2 (Application of Unsuitability Criteria), four decisions in KFO RMP (BLM 2008b) pertain to sage-grouse management (SSS-54, SSS-55, SSS-56, and SSS-57), and detail temporal and spatial buffers for leks and winter habitat within which no surface-disturbing activity may occur. SSS-57 states that an exemption, waiver, or modification may be granted for each RMP decision on a case-by-case basis. For the purpose of analysis in this EIS, it is assumed that an exception, modification, or waiver would be granted in the event of a lease per decision SSS-57. An exception, modification, or waiver of these decisions would eliminate no surface occupancy protections within 0.5-

mile of sage-grouse leks, allow surface-disturbing activities within 2 miles of sage-grouse leks from March 15 to July 15, and allow surface-disturbing activities within sage-grouse wintering habitat from December 1 to March 14. Eliminating these protections could result in the short- or long-term displacement or loss of the local birds. Despite the requirements of the lease stipulations, suitable habitats may not be adequately available to prevent the loss or displacement of the existing breeding and wintering group(s). If displacement occurs, it is unknown whether the grouse would return to the area in the long term, following reclamation. The long-term beneficial impacts from the vegetation treatments required by the lease stipulations are contingent upon the local sage-grouse breeding and wintering group(s) having persisted in the area.

Reclamation actions would include seeding sagebrush and planting seedlings to accelerate the successional development of suitable sage-grouse habitat. Over the long term, these reclamation measures would improve the overall quality of habitat areas that are degraded prior to mining. The sage-grouse mitigation plan was developed to address potential impacts to sage-grouse (see Section 4.18.2.1.2.3 and Appendix E). The sage-grouse mitigation plan would be included as a special lease stipulation if the tract is leased. This plan would maintain short-term habitat losses through the requirements of the lease stipulations, and ultimately create four times the habitat disturbed in the analysis area.

The Alton sage-grouse population is isolated by its distribution at the southern portion of the species' range and the limited distribution of nesting, brood-rearing, and wintering habitats in the area. Under the Proposed Action, the sage-grouse occupying the Alton–Sink Valley area would be adversely affected where surface disturbance associated with coal mining and construction activities occur in the species' habitats. As described in Section 4.17.1.2, reclamation measures would be required to restore Greater Sage-Grouse nesting, brooding, and wintering habitats. Pre-mining vegetation treatment actions in Block Sa (i.e., eliminating juniper, planting grass, forb, and sagebrush seedlings) would also be required to minimize loss of existing sagebrush habitat in the short term. Reclamation actions would create new sagebrush habitats in the long term, which according to BLM's local experience with habitat treatments on undisturbed soils, reclamation could require approximately 20 years (personal communication, Petersen 2013); however, the exact timing would depend on site and environmental conditions (see Section 4.17.3). In the long term, reclamation and vegetation treatment actions throughout the tract would create sagebrush stands of varying ages and structure, and would increase the overall quality and quantity of habitats available to the sage-grouse breeding in the Alton area.

Some anecdotal observations suggest the sage-grouse breeding in the Alton–Sink Valley area are unusually tolerant of human disturbance (Curtis et al. 2007; Frey 2009), which indicates that the population may be able to tolerate some level of indirect disturbance associated with mining and reclamation. As described in Chapter 3, the Alton–Sink Valley birds have been observed on the Coal Hollow parcel inside the active mining pit, flying over active mining equipment, and occupying roadsides (Personal Communication, Petersen 2013). The presence of sage-grouse in the active mining area suggests that birds may be somewhat tolerant of human disturbance, and may not be completely displaced if mining commences on the tract. However, the birds' continued use of the area does not prove that the levels of human disturbance are not adversely affecting annual mortality rates or fecundity. Also, as indicated by Frey's telemetry information, these birds are assumed to be a nonmigratory population. Thus, the continued use of the area may just be a result of the birds having nowhere else to go.

A sage-grouse mitigation plan was developed for this project and would require that off-site mitigation actions take place off the tract but in the analysis area concurrent with mining operations (see Appendix E and Section 4.18.2.1.2.3). Off-site mitigation actions include vegetation treatments at a ratio of 4:1 acres of direct disturbance, marking or removal of all fences within 2 miles of an active lek, funding a portion of UDOT's carcass removal program on the transportation route, and providing contributions to predator control actions. The BLM's South Canyon Vegetation Enhancement Project and the Upper Kanab Creek Watershed Improvement Project have analyzed and approved 121,327 and 51,600 acres, respectively, of vegetation for treatments to take place over the next 10–15 years within the sage-grouse analysis area, and mitigation-related vegetation treatments would be prioritized in these areas—especially in areas adjacent to habitat occupied by sage-grouse. Under the Proposed Action, approximately 7,258 acres of habitat off-tract would be enhanced for sage-grouse use through vegetation treatments. Off-site vegetation treatments would be completed no more than one year after the corresponding on-tract surface disturbance occurs. The exact timing of mitigation projects would be determined at the permitting stage, when more detailed knowledge of the mining sequence and level of disturbance are known. These mitigation actions would lessen impacts of mining operations on the sage-grouse population by providing additional and alternate habitat for use, reducing the potential for collisions with fence lines, and controlling local populations of species that predate on sage-grouse eggs and juveniles. Actions required in the mitigation plan would apply to all action alternatives.

The development of the coal mine would eliminate nesting, brood-rearing, and wintering habitat resources adjacent to the lek complex during the life of the mine and during the subsequent restoration and recovery period. The new lek is in a limited-touch area of Block S, meaning that it would not be mined, and the avoidance measures detailed in the lease stipulations would be followed so disturbance to this habitat would be minimized as much as possible. Fragmentation, alteration, degradation, and loss of Greater Sage-Grouse habitats would occur as a result of mining activity and associated noise and human presence. Development of the coal mine, removal of overburden, and surface mining operations would result in the short-term loss of habitat resources and displacement or loss of individual birds. The mitigation, reclamation, and on- and off-tract vegetation treatment plans would be designed to enhance the long-term persistence of the sage-grouse breeding in the Alton area.

A telemetry study of movement between the Hoyt's Ranch lek and the Alton–Sink Valley lek found that the birds known to breed at the Hoyt's Ranch lek traveled to the Alton Valley during summer and fall months, indicating that they are using the Alton Valley to forage, raise their young, and winter (Petersen 2010; Frey 2010). The noise and human activity on the tract may deter grouse that breed at Hoyt's Ranch from traveling to the Alton Valley, thereby reducing connectivity between the two breeding groups. A reduction in connectivity would exclude or discourage the Hoyt's Ranch group from using the foraging, brood-rearing, and wintering habitat of Alton Valley, thereby reducing the health of the birds attending the Hoyt's Ranch lek and the overall Panguitch population.

4.18.2.4.2.2 Infrastructure Impacts, Including Roads

Infrastructure associated with mining activities, such as buildings, fences, and power lines, could cause injury or mortality from collisions and facilitate increased predation by raptors and *Corvus* species (crows and ravens) by increasing the availability of perching sites. The mitigation measure for the selected lessee to provide $12,000 every five years to fund predator control actions in the analysis area (described in Appendix E) would lessen the severity of predation on the grouse population.

Mining activities and associated surface disturbance and road development would also facilitate invasion by weed species (Bergquist et al. 2007). In addition, the creation of holding ponds would increase mosquito abundance and could increase the likelihood of West Nile virus being transmitted to local sage-grouse. In Wyoming and Oregon, West Nile virus has caused sage-grouse mortality (Naugle et al. 2004).

Any additional individual mortalities of birds that use the tract could have a substantial impact on the overall likelihood of local persistence. The lease stipulation requiring mosquito abatement in holding ponds and standing water would reduce the potential for transmission of West Nile virus to the sage-grouse population.

Construction activities near active leks during the breeding season would have direct adverse impacts to sage-grouse by disrupting courtship behaviors, decreasing nest initiation rates, decreasing nest success, and increasing the risk of mortality of sage-grouse adults and chicks from collisions with, or crushing by, vehicles and construction equipment. Recent studies indicate that sage-grouse lekking and brooding habitat is devalued within 1,300 feet of roads and other surface disturbances, which causes avoidance and displacement to other habitat areas (Connelly et al. 2000; Crawford et al. 2004; UDWR 2002). Other recent studies have found that natural gas field development within 1–3 miles of an active Greater Sage-Grouse lek can lead to dramatic declines in breeding populations, and energy development within 4 miles of a lek can decrease male attendance (Holloron 2005:638–649; Walker et al. 2007), indicating a 0.5-mile buffer around active leks may not be sufficient to avoid impacts to breeding activities. Manier et al. (2013) identified indirect impacts to sage-grouse from highways, primary, and secondary routes using a 1.9-mile buffer; however, they acknowledge that road-effect distances generally increase with increased traffic density and speed. Noise associated with human presence, mining, and associated facilities (i.e., power generators) in the tract, and coal truck traffic to and from the tract, could reduce breeding success by decreasing nest initiation and nest success in adjacent habitats. Ongoing surface disturbance and associated noise could cause the displacement of sage-grouse from crucial nesting and brood-rearing habitats in the tract. Under the Proposed Action, approximately 1,992 acres (56% of the tract and 0.7% of the analysis area over the life of the mine) of occupied habitat would be impacted through direct surface disturbance (Table 4.18.4; see Map 3.25).

Sage-grouse may avoid habitats near roads. Greater Sage-Grouse are susceptible to reduced gene flow and a reduced regional population size due the presence of roads from barrier effects (which reduce landscape connectivity). Sage-grouse are therefore at a greater risk of a regional population size reduction due to the continuing presence of existing roads, increased traffic on roads, and the relocation of KFO Route 116. The mining and haul truck activity on the tract and road, as well as the associated habitat removal, would lead to habitat fragmentation. This fragmentation could augment typical movement patterns, such as seasonal migration and daily use.

Table 4.18.4. Direct Impacts to Greater Sage-Grouse Habitats in the Tract under the No Action and Action Alternatives

	Acres in the Analysis Area	Alternative A (No Action)	Alternative B (Proposed Action)			Alternative C (Reduced Tract Acreage and Seasonal Restrictions)			Alternative K1 (Reduced Tract Acreage)		
		Acres Disturbed	Acres in Tract	Acres Disturbed	Percentage Disturbed (Tract/Analysis Area)	Acres in Tract	Acres Disturbed	Percentage Disturbed (Tract/Analysis Area)	Acres in Tract	Acres Disturbed	Percentage Disturbed (Tract/Analysis Area)
UDWR Occupied Habitat*	271,617	0	3,550.8	1,991.7	56.1%/0.7%	3,147.7	1,661.3	52.8%/0.6%	2,088.3	1,011.9	48.5%/0.4%

Source: UDWR (2012)

Note: This analysis assumes that all dispersed facilities would occur in sage-grouse habitat; however, the exact locations of these facilities are unknown.

* The tract habitat is designated by UDWR as brood-rearing habitat, but based on site-specific information available to date (i.e., Frey et al. 2013; Frey 2010; Curtis and Frey 2008; Petersen 2007; 2010; 2012; 2013), it is evident the species does not use the tract habitat solely for brood-rearing; therefore, throughout this document the term “occupied” is employed.

4.18.2.4.2.3 Noise and Nighttime Lighting Impacts

Acoustic communication is important to the reproductive behaviors of sage-grouse. There is evidence that the acoustic displays produced by males on leks facilitate reproduction in at least two ways. First, females use these vocalizations to find lek locations within the habitat. Second, after arrival at a lek, there is evidence that females use male vocalizations (and other aspects of male display) to choose a mate. Anthropogenic noise in sage-grouse habitat may mask vocalizations produced by males (thereby interfering both with the females' ability to locate leks and to choose mates [Upper Green River Basin Sage-Grouse Working Group 2007]), produced by females to communicate with chicks, and to warn other sage-grouse of nearby predators. Noise levels on the tract could range from as low as 48 dBA to over 80 dBA within approximately 1 km of the equipment and centralized facilities, and as high as 56 dBA from 1 km to 5 km out from the range of the equipment and centralized facilities. There would be intermittent locations of no additional noise (0 dBA) occurring at increasing frequency the further away from the equipment and processes one is located. Increases in ambient noise levels would cease out to distances greater than 5 km from equipment and processes, as discussed in the noise modeling report (see Appendix L). Therefore, when mining would take place within a 5-km radius of the Alton–Sink Valley lek complex, the active lek location(s) could experience noise levels greater than the 40-dBA baseline sound levels expected. Furthermore, Blocks S and NW (areas intended to provide refuge for grouse raising broods) would have elevated noise levels when the mining activity would take place within 5 km of each block.

Noise associated with human presence, mining, and associated facilities (e.g., power generators) in the tract, as well as coal truck traffic to and from the tract, could reduce breeding success by decreasing nest initiation and nest success in adjacent habitats. Ongoing surface disturbance and associated noise could cause the displacement of sage-grouse from occupied habitats in the tract, including on Blocks S and NW, and may interfere with auditory cues important to mate selection and may interfere with predator detection.

The nature of the impacts from nighttime lighting on sage-grouse would be the same as that described for all other special status species (Section 4.18.1.4). Although it is unclear exactly to what degree, sage-grouse individuals using the tract would be negatively impacted by artificial nighttime lighting associated with mining activities. Because mining would occur on 120 acres at any one time, these impacts would decrease with distance from the mining operations.

4.18.2.4.3 Alternative C: Reduced Tract Acreage and Seasonal Restrictions

Under Alternative C, the nature of impacts would be the same as under the Proposed Action, but would differ in the acres of disturbance and timing of mine-related activities. Impacts to Greater Sage-Grouse from Alternative C would be identical to those described for all other special status wildlife species (Section 4.18.1.4) except for the following.

Timing restrictions would be in place for Block S to reduce impacts to the Greater Sage-Grouse that use the tract habitat (see Section 2.4.2.3 Sage-grouse Timing Restrictions). These timing restrictions would be implemented to reduce impacts to the lek complex and sage-grouse that occupy portions of the tract during the nesting and brood-rearing periods by opening up potential habitats that are adjacent to occupied habitat with mixed sagebrush and junipers. Under this alternative, no surface-disturbing activities would be allowed within 0.5 mile of the lek location(s) during the lek establishment and strutting period (February 15–March 15) or in Block S (see Map 2.2) during the strutting, nesting, brooding period (March 15–July 15). There are approximately 124 acres of the tract that are within 0.5 mile of the lek and would be subject to timing restrictions during the lekking period. There are approximately 1,059 acres in Block S that would be subject to timing restrictions during the nesting and brooding period. These timing restrictions would alter the timing and distribution of mining activities, and

would reduce impacts to Greater Sage-Grouse as well as to surface waters, soils, vegetation, and other wildlife and special status species. The loss of the local breeding group would be less likely under this alternative than under the Proposed Action because of the impacts avoided by employing the timing restrictions.

Under Alternative C, mining would not occur in Block NW, and impacts to that habitat would be avoided. Timing restrictions would be placed on mining activities in Block S, and pre-mining vegetation treatments (i.e., reducing conifer encroachment) would be implemented in Block Sa to minimize impacts to the Greater Sage-Grouse population currently using the tract. The sage-grouse population and its habitats would be adversely affected in both the short term and long term due to surface coal-mining activities on and adjacent to the tract, but to a lesser degree than would occur under the Proposed Action. The new Alton–Sink Valley lek location occurs on a limited-touch area on Block S of the tract. This location would not be mined, and the avoidance measures detailed in the lease stipulations would be followed so disturbance to this habitat would be minimized as much as possible. Additionally, birds from the Alton sage-grouse population use Block S during the nesting, brooding, and wintering periods. As would occur under the Proposed Action, human presence, noise, and night-lighting associated with mining activities would impact the daily habitat use patterns of individual grouse. As previously mentioned, under Alternative C, no surface-disturbing activities would be allowed within 0.5 mile of the lek(s) during the lekking period or in Block S during the nesting and brooding period; however, outside of these time periods, surface disturbance would occur and would adversely impact habitat known to be used by the local sage-grouse population. There would be potential for direct and indirect impacts associated with human presence, noise, and night lighting on the lek location, within the 0.5-mile lek buffer, and in adjacent habitats.

Fragmentation, alteration, degradation, and loss of Greater Sage-Grouse habitats are likely to occur as a result of mining activity and associated noise and human presence. Due to timing stipulations, there would be a greater area of open pits during active mining under this alternative than would occur under the Proposed Action. Development of the coal mine, removal of overburden, and surface-mining operations would result in the short-term loss of habitat resources and displacement or loss of individual birds. The reclamation and restoration plan would be designed to enhance the long-term persistence of the Alton sage-grouse population. The sage-grouse mitigation plan was developed to address potential impacts to sage-grouse (see Section 4.18.2.1.2.3 and Appendix E). The sage-grouse mitigation plan would be applied as a special lease stipulation if the tract is leased. Under this alternative, 6,052 acres of off-tract habitat would be enhanced for sage-grouse use. Due to the success of other vegetation treatments that BLM has conducted for sage-grouse within the sage-grouse analysis area (South Canyon Vegetation Enhancement and Upper Kanab Creek Watershed Improvement projects), similar treatment types would be the focus of mitigation-related efforts. These treatments would be conducted within the South Canyon Vegetation Enhancement and Upper Kanab Creek Watershed Improvement project areas. These projects have analyzed and approved 121,327 and 51,600 acres, respectively, of vegetation for treatments to take place over the next 10–15 years within the sage-grouse analysis area. Mitigation-related vegetation treatments would be prioritized in these areas; especially in areas adjacent to habitat occupied by sage-grouse. However, although mitigation and reclamation actions are expected to reduce impacts to sagebrush habitats in the short term and increase the quality and quantity of sagebrush habitats over the long term, habitat loss and disturbance associated with the coal mine could result in the short-term displacement or loss of the local population.

Under Alternative C, approximately 1,661 acres of occupied habitat in the tract would be impacted through direct surface disturbance (52.8% of tract and 0.6% of the analysis area; see Table 4.18.4). *Occupied* habitat denotes habitat that may be used throughout the year, although not all habitat is used year-round. Habitat types that would be removed include breeding, brood rearing, and wintering. According to locally collected telemetry data (Frey et al. 2013), impacts from Alternative C would result in disturbance to 1,225.5 acres of breeding habitat (17.8% of available habitat and 38.9% of the tract), 1,416.8 acres of brood-

rearing habitat (16.0% of available habitat and 45.0% of the tract), 1,191.6 acres of late season brood-rearing habitat (32.7% of available habitat and 37.9% of the tract), and 1,197.0 acres of wintering habitat (30.0% of available habitat and 38.0% of the tract). Note that these habitat types overlap and do not add to a comprehensive total. Alternative C would result in more direct adverse impacts to the sage-grouse occupying the Alton–Sink Valley and their habitat than would occur under the No Action Alternative. Over the long-term, habitat restoration measures would result in improvements to the overall quantity and quality of habitats in some areas of the tract that are degraded before mining begins.

4.18.2.4.4 Alternative K1: Reduced Tract Acreage

Under Alternative K1, mining would not occur in Block NW or Block S. Pre-mining vegetation treatment would be implemented in Block Sa to minimize impacts to the Greater Sage-Grouse population in the tract. The sage-grouse population and habitats would be adversely affected in both the short and long term due to surface coal-mining activities on and adjacent to the tract, but to a lesser degree than would occur under the Proposed Action and Alternative C. Portions of the Alton–Sink Valley lek complex occur on Block S of the tract. As would occur under the Proposed Action, human presence, noise, and night lighting associated with mining activities would impact the daily habitat use patterns of individual grouse. Additionally, birds from the Alton sage-grouse population use Block S during the nesting, brooding, and wintering periods. Under this alternative, mining activities in the tract would not directly disturb the sage-grouse lek or the habitat of Block S, but there is potential for indirect impacts to a lek from human presence, noise, and night lighting associated with mining activities. Because the nesting, brood-rearing, and wintering habitat on Block S and Block NW would not be destroyed, loss of the local population is less likely under this alternative than under all other action alternatives.

Fragmentation, alteration, degradation, and loss of Greater Sage-Grouse habitats are likely to occur from mining activity and associated noise and human presence. Development of the coal mine, removal of overburden, and surface-mining operations would result in the short-term loss of habitat resources and displacement or loss of individual birds. The reclamation and restoration plan would be designed to enhance the long-term persistence of the Alton sage-grouse population. The sage-grouse mitigation plan was developed to address potential impacts to sage-grouse (see Section 4.18.2.1.2.3 and Appendix E). The sage-grouse mitigation plan would be applied as a special lease stipulation if the tract is leased. Under this alternative, approximately 3,656 acres of habitat would be enhanced for sage-grouse use. Vegetation treatments in the sage-grouse analysis area have already occurred as part of the BLM's South Canyon Vegetation Enhancement Project and the Upper Kanab Creek Watershed Improvement Project. These projects have analyzed and approved 121,327 and 51,600 acres of vegetation for treatment within the sage-grouse analysis area, respectively, of vegetation for treatments to take place over the next 10–15 years within the sage-grouse analysis area. Mitigation-related vegetation treatments would be prioritized in these areas, especially in areas adjacent to habitat occupied by sage-grouse.

Under Alternative K1, approximately 1,012 acres (48.5% of the tract and 0.4% of the analysis area) of occupied habitat in the tract would be impacted through direct surface disturbance (see Table 4.18.4). *Occupied* habitat denotes habitat that may be used throughout the year, although not all habitat is used year-round. Habitat types that would be removed include breeding, brood rearing, and wintering. According to locally collected telemetry data (Frey et al. 2013), impacts from Alternative K1 would result in disturbance to 619.0 acres of breeding habitat (9.0% of available habitat and 29.6% of the tract), 810.3 acres of brood-rearing habitat (9.2% of available habitat and 38.8% of the tract), 718.6 acres of late season brood-rearing habitat (19.7% of available habitat and 34.4% of the tract), and 628.5 acres of wintering habitat (15.8% of available habitat and 30.1% of the tract). Note that these habitat types overlap and do not add to a comprehensive total. Alternative K1 would result in more direct adverse impacts to the Alton sage-grouse population and its habitat than would occur under the No Action Alternative. Over the long term, habitat restoration measures would result in improvements to the overall quantity and quality of habitats in some areas on the tract that are degraded prior to commencement of mining.

4.18.2.5 IMPACTS FROM COAL HAULING

There would be no additional loss of special status species habitat from the reasonably foreseeable coal haul transportation route. Coal transportation would occur on existing roads and would not necessitate road upgrades. Impacts to special status species are identical to those described for wildlife (Section 4.17.5) except for the information provided in following analysis, which focuses on direct and indirect impacts to special status species from increased rates of traffic.

4.18.2.5.1 Alternative A: No Action

Impacts to Greater Sage-Grouse resulting from coal hauling under the No Action Alternative would be identical to those described for all other special status species (Section 4.18.1.5.1).

4.18.2.5.2 Alternative B (Proposed Action), Alternative C (Reduced Tract Acreage and Seasonal Restrictions), and Alternative K1 (Reduced Tract Acreage)

Impacts to Greater Sage-Grouse from the Proposed Action, Alternative C, and Alternative K1 are identical to those described for wildlife (Section 4.17.5.2) and other special status species (Section 4.18.1.5.2) with the following exceptions.

Occupied Greater Sage-Grouse habitat occurs adjacent to 40.7 miles of the reasonably foreseeable coal haul transportation route, and is displayed in Table 4.18.5.

Table 4.18.5. Greater Sage-Grouse Habitat on the Reasonably Foreseeable Coal Haul Transportation Route

Habitat*	Linear Miles	Percentage of Route
Brood-rearing	37.9	33.0%
Wintering	2.8	2.3%

* Data from UDWR (2012).

Greater Sage-Grouse that occur along the reasonably foreseeable coal haul transportation route are most likely distinct from the group that occurs in the tract due to the isolated distribution of that population.

Adverse impacts to the Greater Sage-Grouse along the reasonably foreseeable coal haul transportation route could occur from an increase in collisions with truck and commuter traffic, increased noise, and increased predator activity along roadways due to roadkill. Greater traffic volume would increase the risk of mortality of sage-grouse adults and chicks from vehicles. Noise and vibration near active leks during the breeding season could disrupt courtship behavior or prevent hens from locating lekking areas. Sage-grouse have been found to avoid lekking and brooding habitats within 1,300 feet of roads and other surface disturbances, which could cause displacement and increased competition for habitat resources (Connelly et al. 2000; Crawford et al. 2004). Any increase in roadkill could increase raptor activity along the reasonably foreseeable coal haul transportation route, which could result in increased predation on sage-grouse occupying habitats adjacent to the route. Under the Proposed Action, Alternative C, and Alternative K1, traffic and noise-related adverse impacts to the Greater Sage-Grouse and its habitats along the reasonably foreseeable coal haul transportation route would likely be greater than would occur under the No Action Alternative.

4.18.3 Potential Mitigation Measures

4.18.3.1 SPECIAL STATUS SPECIES (EXCEPT GREATER SAGE GROUSE)

Protective measures for special status animal species described above and in Management and Considerations Common to Each Action Alternative in Chapter 2 would mitigate and/or minimize impacts to special status species in the tract. Potential mitigation measures for special status animal species include those listed below. BLM will incorporate selected mitigation measures into the ROD for this EIS. Additional wildlife-related mitigation measures are listed in section 4.17.6.

- Install fencing and/or netting or other protective features around evaporation and production pits to reduce mortality of wildlife and special status species (e.g., migratory birds, raptors, bats) due to drowning or entrapment.
- In cooperation with BLM and UDWR, translocate pygmy rabbit individuals that occur in the tract into appropriate habitat in areas not planned for disturbance.

4.18.3.2 GREATER SAGE-GROUSE

Design features that have been incorporated into the analysis and target impacts to Greater Sage-Grouse are described in detail in Section 4.18.2.1.2 and have been incorporated into the impacts analysis above. The following measures have not been incorporated into the analysis and may be incorporated by the BLM into the ROD.

- Limit the time standing water is left in ponds to less than 48 hours to prevent the potential for West Nile virus in the Greater Sage-Grouse population.
- Monitor and treat water storage impoundments to prevent mosquito breeding and the associated spread of West Nile virus to the Greater Sage-Grouse population.
- Develop an adaptive management plan based on results of Greater Sage-Grouse population monitoring that incorporates an assessment of whether habitat needs are being met by vegetation treatment, reclamation, and mitigation actions; “lessons learned” and recommendations for future avoidance; and minimization and mitigation strategies based on “lessons learned”.
- Employ noise-reducing measures (e.g., hospital grade mufflers and/or timing limitations on noisy activities) within 5 km of the lek during the breeding and nesting season (March 15–July 15).
- For Alternative K1 only, complete vegetation treatment (conifer removal) in Block Sa before mining begins. This potential mitigation measure is necessary because alternative K1 does not include Block S, and so the lease stipulation to complete pre-mining vegetation treatment in Block Sa would not apply if Alternative K1 is chosen. Pre-mining vegetation treatments are necessary to maintain compliance with the Washington Office IM 2012-043 (BLM 2011b).

4.18.4 Unavoidable Adverse Impacts

Unavoidable adverse impacts would occur where the loss of a special status species individual occurs during mining pit disturbance, soil stockpiling, road and infrastructure development, or regular mine operations. Unavoidable loss could occur where special status species individuals are not detected or identified during surveys. Unavoidable loss of special status species individuals due to nondetection or inadvertent adverse impacts would also occur. There would also be unavoidable, short-term loss of special status species habitats as a result of mining operations.

4.18.5 Short-term Uses versus Long-term Productivity

The short-term use of the tract for coal extraction would result in reduced structural and compositional diversity and reduced long-term productivity of special status species habitats. The habitats present in the tract are typically slow to recover from disturbance, and productivity would be limited during reclamation and restoration activities. Long-term productivity would be reduced because vegetation communities

would not develop immediately following mining and restoration activities. Until they are fully developed, these habitats would be less diverse and less productive, particularly if critical habitat components such as biological soil crusts and other soil properties have been lost. Effective implementation of the mitigation measures outlined above would minimize impacts to the long-term productivity of these vegetation communities and the special status species that rely on them.

4.18.6 Irreversible and Irretrievable Commitments of Resources

Under the Proposed Action, Alternative C, and Alternative K1, special status species forage and cover removed for surface mining would be irretrievably altered during the life of the mine. Once impacted by surface mining, dispersed and centralized facilities, roads, and ROWs, the productivity of vegetation communities would be irretrievably removed or reduced until reclamation and restoration have been completed. The loss of special status animal individuals from mining and associated activities and from coal truck strikes along the reasonably foreseeable coal haul transportation route would constitute an irreversible commitment of the resource because these individuals would be permanently lost.

4.19 Cumulative Impacts

Cumulative impacts are the environmental effects that result from the incremental impacts of an action, when added to other past, present, and RFFAs, regardless of who is responsible for such actions (40 CFR 1508.7). Past actions are those that have created the affected environment, as described in Chapter 3 of this SDEIS. Present actions are those that are occurring at the time of this evaluation. RFFAs are actions that are planned, funded, or reasonably foreseeable based on known opportunities or trends in the next 20 years. Cumulative impacts can result from individually minor, but collectively substantial actions occurring over time. This section analyzes the cumulative impacts to specific resource values and uses that would occur from implementation of the Proposed Action, Alternative C, and Alternative K1 when added to other past, present, and RFFAs that are not associated with this action.

In general, the geographic scope of this analysis—the CIAA—is the BLM-KFO, approximately 2.85 million acres of lands in Kane and Garfield counties, and the reasonably foreseeable coal haul transportation route (Map 4.6). This area was selected because the BLM recently completed the KFO RMP, a large-scale, land use planning effort that includes a cumulative impact assessment of this area. This analysis provides good baseline information for comparison with the effects of potential mining operations on the tract and coal haulage on the reasonably foreseeable coal haul transportation route. Overall, the CIAA provides a reasonable area for analysis of 1) the cumulative impacts of mining the tract and 2) other actions on the multiple resource values and uses of the CIAA. It does this because 1) there is a reasonable degree of data available to conduct the analysis, 2) it is large enough to account for resource impacts where impacts may be far-reaching (e.g., watersheds and wildlife), and 3) it is small enough that analyses do not become unreasonably cumbersome to complete with an acceptable degree of accuracy and precision. However, for certain resource values and uses, the CIAA may be slightly different than that described here. In these cases, the modified CIAA is described and explained. The timeframe for analysis of cumulative impacts is approximately 20 years.

The following list comprises land use planning and environmental documents that were consulted to determine the existing and RFFAs that are analyzed in this cumulative analysis:

- Coal Hollow Mine Permit C/025/005 (private fee coal area)
- KFO RMP (BLM 2008b)
- *Alton Road Relocation Environmental Assessment* (BLM 2008f)
- *Programmatic Environmental Impact Statement, Designation of Energy Corridors on Federal Land in the 11 Western States* (BLM and DOE 2008)

Although much of the cumulative impact analysis focuses on *adverse* cumulative impacts, cumulative impacts may also be beneficial. For example, beneficial economic impacts from coal mining would include additional employment, additional tax revenues to local governments, and additional royalties to the federal government. Further, vegetation treatments planned in the BLM-KFO create long-term beneficial impacts to sage-grouse and other sagebrush-obligate species in terms of habitat enhancement.

The BLM is also currently revising its land use plan amendment for Greater Sage-Grouse management. The purpose of this plan amendment is to provide the BLM with regulatory mechanisms to avoid the continued decline in sage-grouse populations that are anticipated across the species' range. It is likely that the results of this revision will have a restrictive effect on surface-disturbing actions affecting sage-grouse habitat. Such restrictions would also likely limit surface-disturbing impacts on other natural resources where these resources overlap sage-grouse habitat. This would have a countervailing effect to the potential adverse effects that the Proposed Action and alternatives would have on these natural resources in the CIAA. Because the BLM has not made a final decision on the land use plan amendment, the specific impacts resulting from the plan amendment are not yet known and are not incorporated into this cumulative impacts analysis in detail. However, in October 2013, the BLM published its draft land use plan amendment and EIS for the Utah Greater Sage-Grouse (BLM 2013c). That document contains a cumulative impact assessment related to all the land use plan amendment alternatives analyzed.

Section 4.19.1 identifies and summarizes the RFFAs included in this cumulative impact analysis. Past and present actions have generally been described in the affected environment and are summarized in this cumulative impacts analysis under each resource heading.

4.19.1 Reasonably Foreseeable Actions and Development

This section incorporates ongoing, proposed, and potential projects in Kane and Garfield counties in the CIAA. For the purposes of analysis, the RFFAs come from the proposed actions and records of decision from the land use planning and environmental documents identified in the list above. These RFFAs are not to be considered part of the Proposed Action, Alternative C, or Alternative K1. Table 4.19.1 summarizes the RFFAs and anticipated acres of disturbance. Tables 4.19.2 and 4.19.3 summarize the surface disturbance and subsidence disturbance from the Proposed Action and alternatives for mining the tract. The discussion that follows provides further explanation of the information in the tables.

Table 4.19.1. Reasonably Foreseeable Actions and Development in the Cumulative Impact Assessment Area, Next 20 Years

Action	Anticipated Disturbance (acres)	Total Anticipated Disturbance (%)
Wildfire	3,476	4.6%
Wildfire use	390	0.5%
Prescribed fire	800	1.1%
Vegetation treatments	60,000	78.9%
Alton Coal Mine, northern private coal area (permit application not submitted)	378	0.5%
Coalbed CH_4 exploration	0	0%
Oil and gas exploration, development, and production	2,070	2.7%
Seismic exploration	906	1.2%
Mining alabaster and septarian nodules	20	0.03%
Sand and gravel production	625	0.8%
Building stone production	400	0.5%
Clay production	5	0.01%
Cross-country OHV travel	1,000	1.3%
Lake Powell pipeline	5,745	7.6%
Future West-wide Energy Corridor development	0	0.0%
Wind energy development	0	0.0%
SITLA Exploration Agreement and Option to Lease	1,255	0.0%*
Total	**75,815**	**100.0%**†

* The acreage affected by the SITLA Exploration Agreement and Option to Lease would result from the potential subsidence caused by underground mining. Thus, it would not be direct surface disturbance and is not included in the total RFFA surface disturbance.

† The total surface disturbance is less than 100% because surface disturbance resulting from the West-wide Energy Corridor, wind energy development, and coalbed CH_4 exploration is not known at this time.

Table 4.19.2. Additional Surface Disturbance from Mining the Alton Coal Tract

	Additional Surface Disturbance (acres) from Mining Operations on the Alton Coal Tract	Increase in Surface Disturbance in the CIAA over the next 20 years from Mining Operations on the Alton Coal Tract (%)
Proposed Action	1,993	2.6%
Alternative C	1,662	2.2%
Alternative K1	1,012	1.3%

Table 4.19.3. Additional Subsidence Disturbance from Mining the Alton Coal Tract

	Additional Subsidence Disturbance (acres) from Mining Operations on the Alton Coal Tract	Increase in Subsidence Disturbance in the CIAA over the next 20 years from Mining Operations on the Alton Coal Tract (%)
Proposed Action, Alternative C, and Alternative K1	779	62.1%

RFFAs in the CIAA would impact 75,815 surface acres. Under the Proposed Action, the tract would directly impact 1,993 acres, which is a 2.6% increase in the total surface disturbance in the CIAA over the next 20 years. Alternative C would directly impact 1,662 acres, which is a 2.2% increase in the total disturbance in the CIAA over the next 20 years. Alternative K1 would directly impact 1,012 acres, which is a 1.3% increase in the total disturbance in the CIAA over the next 20 years.

4.19.1.1 MINERALS AND ENERGY EXPLORATION, DEVELOPMENT, AND PRODUCTION

4.19.1.1.1 Exploration, Development, and Production of Coal

In November 2010, the State of Utah approved a permit for the Coal Hollow Mine (Permit #C/025/005) on approximately 424 acres of private lands. The tract is currently being developed by surface mining methods. ACD is also pursuing development of an additional coal mine on 378 acres. This area is referred to as the "northern private coal area" in Table 4.19.1 and generally referred to on maps as the "potential fee coal mine". The permitting process for the northern private coal area is currently ongoing. These two private areas are adjacent to federally administered coal that BLM is considering for competitive leasing in this SDEIS.

Furthermore, pursuant to an Exploration Agreement and Option to Lease between ACD and SITLA, exploration and possible underground coal mining operations on state-owned coal (in Section 36, Township 39 South, Range 5 West and Section 2, Township 40 South, Range 5 West, Kane County, Utah) are RFFAs (SITLA 2013). The exploration and underground mining covers a maximum acreage of approximately 1,255 acres. Thus, there would be a potential for a maximum of approximately 1,255 acres of subsidence effects in this area of Kane County. Subsidence is the gradual lowering of the land surface as coal is removed underground. The level of subsidence generally depends on the thickness of the coal extracted and the thickness of the overburden, as well as other geological factors. Subsidence has the potential to affect resources such as topography, geology, visual resources, and water resources if any are present in the area of potential subsidence. At this time, there are not enough details known about these potential mining activities to estimate the level of subsidence that would result.

Coalbeds that have not been mined or are too deep and/or thin for surface or underground mining often have recoverable coalbed CH_4. To extract coalbed CH_4, water permeating the coalbed is drawn off first, allowing CH_4 to flow out of the coalbed and into a well bore. Although there are no existing permits for coalbed CH_4 extraction in the CIAA, there is the potential for a concentration of coalbed CH_4, but not anticipated at the depths planned for this lease tract.

4.19.1.1.2 Exploration, Development, and Production of Oil and Gas and Other Leasable Minerals, Salable Minerals, and Mining under the Mining Laws

In all, 90 oil and gas wells (70 exploration wells and 20 production wells) could be drilled on public lands managed by the BLM-KFO over the next 15–20 years. This exploration, development, and production could disturb 2,070 acres, and seismic operations could disturb an additional 906 acres. Of this total disturbance, 2,370 acres could be reclaimed.

Septarian and gypsum (alabaster) mining could disturb 1 acre per year, or 20 acres over the next 15–20 years.

Surface disturbance from salable mineral production (sand, gravel, building stone, and clay) could be 1,030 acres over the next 15–20 years. Of that total, sand and gravel operations could disturb 625 acres, building stone operations could disturb 400 acres, and clay production could disturb 5 acres.

4.19.1.2 UTILITY CORRIDORS AND TRANSMISSION LINES

4.19.1.2.1 West-wide Energy Corridor

The *Programmatic Environmental Impact Statement, Designation of Energy Corridors on Federal Land in the 11 Western States* analyzes the environmental impacts of designating more than 6,000 miles of energy corridors on federal land in 11 western states (BLM and DOE 2008). One corridor has been designated by the KFO RMP in the CIAA. Future development within the designated energy corridor can be expected.

4.19.1.3 WATER PROJECTS

4.19.1.3.1 Lake Powell Pipeline

The State of Utah Board of Water Resources and Washington, Kane, and Iron counties are pursuing the construction of a pipeline that would run from Lake Powell to Sand Hollow Reservoir, approximately 10 miles east of St. George. The pipeline would consist of approximately 120 miles of 66-inch pipe and 38 miles of 30-inch pipe north from Sand Hollow to Cedar City. The corridor is anticipated to be 300 feet wide. As part of the initial feasibility studies, various alternative alignments are being investigated. The pipeline would bring 70,000 acre-feet of water to Washington County, 10,000 acre-feet to Kane County, and 20,000 acre-feet to Iron County. Construction of the pipeline is estimated to take three years.

4.19.1.4 ROAD PROJECTS

4.19.1.4.1 U.S. Highway 89

US-89 is expected to be widened over the next 20 years. The widening of the highway would allow for an increase in traffic volume. In addition, portions of the highway would be developed into a four-lane divided highway.

4.19.1.5 VEGETATION TREATMENTS

Historically, the BLM has treated on average 3,000 acres of upland vegetation annually. Using this average, it is estimated that the BLM would treat 60,000 acres over the next 20 years (Church 2010). These treatments are to enhance wildlife habitat, restore watershed condition, increase livestock forage, and reduce fuel loading. A full range of upland vegetation treatment methods would be used, including wild and prescribed fire; mechanical, chemical, and biological treatments; and woodland product removal. There are currently two approved burn plans in the KFO totaling 800 acres (BLM 2001b, 2002). According to the KFO RMP, wildfire use disturbance over the next 20 years would total 390 acres (BLM 2008b).

4.19.1.6 WILDFIRE

A five-year average for wildfires in the KFO totals approximately 869 acres (Church 2010). Using these past numbers, it is estimated that wildfires would disturb 3,476 acres over the next 20 years.

4.19.1.7 LAND USE PLANNING AND DEVELOPMENT

As communities in the CIAA continue to grow, agricultural lands are expected to be converted to residential and commercial uses. There is no specific projection as to the number of acres per year that would be converted, but for analysis purposes, growth (and thus, conversion of agricultural land) is expected to continue at a steady pace. Under the KFO RMP, BLM has identified 6,000 acres potentially available for sale over the next 20 years. If disposed of, these lands would provide for the needs of the communities in the field office area. Assuming these lands would be developed for public purposes, 320 acres per year would convert to community purposes.

4.19.2 Cumulative Impacts Related to the Proposed Action and Alternatives

4.19.2.1 AESTHETIC RESOURCES

4.19.2.1.1 Cumulative Impact Analysis Area

The geographic extent of the CIAA for aesthetic resources consists of the BLM-KFO and the coal haul transportation route to the loadout west of Cedar City, Utah. It includes sensitive viewpoints and soundscapes in Bryce Canyon National Park to the east, Dixie National Forest to the east and west, and the communities along the coal haul transportation route (Map 4.7). The area was selected to incorporate lands where aesthetic resources would be affected regardless of administrative jurisdiction. The area is primarily used for agriculture, travel, tourism, and recreational activities.

4.19.2.1.2 Soundscape

Past and present actions that have resulted in ambient and existing noise levels in the characteristic soundscapes of the CIAA (as described in Section 4.19.2.1.1 above) include vehicle traffic on the coal haul transportation route, motorized recreation, mineral material mining, mechanical vegetation treatments, and wild and prescribed fire operations. Measured ambient and existing noise levels at specific locations in the CIAA are described in Section 3.2.1.4.

Future actions include the expansion of US-89; the realignment of KFO Route 116; construction of the Tropic to Hatch transmission line; coal mining near the Town of Alton (private coal); oil and gas exploration, development, and production; continued sand and gravel, building stone, and clay mining; additional vegetation treatments; continued wild and prescribed fire operations; construction of the Lake Powell pipeline; continued growth in OHV use and backcountry driving; and construction of facilities

within a utility corridor as part of the West-wide Energy Corridor grid. The level of disturbance associated with these actions can be described in terms of acres, a proxy to describe areas where noise would be generated. All of the projected actions combined could disturb approximately 75,815 acres of lands. That said, RFFAs would only result in cumulative impacts if they were to occur at the same time (temporally) and/or in the same place (spatially). This analysis is conservative because it assumes that the RFFAs overlap with one and other and with mining on the tract.

Mining operations on the Alton Coal Tract under the Proposed Action would disturb approximately 1,993 acres, a 2.6% increase in the entire disturbance associated with the RFFA. Under Alternative C, mining operations on the Alton Coal Tract would disturb approximately 1,662 acres, or a 2.2% increase in the entire disturbance associated with the RFFA. Under Alternative K1, mining operations on the Alton Coal Tract would disturb approximately 1,012 acres, or a 1.3% increase in the entire disturbance associated with the RFFA. Using the amount of surface disturbance as an indication of noise levels associated with this activity, coal mining on the tract would contribute less than 3% of future anticipated surface disturbance, and thus ambient noise to soundscapes. Individuals in Alton would experience noise levels above ambient (traffic, conversations, appliances, electronics, pets, and airplanes flying overhead) and above regulatory thresholds for human annoyance by blasting noise and vibration as described in Table 4.2.4. Mitigation measures could be implemented with the Proposed Action, Alternative C, or Alternative K1 to reduce the impacts of increased noise levels on noise-sensitive receptors. Additionally, noise from the Proposed Action, Alternative C, or Alternative K1 would occur only for the duration of active mining.

Blasting as a result of mine activities would be heard and felt at sensitive noise receptors as described in Section 4.2.2.2.2. Cumulative vibration levels could be felt in the town of Alton if blasting on the tract occurs simultaneously with blasting on the Coal Hollow Mine or the northern private fee coal area. However, it is unlikely that blasting on two different mines would occur at the exact same time, and operators could be required to communicate with one another in advance of planned blasting events to prevent such an occurrence. Blasting impacts would contribute to cumulative vibration impacts in the town of Alton. **C**umulative impacts to structures that could be damaged by blasting vibration could occur over time from subsequent blasting events, both on the tract and from the RFFAs on the Coal Hollow Mine or the northern private fee coal area.

As discussed in Appendix H and Section 4.14.3, traffic volume increases on SR-89 through Hatch and Panguitch are expected to increase by 2020. Mine-related transport activities are expected to account for approximately 4% of the total increased traffic volume on SR-89 in the year 2020. Because the modeled values for noise impacts to Hatch and Panguitch are within the currently measured baseline values, any future increase in roadway noise above currently measured background levels is expected to be from traffic increases unrelated to mine activities.

4.19.2.1.3 Visual Resources

The CIAA for visual resources consists of the BLM-KFO, including the viewshed surrounding the tract as well as portions of the Dixie National Forest and private lands. Past and present actions have contributed to modifications to the characteristic landscape in the CIAA, including mechanical vegetation treatments, transmission lines, and other linear ROWs. The characteristic landscape is described in Section 3.2.

RFFAs that would contribute to cumulative impacts to the landscape (visual resources) consist of cross-country OHV travel, additional vegetation treatments, coal mining private coal near the town of Alton, oil and gas exploration and production, mining, sand and gravel and building stone production, and development of pipelines and power lines (see Table 4.18.1). Over the next 20 years, reasonably foreseeable future development would change the character of the existing landscape. Reasonable foreseeable actions could remove vegetation by fire and land treatment methods, change landform by surface disturbance during mining and road building, and introduce linear structures, such as power lines and pipelines, to the landscape. These developments would introduce moderate to noticeable changes to the characteristics landscape (visual resources) on as much as 75,815 acres.

The incremental impacts of mining coal on the Alton Coal Tract under the Proposed Action, Alternative C, or Alternative K1 would add moderate to strong contrasts to the characteristic landscape on up to 1,993, 1,662, or 1,012 acres, respectively. These impacts would be spread out over the active mining period and would result in cumulative impacts to the viewshed. Over the next 20 years, coal mining on the Alton Coal Tract would increase disturbance by approximately 2.6% under the Proposed Action, 2.2% under Alternative C, and 1.3% under Alternative K1 in the CIAA. Mitigation measures would be implemented to return the tract to a more natural landscape as pit activities are completed. The analysis assumes that mitigation measures for visual resources would be implemented with reasonably foreseeable future projects to reduce contrasts. Cumulatively, contrasts would remain consistent with applicable BLM VRM Class objectives in the CIAA.

Pursuant to an Exploration Agreement and Option to Lease between ACD and SITLA, exploration and possible underground coal mining operations in Kane County could result in a maximum of approximately 1,255 acres of subsidence impacts. The level of subsidence generally depends on the thickness of the coal extracted and the thickness of the overburden, as well as other geological factors. Subsidence could impact the topography of the area mined, creating visual impacts. At this time, there are not enough details known about these potential mining activities to estimate the level of subsidence that would result. The visual impact from subsidence would generally be small when compared to the surface disturbance caused by surface mining, but would add incrementally to the cumulative disturbance to visual resources from other mining activities in the CIAA.

4.19.2.1.4 Night Sky

The CIAA consists of the lands surrounding the tract, including portions of Bryce Canyon National Park, Dixie National Forest, and private lands. Because of the nature of artificial light, the area of analysis must be larger than the tract's viewshed. Past and present actions in the area of analysis that have contributed to the existing night sky conditions include the development of towns and cities in the region, management of Bryce Canyon National Park, residential development, and tourism facilities. Future actions include expansion of US-89 and population growth in existing towns and cities in the region. Future construction-related actions would increase the amount of light seen during construction, but these impacts would be temporary (limited to the construction timeframe). However, increased uplight lumens over time from projected population growth in the region from 2010 to 2040 are shown in Table 4.19.4.

Table 4.19.4. Light Source Locations and Output with Projected Population Growth

Town/City	2010 Population	Total Estimated Lumens 2010	2040 Projected Population	Total Projected Lumens 2040
Alton	119	297,500	210	526,147
Brian Head	83	207,500	157	391,518
Cedar City	28,857	72,142,500	54,448	136,121,050
Fredonia	1,314	3,285,000	1,403	3,507,500
Glendale	381	952,500	674	1,684,555
Kanab	4,312	10,780,000	7,626	19,065,092
Orderville	577	1,442,500	1,020	2,551,150
Page	7,247	18,117,500	8,303	20,757,500
Panguitch	1,520	3,800,000	2,162	5,405,375

Table 4.19.4. Light Source Locations and Output with Projected Population Growth

Town/City	2010 Population	Total Estimated Lumens 2010	2040 Projected Population	Total Projected Lumens 2040
St. George	72,897	182,242,500	196,206	490,514,236
Tropic	530	1,325,000	754	1,884,769
Total	**117,837**	**294,592,500**	**272,964**	**682,408,892**

Source: U.S. Census Bureau (2013k); UGOPB (2013).

Table 4.19.4 shows that as population increases in the 11-town region over the next 30 years, total lumens output (at an estimated 2,500 lumens per capita) would increase approximately 132% from 295 million lumens in 2010 to 682 million lumens in 2040.

The 2,500 lumens-per-capita assumption does not account for uplight because only a small fraction of lumens output from human settlements gets reflected upward into the atmosphere (see Figure 4.2.6). Therefore, uplight is accounted for by two potential future scenarios: 1) a 10% uplight fraction, and 2) a 5% uplight fraction (see Appendix J). The 5% uplight fraction scenario represents an optimistic scenario where lighting ordinances, conservation, technological improvements, or a combination thereof decrease the uplight fraction of human settlements in 2040 by half (from 10% uplight to 5% uplight).

Assuming an uplight fraction of 10%, approximately 29 million uplight lumens in 2010 would grow, as the population grows, to an estimated 68 million uplight lumens in 2040. Assuming a reduced uplight fraction of 5%, the predicted uplight lumens for 2040 would be reduced to 34 million lumens. Future mine lighting scenarios also vary depending on how many portable and mobile light sources are analyzed (see Section 4.2.4.2.1), and are presented as three possible future uplight scenarios. Under Scenario 1, the mine is expected to produce 241,900 annual uplight lumens, 869,160 annual uplight lumens under Scenario 2, and 1,628,160 annual uplight lumens under Scenario 3.

Accounting for future population increases, two potential future uplight fraction scenarios, and three potential mine lighting scenarios, Table 4.19.5 shows the relative contribution to uplight lumens of the mine over time. The relative contribution to uplight lumens is calculated by dividing the expected lumens uplight output for each mine scenario by the expected lumens uplight output for current and future uplight lumens estimates (a 10% uplight fraction in 2010 results in an output of 29 million uplight lumens, a 10% uplight fraction in 2040 results in an output of 68 million uplight lumens, and a 5% uplight fraction in 2040 results in an output of 34 million uplight lumens).

Table 4.19.5. Current and 2040 Cumulative Contribution to Uplight Lumens at 5% and 10% Uplight Fractions for Mine Lighting Scenarios 1–3

Scenario	Net Uplight Lumens Output	Contribution to Uplight Lumens (at 2010 population levels) Assuming a 10% Uplight Fraction	Cumulative Contribution to Uplight Lumens in 2040 Assuming a 10% Uplight Fraction	Cumulative Contribution to Uplight Lumens in 2040 Assuming a 5% Uplight Fraction
1	241,900	0.8%	0.4%	0.7%
2	869,160	3.0%	1.3%	2.5%
3	1,628,160	5.5%	2.4%	4.8%

As shown in Table 4.19.5, at current population levels and a 10% uplight fraction, the mine would be estimated to contribute between 0.8% and 5.5% to overall uplight lumens in the region. Assuming a 10% uplight fraction in 2040, the mine's estimated contribution to overall uplight lumens would be between 0.4%

(mine lighting Scenario 1) and 2.4% (mine lighting Scenario 3). Lastly, assuming a 5% uplight fraction in 2040, the mine's estimated contribution to overall uplight lumens would be between 0.7% (mine lighting Scenario 1) and 4.8% (mine lighting Scenario 3).

Table 4.19.4 shows that the mine's relative contribution to uplight lumens over time decreases under both future uplight fraction assumptions. Assuming a 10% uplight fraction, the mine's relative contribution to uplight lumens by 2040 would decrease by between 0.4% (from 0.8% to 0.4% contribution) and 3.1% (from 5.5% to 2.4% contribution) as compared to current estimated levels. Assuming a 5% uplight fraction, the optimistic scenario, the mine's relative contribution to uplight lumens is expected to decrease in 2040 by between 0.1% (from 0.8% to 0.7%) and 0.7% (from 5.5% to 4.8%) in 2040, also resulting in a decreased cumulative impact to uplight lumens over time. These calculations demonstrate that an increase in population over time in the region results in a decreased cumulative impact to uplight lumens over time from the mine, regardless of uplight scenario or mine lighting scenario.

4.19.2.2 AIR RESOURCES

The CIAA for air resources is the 300 × 300–km area depicted in Map 3.5. The tract and the reasonably foreseeable coal haul transportation route are in this area with the tract in the approximate center.

4.19.2.2.1 Cumulative Emission Inventory

The cumulative emission inventory is composed of 1) an inventory of emissions from the reasonably foreseeable coal haul transportation route, and 2) an inventory of emission sources within a 300 × 300–km area. The cumulative inventory includes the identification and evaluation of permitted source changes (increases or decreases), RFFAs, and RFDs.

It was assumed that all existing permitted emission sources are included in the background concentrations estimates. The cumulative emission inventory was developed based on any Title V major modifications and new minor- or major-source permits that occurred after September 1, 2008. The data were obtained from the state air resources regulators (e.g., Utah, Nevada, and Arizona) in the emission inventory domain. RFFA and RFD sources are proposed sources and include new sources expected from BLM- and USFS-related activities, such as oil and gas development and mining. Oil and gas commissions in the various states and other state agencies also provided information on planned, new emission-producing sources. Because of the uncertainty in projected traffic increases on the existing road network, only mine-related transportation increases are considered in the analysis. RFFA and RFD sources evaluated in the modeling domain are listed in Table 4.19.6, and the projected emissions from these RFFA and RFD sources are presented in Table 4.19.7.

Table 4.19.6. Sources of Potential Reasonable Foreseeable Future Actions and Reasonable Foreseeable Developments in the Modeling Domain

NEPA Documents, Land Use Plans, and Personnel	Disposition
Oil and Gas Leasing on Lands Administered by the Dixie National Forest Draft EIS	Dixie and Fishlake national forests oil field development are included as point sources in cumulative modeling (20-well oil field development in Dixie National Forest; directional drilling from 3 well pads in Fishlake National Forest).
BLM-KFO RMP	90 new production wells over 20 years (4.5 wells per year); no production or drilling of coalbed CH_4 wells; no oil wells
BLM-KFO Mineral Potential Report	Uses highest projected pollutant emissions for oil and gas and area sources
	Includes lands and realty, livestock grazing, OHVs, resource roads, saleable minerals, and vegetation

Table 4.19.6. Sources of Potential Reasonable Foreseeable Future Actions and Reasonable Foreseeable Developments in the Modeling Domain

NEPA Documents, Land Use Plans, and Personnel	Disposition
	Eliminates coal mining (projected mine is the Alton Coal Tract)
	Eliminates prescribed burning as a cumulative source because it is intermittent and regulated such that it occurs during favorable weather conditions
BLM Richfield Field Office RMP	Oil well and non-oil well activities: 30 wells per year
	Uses highest projected pollutant emissions for oil and gas and area sources
	Included lands and realty, livestock grazing, OHVs, resource roads, saleable minerals, and vegetation
	Eliminates coal mining (outside domain)
BLM Cedar City Field Office	No sources to add
BLM St. George Field Office	No sources to add
BLM Ely Field Office	No sources to add
BLM Las Vegas Field Office	No sources to add
BLM Arizona Strip Field Office	No sources to add
UDAQ: Permit Actions	Two new gas turbines at St. George City Power
Arizona Department of Environmental Quality: Permit Actions	EPA PSD permit: Modification to Navajo generating station
Nevada Department of Environmental Quality: Permit Actions	No sources to add
UDOT	No sources to add

Table 4.19.7. Emissions (TPY) from Potential Reasonable Foreseeable Future Actions and Reasonable Foreseeable Developments in the Modeling Domain

	PM_{10}	$PM_{2.5}$	NO_x	SO_2	CO	VOCs	HAPs
Dixie National Forest	84.0	36.8	529.8	28.6	–	–	–
Fishlake National Forest	30.9	21.1	364.9	17.7	–	–	–
BLM-KFO RMP	15	10	10	0	692	258	26
BLM Richfield Field Office RMP	58.0	18.0	230.5	3.8	558.0	177.1	17.7
UDEQ: St George City Power	–	–	33.3	–	34.4	–	–
Arizona DEQ: Navajo generating station modifications*	–	–	-22,386	–	36,570	–	–
Total RFFA and RFD	**188**	**85**	**-21,217**	**50**	**37,855**	**435**	**44**

* Planned modifications at the Navajo generating station result in a net decrease of total RFFA and RFD NO_x emissions.

Table 4.19.7 shows reasonably foreseeable changes in emissions (increases or decreases) from the RFFA and RFD sources in the modeling domain from September 1, 2008 onward. The decrease in NO_x emissions from the Navajo generating station (22,386 TPY) was described in the PSD permit (AZ-08-01) issued to the facility on November 20, 2008 (EPA 2008). The permit indicated that voluntary emission reduction projects were to be implemented at the Navajo generating station by retrofitting three boilers with low-NO_x burners and separated over-fire air systems. The emission reduction projects were to be completed by the end of 2011.

4.19.2.2.2 Cumulative Impacts Results

An ambient, air resources impact assessment was performed to quantify cumulative impacts near the tract and in the far-field modeling domain. To demonstrate that air quality standards and AQRV are protected, the RFFA and RFD sources were modeled in conjunction with the tract sources. The KFO RMP sources are in the near-field modeling domain; the remaining RFFA and RFD sources are in the far-field modeling domain.

4.19.2.2.3 Cumulative National Ambient Air Quality Standards and Hazardous Air Pollutants Results

The modeling results indicate that there is minimal interaction between the RFFA/RFD sources and the receptors exhibiting the highest concentrations in the tract-only analysis. Therefore, the results and conclusions drawn for the PM_{10}, $PM_{2.5}$, NO_2, CO, SO_2, and HAPs are as presented in Table 4.3.4, Tables 4.3.7 through 4.6.10, and Tables 4.3.12 and 4.3.13 in Section 4.3.3.

4.19.2.2.4 Class I and Class II Increments Results

Under federal and state PSD regulations, increases in ambient air concentrations in Class I areas are limited by PSD Class I increments. Specifically, emissions associated with a particular development may increase ambient concentrations above baseline levels only within those specific increments developed for SO_2, PM_{10}, and NO_2. The modeling results for the maximum cumulative scenarios are presented in Table 4.19.8 for the near-field Class I and II areas and Table 4.19.9 for the far-field Class I and II areas. The modeling included the Alton sources and all regional background sources. Negative values indicate a net improvement due to cumulative sources showing a net reduction in emissions. The analysis did not follow the methodology for a regulatory PSD increment analysis, and the increment comparison is included to disclose maximum cumulative scenario impacts.

Table 4.19.8. Cumulative Near-field Class I (Bryce Canyon National Park) and Class II (Grand Staircase-Escalante National Monument) Results, Alternative C, 200-foot Overburden Removal

Pollutant	Averaging Period	Class I Analysis Results		Class II Analysis Results	
		Cumulative Concentration ($\mu g/m^3$)	Class I Increment ($\mu g/m^3$)	Cumulative Concentration ($\mu g/m^3$)	Class II Increment ($\mu g/m^3$)
PM_{10}	Annual	0.01	4	0.33	17
	24-hour	0.30	8	2.39	30
SO_2	Annual	0.01	2	0.00	20
	24-hour	0.01	5	0.03	91
	3-hour	0.06	25	0.20	512
NO_x	Annual	0.04	2.5	1.73	25
$PM_{2.5}$	Annual	0.00	n/a	0.08	n/a
	24-hour	0.07	n/a	0.93	n/a
CO	8-hour	31	500*	92	500*
	1-hour	91	2,000*	541	2,000*

* CO modeling significance level.

Table 4.19.9. Cumulative Far-field Class I (Zion, Grand Canyon, and Capitol Reef National Parks) and Class II (Grand Staircase-Escalante National Monument) Results, Alternative C, 200-foot Overburden Removal

Pollutant	Averaging Period	Class I Analysis Results		Class II Analysis Results	
		Cumulative Concentration ($\mu g/m^3$)	Class I Increment ($\mu g/m^3$)	Cumulative Concentration ($\mu g/m^3$)	Class II Increment ($\mu g/m^3$)
PM_{10}	Annual	0.14	4	0.03	17
	24-hour	1.06	8	0.24	30
SO_2	Annual	0.00	2	0.00	20
	24-hour	0.02	5	0.01	91
	3-hour	0.06	25	0.07	512
NO_x	Annual	0.01	2.5	-0.01	25
$PM_{2.5}$	Annual	0.01	n/a	0.00	n/a
	24-hour	0.04	n/a	0.02	n/a
CO	8-hour	25	500*	52	500*
	1-hour	108	2,000*	118	2,000*

* CO modeling significance level.

Because modeling shows values far below the relevant increments, results are only presented for the cumulative sources with the tract maximum emission rate case (200-foot overburden removal, Alternative C). Impacts from the other alternatives would be less than presented here. The impacts are significantly below both the Class I and Class II increments. Even though there are no increments for $PM_{2.5}$ or CO, results are presented in Tables 4.19.8 and 4.19.9 to convey a general impression of impact levels.

4.19.2.2.5 Visibility

Cumulative visibility results for the Proposed Action are presented in Tables 4.19.10 (Method 6) and 4.19.11 (Method 8). Using Method 6, Bryce Canyon and Capitol Reef national parks have visibility extinction changes that surpass 10%, with maximums of 10.9% and 10.5%, respectively. These impacts are due to one of the regional sources (i.e., Dixie Oil Field Development), because the tract-alone impacts at Capitol Reef National Park are small (maximum change of 1.3%). With Method 6, Bryce Canyon and Capitol Reef national parks had one day with impacts greater than 10%. Four of the five parks and monuments have visibility extinction changes that surpass 5%, with a maximum of seven days exceeding 5% (at Bryce Canyon National Park). The cumulative visibility results for Method 8 show all parks and monuments with percentage changes below 5%, with the exception of 5.2% in 2002 at Zion National Park.

The tract-alone visibility modeling for the Proposed Action was performed with VISCREEN. It is likely that the cumulative impacts at Bryce Canyon National Park are attributable to Alton emissions. Based on the results presented in Table 4.3.17, the cumulative impacts at Zion National Park and Grand Canyon National Park are attributable to Alton emissions. At Grand Staircase–Escalante National Monument, approximately 48% of the cumulative impact is attributable to Alton emissions. The remaining portion is attributable to other regional sources.

Table 4.19.10. Cumulative Visibility Results, Alton Coal Tract, Proposed Action, 200-foot Overburden Removal (with EC and HNO_3/NO_3 partitioning)

Method 6*	**Proposed Action, 200-foot Overburden**		
Class I/Class II Area	**No. of Days > 5%†**	**No. of Days > 10%†**	**Max. Change (%)**
Bryce Canyon National Park	7 (in 2002)	1 (in 2002)	10.9 (in 2002)
Capitol Reef National Park	4 (in 2003)	1 (in 2001)	10.5 (in 2001)
Grand Canyon National Park	0	0	3.1 (in 2001)
Zion National Park	3 (in 2002)	0	5.9 (in 2002)
Grand Staircase-Escalante National Monument	2 (in 2002, 2003)	0	5.8 (in 2003)

* Method 2 results can be found in the *Supplement to Air Resources Impact Assessment Technical Report for the Alton Coal Lease by Application* in Appendix K. Method 6 results are shown here because they indicate the overall highest impact. One individual max. change % for Method 2 is higher at Bryce Canyon National Park and at Capitol Reef National Park.

† No. of Days > 5% is approximately equivalent to a change of 0.5 deciview and No. of Days > 10% is approximately equivalent to a change of 1.0 deciview.

Table 4.19.11. Cumulative Visibility Results, Alton Coal Tract, Proposed Action, 200-foot Overburden Removal (with EC and HNO_3/NO_3 partitioning)

Method 8	**Proposed Action, 200-foot Overburden**		
Class I/Class II Area	**2001 Change (%) 8th-high**	**2002 Change (%) 8th-high**	**2003 Change (%) 8th-high**
Bryce Canyon National Park	2.89	5.21	3.50
Capitol Reef National Park	2.80	4.18	4.44
Grand Canyon National Park	1.02	1.26	1.10
Zion National Park	3.18	3.94	3.02
Grand Staircase-Escalante National Monument	2.48	3.41	3.45

Cumulative visibility results for Alternative C are presented in Tables 4.19.12 (Method 6) and 4.19.13 (Method 8). Using Method 6, Capitol Reef National Park impacts exceed the 10% change threshold on one day (maximum of 10.5%). These impacts are due to one of the regional sources (i.e., Dixie Oil Field Development), because the tract-alone impacts at Capitol Reef were small (maximum change of 1.3%). Bryce Canyon National Park also has impacts that exceed the 10% threshold on one day (maximum of 11.1%). Four of the five parks and monuments have visibility extinction changes that surpass 5%, with a maximum of eight days exceeding 5% (at Bryce Canyon National Park). The cumulative visibility results for Method 8 show all parks and monuments with percentage changes below 5%, with the exception of 5.5% in 2002 at Zion National Park.

The tract-alone visibility modeling for Alternative C was performed with VISCREEN. It is likely that the cumulative impacts at Bryce Canyon National Park are attributable to Alton emissions. Based on the results presented in Table 4.3.19, the cumulative impacts at Zion National Park and Grand Canyon National Park are attributable to Alton emissions. At Grand Staircase–Escalante National Monument, approximately 48% of the cumulative impact is attributable to Alton emissions. The remaining portion is attributable to other regional sources.

Table 4.19.12. Cumulative Visibility Results, Alton Coal Tract, Alternative C, 200-foot Overburden Removal (with EC and HNO_3/NO_3 partitioning)

Method 6*	**Alternative C, 200-foot Overburden**		
Class I/Class II Area	**No. of Days > 5%†**	**No. of Days > 10%†**	**Max. Change (%)**
Bryce Canyon National Park	8 (in 2002)	1 (in 2002)	11.1 (in 2002)
Capitol Reef National Park	4 (in 2003)	1 (in 2001)	10.5 (in 2001)
Grand Canyon National Park	0	0	3.1 (in 2001)
Zion National Park	3 (in 2002)	0	5.9 (in 2002)
Grand Staircase-Escalante National Monument	2 (in 2002, 2003)	0	5.8 (in 2003)

* Method 2 results can be found in the *Supplement to Air Resources Impact Assessment Technical Report for the Alton Coal Lease by Application* in Appendix K. Method 6 results are shown here because they indicate the overall highest impact. One individual max. change % for Method 2 is higher at Bryce Canyon National Park and at Capitol Reef National Park.

† No. of Days > 5% is approximately equivalent to a change of 0.5 deciview and No. of Days > 10% is approximately equivalent to a change of 1.0 deciview.

Table 4.19.13. Cumulative Visibility Results, Alton Coal Tract, Alternative C, 200-foot Overburden Removal (with EC and HNO_3/NO_3 partitioning)

Method 8	**Proposed Action, 200-foot Overburden**		
Class I/Class II Area	**2001 Change (%) 8th-high**	**2002 Change (%) 8th-high**	**2003 Change (%) 8th-high**
Bryce Canyon National Park	3.00	5.47	3.64
Capitol Reef National Park	2.80	4.20	4.44
Grand Canyon National Park	1.02	1.28	1.11
Zion National Park	3.18	3.94	3.02
Grand Staircase-Escalante National Monument	2.48	3.41	3.46

Cumulative visibility results for Alternative K1 would be equal to or less than the results reported in Tables 4.19.10, 4.19.11, 4.19.12, and 4.19.13.

4.19.2.2.6 Deposition

Maximum predicted sulfur and nitrogen deposition impacts were estimated for the cumulative sources (Table 4.19.14). Cumulative visibility results for Alternative K1 would be equal to or less than the results reported below.

Total deposition impacts from direct mine-related and regional sources were compared to the DATs for nitrogen and sulfur in western Class I parks and refuges. All sulfur and nitrogen deposition impacts are below the DATs. The improvements in the cumulative cases versus the Alton cases are due to the large NO_x emission decrease from the Navajo generating station. In fact, the nitrogen deposition values turned out to be 0, signifying that the Navajo emission decrease over the annual period exceeded the increased impacts from other sources. However, based on data from the NPS (as described in Section 3.3.3.3), current total nitrogen deposition at Bryce Canyon National Park is estimated at 2.5 kg/ha/year. This indicates that levels of nitrogen deposition are not 0 at Bryce Canyon National Park, which may be due to sources of deposition that were unforeseen at the time of the DEIS cumulative analysis or to a smaller actual NO_x emission decrease than projected at the Navajo generating station.

Table 4.19.14. Maximum Predicted Sulfur and Nitrogen Deposition Impacts, Alternatives B and C, Cumulative

Location	Overburden Thickness (feet)	Alternative	Cumulative Sources			
			Maximum Dry and Wet Annual Sulfur Deposition (kg/ha/year)	Sulfur DAT for Western Class I Parks and Refuges (kg/ha/year)	Maximum Dry and Wet Annual Nitrogen Deposition (kg/ha/year)	Nitrogen DAT for Western Class I Parks and Refuges (kg/ha/year)
Bryce Canyon	200	B, C	0.0003	0.005	0.0000	0.005
Capitol Reef	200	B, C	0.0007	0.005	0.0000	0.005
Grand Staircase-Escalante	200	B, C	0.0010	0.005	0.0000	0.005
Grand Canyon	200	B, C	0.0001	0.005	0.0000	0.005
Zion	200	B, C	0.0001	0.005	0.0000	0.005
Navajo Lake	200	C	–	–	–	–

4.19.2.3 CLIMATE CHANGE

The human and natural causes of climate change, and the impacts of climate change, are global. GHG emissions, which contribute to climate change, do not remain localized but become mixed with the general composition of the earth's atmosphere. Therefore, this analysis cannot separate the particular contribution of project GHG emissions to global climate change (and its regional implications) from the multitude of other past, present, and reasonably foreseeable projects that have produced or would produce or mitigate GHG emissions. Rather, this analysis focuses on the cumulative impacts of GHG emissions and climate change from a global perspective.

A worldwide environmental issue is the likelihood of changes in the global climate as a consequence of global warming from increasing atmospheric concentrations of GHGs (Intergovernmental Panel on Climate Change [IPCC] 2007a). The atmosphere allows a large percentage of incoming solar radiation to pass through to the earth's surface, where it is converted to heat energy (infrared radiation) that is more readily absorbed by GHGs such as CO_2 and water vapor than by incoming solar radiation. The heat energy absorbed near the earth's surface increases the temperature of air, soil, and water.

GHGs include water vapor, CO_2, CH_4, N_2O, O_3, and several chlorofluorocarbons. GHGs constitute a small percentage of the earth's atmosphere, but are entirely responsible for its heat-trapping properties. Water vapor, a natural component of the atmosphere, is the most abundant GHG, but its atmospheric concentration is driven primarily by changes in the earth's temperature. As such, water vapor simply serves to amplify the effects of other GHGs such as CO_2. The second-most abundant GHG is CO_2, which remains in the atmosphere for long periods of time. Due to human activities, atmospheric CO_2 concentrations have increased by approximately 35% over preindustrial levels. Fossil fuel burning, specifically from power production and transportation, is the primary contributor to increasing concentrations of CO_2 (IPCC 2007a). In the United States, stationary CO_2 emission sources include energy facilities (such as coal and natural gas power plants) and industrial plants. Industrial processes that emit these gases include cement manufacture, limestone and dolomite calcinations, soda ash manufacture and consumption, CO_2 manufacture, and aluminum production (EIA 2009).

In the preindustrial era (before A.D. 1750), the concentration of CO_2 in the atmosphere appears to have been 275–285 ppm (IPCC 2007). In 1958, C.D. Keeling and others began measuring the concentration of atmospheric CO_2 at Mauna Loa in Hawaii (Keeling et al. 1976). The data collected by Keeling's team indicate that the amount of CO_2 in the atmosphere has been steadily increasing from approximately 316 ppm in 1959 to 397 ppm (preliminary data) in 2013 (NOAA 2013). This increase in atmospheric CO_2 is attributed almost entirely to the anthropogenic (e.g., human) activities noted previously. In addition, industrial and agricultural activities release GHGs other than CO_2—notably CH_4, NO_x, O_3, and chlorofluorocarbons—to the atmosphere, where they can remain for long periods of time.

4.19.2.3.1 Impacts of Greenhouse Gases on Climate

Climate is usually defined as the average weather of a region, or more rigorously as the statistical description of a region's weather in terms of the means and variability of relevant parameters over time periods ranging from months to thousands of years. The relevant parameters include temperature, precipitation, wind, and dates of meteorological events such as first and last frosts, beginning and end of rainy seasons, and appearance and disappearance of pack ice. Because GHGs in the atmosphere absorb energy that would otherwise radiate into space, the possibility that human-caused emissions of these gases could result in warming that might eventually alter climate was recognized soon after the data from Mauna Loa and elsewhere confirmed that the atmosphere's content of CO_2 was steadily increasing (IPCC 2007a; NOAA 2010).

Changes in climate are difficult to detect because of the natural and complex variability in meteorological patterns over long periods of time and across broad geographical regions[13]. There is uncertainty regarding the extent of global warming caused by human-caused GHGs, the climate changes this warming has or will produce, and the appropriate strategies for stabilizing the concentrations of GHGs in the atmosphere. The World Meteorological Organization and United Nations Environment Programme established the IPCC to provide an objective source of information about global warming and climate change, and IPCC's reports are generally considered to be an authoritative source of information on these issues.

According to the IPCC fourth assessment report, "[w]arming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level" (IPCC 2007b). The IPCC report finds that the global average surface temperature has increased by approximately 0.74 degrees Celsius in the last 100 years; global average sea level has risen approximately 150 millimeters over the same period; and cold days, cold nights, and frosts over most land areas have become less frequent during the past 50 years. The report concludes that most of the temperature increases since the middle of the twentieth century "is [are] very likely due to the observed increase in anthropogenic [GHG] concentrations."

[13] Detection of these types of changes was also difficult because of the limited tools that were available for collecting data and for modeling climate systems. However, scientific advances over the last 20 years have vastly improved the tools available for climatological research.

The 2007 report estimates that CO_2 accounts for approximately 77% of the GWP attributable to human-caused releases of GHGs, with most (74%) of this CO_2 coming from the combustion of fossil fuels. Although the report considers a variety of future scenarios regarding GHG emissions, CO_2 would continue to contribute more than 70% of the total warming potential under all scenarios. IPCC therefore believes that further warming is inevitable, but that this warming and its effects on climate could be mitigated by stabilizing the atmosphere's concentration of CO_2 through the use of 1) "low-carbon technologies" for power production and industrial processes, 2) more efficient use of energy, and 3) management of terrestrial ecosystems to capture atmospheric CO_2 (IPCC 2007b).

4.19.2.3.2 Environmental Impacts of Climate Changes

IPCC and the U.S. Climate Change Science Program have examined the potential environmental impacts of climate change at global, national, and regional scales. The IPCC report states that, in addition to increases in global surface temperatures, the impacts of climate change on the global environment may include

- more frequent heat waves, droughts, and fires;
- rising sea levels and coastal flooding;
- melting glaciers, ice caps, and polar ice sheets;
- more severe hurricane activity and increases in frequency and intensity of severe precipitation;
- spread of infectious diseases to new regions;
- loss of wildlife habitats; and
- heart and respiratory ailments from higher concentrations of ground-level O_3 (IPCC 2007b).

Socioeconomic impacts from climate change vary by region and locality but are expected to involve food, water, health, coastal regions, and industry, settlements, and society (IPCC 2007b). Socioeconomic costs may result from changes in crop productivity; reduced water availability, flooding, and increased drought; increases in malnutrition and deaths, diseases, and injuries; and rising sea levels and increasing coastal erosion. The most vulnerable industries, settlements, and societies are generally those in coastal and river floodplains, those whose economies are closely linked with climate-sensitive resources, and those in areas prone to extreme weather events. Poor communities may be especially vulnerable (IPCC 2007b).

On a national scale, average surface temperatures in the United States have increased, with the last decade being the warmest in more than a century of direct observations (CCSP 2008). Impacts on the environment attributed to climate change that have been observed in North America include

- extended periods of high fire risk and large increases in burned areas;
- increased intensity, duration, and frequency of heat waves;
- decreased snowpack, increased winter and early spring flooding potentials, and reduced summer stream flows in the western mountains; and
- increased stress on biological communities and habitat in coastal areas (IPCC 2007b).

On a regional scale, there is greater natural variability in climate parameters that makes it difficult to attribute particular environmental impacts to climate change (IPCC 2007b). However, based on observational evidence, there is likely to be an increasing degree of impacts such as coral reef bleaching, loss of specific wildlife habitats, reductions in the area of certain ecosystems, and smaller yields of major cereal crops in the tropics (IPCC 2007b). For the northern hemisphere, regional climate change could affect physical and biological systems, agriculture, forests, and amounts of allergenic pollens (IPCC 2007b)[14].

[14] The IPCC report provides more detailed information on the current and potential environmental impacts of climate change and on how climate may change in the future under various scenarios of GHG emissions.

4.19.2.3.3 Production of Greenhouse Gases

Emissions of GHGs from the tract would increase the atmosphere's concentration of GHGs, and in combination with past and future emissions from all other sources, they would contribute incrementally to the global warming that produces the adverse effects of climate change described previously. At present, however, the climate change research community has not yet developed tools specifically intended for evaluating or quantifying end-point impacts attributable to the emissions of GHGs from a single source. The current tools for simulating climate change generally focus on global- and regional-scale modeling. Global- and regional-scale models lack the capability to represent many important small-scale processes. As a result, confidence in regional- and subregional-scale projections is lower than at the global scale. Therefore, there is no methodology that would allow the BLM to estimate the specific impacts (if any) that this increment of warming or climate change would produce on the tract or elsewhere.

4.19.2.4 CULTURAL RESOURCES

The CIAA for cultural resources is the tract, the Coal Hollow Mine, the potential fee coal mine north of the tract, the Panguitch Historic District, and the Utah Heritage Highway (Map 4.8). Mining activity in these areas is an RFFA that, in conjunction with the Proposed Action, Alternative C, and Alternative K1 analyzed in this EIS, would lead to a broader pattern of impacts to cultural resources in the Alton Amphitheatre and Sink Valley area. There are no other RFFAs identified in the KFO RMP that have the potential to affect archaeological sites in this area. For the Panguitch Historic District and the Utah Heritage Highway 89/Mormon Pioneer Heritage Area, the cumulative impacts analysis considers the anticipated expansion of US-89, the only RFFA identified in the KFO RMP that has the potential to affect these resources.

Ongoing activities in the fee coal areas adjacent to the Alton Coal Tract include surface mining and the construction of facilities. Four archaeological sites that would not be affected by mining in the Alton Coal Tract have been identified in the portion of the Coal Hollow Mine area in which surface mining is currently occurring (as of 2014) (an additional six sites that have been identified in the potential surface mining area straddle the border between the Coal Hollow Mine and the Alton Coal Tract and are included in the analysis of impacts for the Proposed Action, Alternative C, and Alternative K1). Of these, two are NRHP-eligible prehistoric sites, one is an NRHP-eligible multicomponent site, and one is a prehistoric site that is not eligible for the NRHP. There is one archaeological site that has been identified in the potential fee coal area to the north of the tract that occurs in an area where surface mining may occur (this is in addition to two sites that straddle the border between the potential fee coal area and the tract that were considered in the analysis of impacts in the tract). This is an NRHP-eligible prehistoric site. Thus, surface mining in the fee coal areas may impact five sites, four of which are NRHP-eligible, in addition to those that would be affected by the Proposed Action. Impacts of surface mining in the fee coal areas can be expected to be similar to those of surface mining in the tract and would likely result in complete destruction of these sites.

Another three archaeological sites have been identified in the portion of the Coal Hollow Mine in which surface mining will not occur (in addition to two sites in the area where surface mining will not occur that straddle the border between the Coal Hollow Mine and the Alton Coal Tract and are included in the analysis of impacts in the tract). These are all NRHP-eligible prehistoric sites. These sites may be impacted by activities associated with mining, such as facilities construction.

Overall, ongoing and reasonably foreseeable activities in the fee coal areas will incrementally add to the impacts to archaeological sites that would occur under the Proposed Action, Alternative C, or Alternative K1 for the Alton Coal Tract.

Regarding the Panguitch Historic District and the Utah Heritage Highway 89/Mormon Pioneer Heritage Area, according to the KFO RMP (BLM 2008b), it is anticipated that US-89 will be widened over the next 20 years to allow for an increase in traffic volume. The increased truck traffic that would occur under the Proposed Action, Alternative C, or Alternative K1 for the life of the mine would contribute to the increased traffic volume that is already expected to occur on US-89. Overall, it can be expected that truck traffic associated with mining in the Alton Amphitheatre and Sink Valley area would contribute to a broader pattern of increased traffic volume along US-89 that will likely occur over the next two to three decades. To the extent that increased traffic has impacts on the integrity of setting, feeling, and association of the Panguitch Historic District and the Utah Heritage Highway 89, coal truck traffic would contribute to an even broader pattern of such impacts. For a further discussion of cumulative impacts related to US-89, see the Transportation section below (Section 4.19.2.14).

Finally, in the broader CIAA (the BLM-KFO), any increase in surface-disturbing activities would increase the potential to adversely impact known and currently unknown archaeological sites. With the implementation of the Proposed Action, Alternative C, or Alternative K1, there would be a 2.6%, 2.2%, and a 1.3% increase, respectively, in surface disturbance in the entire CIAA over the next 20 years.

4.19.2.5 FIRE MANAGEMENT

The CIAA for fire management is the BLM-KFO and the reasonably foreseeable coal haul transportation route (Map 4.6). As mineral development, recreational activities, and general use of the area increase, so would the number of potential ignition sources and consequently the probability of wildland fire occurrence. Activities associated with fire suppression, recreation, development, and general land use would cumulatively contribute to the modification of the composition and structure of vegetation communities and increase the spread of noxious and invasive weeds. Such effects would, in turn, alter the fire regime of the area, potentially increasing the frequency, size, and intensity of wildland fires. Developed areas and associated roads and ROW corridors could also provide increased accessibility to remote areas for fire suppression equipment and provide fuel breaks in the case of wildland fire events. The RFD in the CIAA would impact 75,815 acres. Of these acres, approximately 3,476 acres would be from wildfire, 390 acres would be from wildfire use, and 800 acres would be from prescribed fire. Most (79%) of the reasonably foreseeable surface disturbance in the CIAA would be from vegetation treatments (60,000 acres). The Proposed Action would increase surface disturbance, as well as potential fire management actions, by 2.6%, Alternative C would increase the total disturbance by 2.2% in the CIAA, and Alternative K1 would increase total disturbance by 1.3% in the CIAA.

4.19.2.6 GEOLOGY AND MINERALS

The CIAA for geology and minerals is the BLM-KFO (Map 4.6). Past and present actions include two mining operations in the Alton Coal Field, both on private lands for fee coal, resulting in the extraction of approximately 13 million tons of coal from the Alton Coal Field (estimated tons assume that acre-for-acre coal tonnage is approximately the same on the private tracts as on the tract). In addition to the Alton Coal Field, there are two other major coal fields (Kaiparowits and Kolob) in the CIAA. No coal mining activities are currently occurring or are reasonably foreseeable in these coal fields.

Reasonably foreseeable mineral development in the CIAA includes oil and gas development, coalbed CH_4 extraction, locatable mineral development, and salable mineral development. RFFAs in the CIAA could impact up to 75,815 surface acres. Of these acres, approximately 4,404 acres (5.8%) would be from mining, coalbed CH_4 extraction, oil and gas exploration/development/production, and associated activities.

Under the Proposed Action, Alternative C, or Alternative K1, 44.9 million tons, 38.1 million tons, or 30.0 million tons, respectively, of coal would be permanently removed from the Alton Coal Field. This would be a 29%, 26%, or 20% increase, respectively, in the amount of coal removed from the coal field when considered with reasonably foreseeable coal mining activities. Under the Proposed Action, the Alton Coal Tract would directly impact 1,993 acres, which is a 2.6% increase in the total surface disturbance in the CIAA over the next 20 years. Alternative C would directly impact 1,662 acres, which is a 2.2% increase in the total surface disturbance in the CIAA. Alternative K1 would directly impact 1,012 acres, which is a 1.3% increase in the total surface disturbance in the CIAA. Various forms of surface disturbance impact geological resources by potentially altering surface and subsurface features, modifying stratigraphic layers, resulting in potential geologic hazards, etc. Pursuant to an Exploration Agreement and Option to Lease between ACD and SITLA, exploration and possible underground coal mining operations in Kane County could result in a maximum of approximately 1,255 acres of subsidence impacts. The level of subsidence generally depends on the thickness of the coal extracted and the thickness of the overburden, as well as other geological factors. These mining operations and the resulting subsidence would impact the geological resources of the area mined. At this time, there are not enough details known about these potential mining activities to estimate the level of subsidence that would result. The geological impacts from underground mining and subsidence would add incrementally to the cumulative geological impacts of other mining activities in the CIAA.

The Alton Coal Tract is in a high potential area for oil and gas. Assuming that coal mining on the tract would preclude all oil and gas development over the life of the mine, the mining activities associated with the Alton Coal Tract under the Proposed Action, Alternative C, or Alternative K1 would decrease impacts to oil and gas resources because their extraction would be postponed to allow for coal mining. On the other hand, impacts to locatable minerals (namely septarian nodules) and salable minerals (largely burnt shale and gravel) would be incrementally increased as a result of coal mining activities under the Proposed Action, Alternative C, or Alternative K1, depending on how their unearthing was dealt with during the mining process (i.e., if the gravel is separated from the overburden). If these materials were returned to mined-out pits along with the remainder of overburden, they would remain in-place following mining, and no extraction-related impact would occur. On the other hand, if these materials were to be set aside and sold, the mining operation would result in increased impacts to these resources in the CIAA via extraction and sale.

4.19.2.7 HAZARDOUS MATERIALS AND HAZARDOUS AND SOLID WASTE

The CIAA for hazardous materials and hazardous and solid waste is the BLM-KFO and the reasonably foreseeable coal haul transportation route (Map 4.6). The State of Utah is considering an application to surface mine privately owned coal resources adjacent to the tract in Kane County. Resource decisions from this project could combine with other past, present, and RFFAs to produce cumulative impacts from hazardous materials and solid waste in the CIAA. Additional opportunities for incidences related to hazardous materials in the CIAA include oil and gas development and transport, prescribed fire treatments, and to a lesser extent the installation of transmission lines and pipelines. Of the approximately 75,815 acres of total surface disturbance from RFFAs in the CIAA, there are approximately 2,070 acres (2.7%) of oil and gas exploration, development, and production. There are approximately 800 acres (1%) of prescribed fire treatments in the CIAA. With adherence to SOPs, cumulative impacts in the CIAA would be minimal.

4.19.2.8 LAND USE AND ACCESS

The CIAA for land use and access is the BLM-KFO (Map 4.6). Cumulative impacts to land use and access could occur from a combination of land uses and permitted actions. Past and present actions in the CIAA have resulted in the current conditions for land use and access as described in Section 3.8. RFFAs

in the CIAA could impact up to 75,815 surface acres. This is a conservative estimate because all of the 75,815 acres of surface disturbance may not affect land use and access. These include the conversion of agricultural lands to residential and commercial uses and known projects such as the Coal Hollow environmental assessment (which occurs on lands adjacent to and including the Alton Coal Tract), the Lake Powell water pipeline project, and the US-89 highway widening project. Under the Proposed Action, the Alton Coal Tract would take up 3,576 acres, which is a 4.7% increase in the total acres disturbed in the CIAA over the next 25 years. Alternative C would take up 3,173 acres, which is a 4.2% increase in the total acres disturbed in the CIAA over the next 20 years. Alternative K1 would take up 2,114 acres, which is a 2.8% increase in the total acres disturbed in the CIAA over the next 16 years.

Land tenure on the tract would not change based on any known past, present, or reasonably foreseeable projects. The land status and prior rights currently held by parties would remain unchanged. However, the overall land use in the tract would be restricted to mining operations. The mine operator would lease federal surface estate and federal mineral estates from the BLM for the life of the mine and until the coal mine area has been reclaimed and released from bond. In addition, as necessary, the mine operator would negotiate surface use agreements with qualified surface owners in the tract prior to any mine activity taking place.

Using total tract acres as an indicator of land use in the CIAA, mining operations on the Alton Coal Tract would increase the total acreage of land in the CIAA used for mineral extraction by 3,576 acres under the Proposed Action, 3,173 acres under Alternative C, and 2,114 acres under Alternative K1. RFFAs would result in the use of 5,659 acres of land for mineral extraction–related activities. Coal mining activities on the tract under the Proposed Action would result in an 81.2% increase in the acreage of land in the CIAA used for mineral extraction. Coal mining activities on the tract under the Alternative C would result in a 72.0% increase in the acreage of land in the CIAA used for mineral extraction. Coal mining activities on the tract under Alternative K1 would result in a 48.0% increase in the acreage of land in the CIAA used for mineral extraction. Under each of the action alternatives, the amount of land used for mineral extraction across the CIAA (again using overall tract acres as an indicator) would still be relatively low at 4.7%, 4.2%, and 2.8%, respectively.

4.19.2.9 LIVESTOCK GRAZING

The CIAA for livestock grazing is the BLM-KFO (Map 4.6). Potential cumulative impacts on livestock grazing operations could occur from a combination of activities and land uses occurring in the CIAA. Vegetation treatments and range improvements on lands adjacent to the tract (public and private) would increase available forage and water for a wide range of uses, including livestock grazing and rangeland health. Surface-disturbing activities, including coal development activities and related construction of roads and infrastructure, could be a primary cause of site-specific loss of forage and the spread of noxious weeds.

Past and present actions in the CIAA have resulted in the current conditions for livestock grazing as described in Section 3.9. RFFAs in the CIAA could impact up to 75,815 surface acres. Under the Proposed Action, the Alton Coal Tract would take up 3,576 acres, which is a 4.7% increase in the total acres disturbed in the CIAA over the next 20 years. Alternative C would take up 3,173 acres, which is a 4.2% increase in the total acres disturbed in the CIAA. Alternative K1 would take up 2,114 acres, which is a 2.8% increase in the total acres disturbed in the CIAA.

The implementation of BLM’s mitigation guidelines, restrictions on surface use, standards for rangeland health, vegetation treatments, and monitoring efforts would all provide measures of protection for forage resources on federal lands, which would help to reduce overall cumulative impacts on livestock grazing operations.

4.19.2.10 PALEONTOLOGY

The CIAA for paleontology is the BLM-KFO (Map 4.6). It is likely that intense hobby fossil collecting and other nearby mining activities for burnt shale clinker and septarian concretions would continue through the life of the mine under the Proposed Action, Alternative C, or Alternative K1. It is also expected that research activities in the Alton Amphitheatre would increase as knowledge of the nearby Kaiparowits Basin matures, creating additional demands for undisturbed fossils and outcrops. The mining of burnt shale, septarian concretions, or nearby coal resources would contribute to the total loss of fossil resources on federal lands, perhaps as much as an additional 40%.

Across the CIAA, RFFAs would result in approximately 75,815 acres of surface disturbance. However, approximately 60,000 acres (79%) of the total surface disturbance would be from vegetation treatments, which have less potential for impacting deeply buried fossils than subsurface activities such as mining and oil and gas exploration and development. Surface-disturbing activities have the potential to result in the destruction of fossils depending on the location of the surface-disturbing activity. On the other hand, surface-disturbing activities can also result in the unearthing of fossils and their inclusion in the paleontological scientific body of knowledge. Mining operations on the tract under the Proposed Action, Alternative C, or Alternative K1 would result in surface disturbance of 1,993, 1,662, and 1,012 acres, respectively. This would represent a 2.6%, 2.2%, or 1.3% increase, respectively, in surface disturbance in the CIAA.

4.19.2.11 RECREATION

The CIAA for recreation is the BLM-KFO and the reasonably foreseeable coal haul transportation route (Map 4.6). Cumulative impacts to recreation resources could occur from a combination of land uses and permitted actions. These include the conversion of agricultural lands to residential and commercial uses and known projects such as the Coal Hollow environmental assessment (which occurs on lands adjacent to and including the Alton Coal Tract), the Tropic to Hatch transmission line project, the Lake Powell water pipeline project, the Jackson Flat Reservoir project, and the US-89 highway widening project.

Past and present actions in the CIAA have resulted in the current conditions available for recreation as described in Section 3.8. RFFAs in the CIAA could impact up to 75,815 surface acres. Under the Proposed Action, the Alton Coal Tract would take up 3,576 acres, which is a 4.7% increase in the total acres removed from potential recreation use in the CIAA over the next 20 years. Alternative C would take up 3,173 acres, which is a 4.2% increase in the total acres removed from potential recreation use in the CIAA. Alternative K1 would take up 2,114 acres, which is a 2.8% increase in the total acres removed from potential recreation use in the CIAA.

This cumulative loss of lands available would impact recreation opportunities by removing lands currently available for recreation pursuits. The conversion of undeveloped land to residential, commercial, and industrial uses is likely the largest area of impact to recreation resources in the CIAA. As removal of minimally developed land available for hunting and dispersed recreation increases, the amount of land available for recreation in those types of settings decreases permanently, displacing existing recreation use to other available lands. Users would move onto adjacent public lands (BLM-administered lands and the Dixie National Forest) for hunting and other dispersed recreation opportunities (camping, hiking, sightseeing, etc.). This would increase crowding and decrease the recreational experiences of displaced and existing users in those remaining areas.

4.19.2.12 SOCIOECONOMICS

The CIAA for socioeconomics is Kane, Garfield, and Iron counties (Map 4.6). Thus, in addition to considering the past, present, and reasonably future impacts from the KFO (Kane and Garfield counties), the cumulative socioeconomic analysis considers management decisions related to the Cedar City Field Office (Iron County) as well. Most of the cumulative impacts to the social and economic conditions of the three-county area would be a result of mineral development.

In Kane County, the Coal Hollow Mine currently in operation adjacent to the tract employs 34 staff at coal production levels between 400,000 and 500,000 TPY. This ratio of production level to employment equates to 160 mine employees at 2 million tons of production (ACD 2013). According to the Utah Geologic Survey, two coal fields exist in Iron County (Harmony and Kolob) (UDNR 2006). However, development of these fields is not anticipated in the foreseeable future. Because there is no current or reasonably foreseeable coal production or oil and gas development in Iron and Beaver counties, the Proposed Action, Alternative C, or Alternative K1 would add a new revenue stream, by indirect expenditures, into the local economy. The Proposed Action, Alternative C, or Alternative K1 could contribute to revenues from existing and future oil and gas development and exploration in the KFO. The KFO estimates that 90 oil and gas wells will be drilled over a 20-year period. An increased contribution of mineral-related royalties, taxes, and payments from the successful bidder to the federal, state, and local government would be beneficial to current economic conditions at all levels of government. As stated in the KFO RMP (BLM 2008b), the Alton coal mine "would provide by far the largest new economic stimulus to the [Kane and Garfield counties]."

Increasing natural resource development in the KFO and potentially in the Cedar City Field Office over the next 20 years would likely alter the social character in many of the small central and southern Utah communities. In addition to the truck traffic required to move mined coal to market, other production-related trucks would further degrade the rural, small-town nature of communities near mines, wells, and along transportation routes. The alteration of landscapes from semiprimitive/natural to ones characterized by coal mining and oil and gas development would be experienced by local residents in the area who enjoy and/or depend on the naturalness of the area for their livelihood. Alton, an EJ community, could experience further disproportionate adverse impacts from the combined effect of reasonable foreseeable future mining on the northern private fee area, the Coal Hollow Mine, and mining in Block NW under the Proposed Action (but not Alternatives C or K1). Cumulatively, these changes could also result in adverse impacts to recreationists who value primitive recreation and businesses dependent on tourism-related revenue.

4.19.2.13 SOILS

The CIAA for soils is the BLM-KFO (Map 4.6). In addition to the 1,993 acres, 1,662 acres, and 1,012 acres of soil disturbance that would occur under the Proposed Action, Alternative C, and Alternative K1, respectively, several other activities would impact soils in the CIAA. The RFFAs in the CIAA would disturb 75,815 surface acres (see Table 4.19.1). The Proposed Action would increase surface disturbance in the CIAA by 2.6%, Alternative C would increase the total disturbance by 2.2%, and Alternative K1 would increase surface disturbance by 1.3% in the CIAA.

Proposed coal mine development on private surface areas adjacent to the Alton Coal Tract would result in an additional 802 acres of surface disturbance to soils, potentially contributing to soil erosion and loss of soil productivity. Other activities could also contribute to cumulative impacts to soil in the CIAA, including OHV and vehicle use, rangeland use, oil and gas development, and other surface uses and activities. Under the KFO RMP, the public lands in the CIAA limit OHV use to designated trails and roads, and the area is open to oil and gas leasing. All oil and gas development, mining, public lands grazing, and other uses of public lands would require permits that would comply with authorizing permit stipulations and apply BMPs that would minimize the overall erosion and loss of soil productivity resulting from incremental impacts. Thus, the mining of the Alton Coal Tract and adjacent private lands would be one of the dominant cumulative impacts to soils in the CIAA.

4.19.2.14 TRANSPORTATION

The CIAA for transportation is the reasonably foreseeable coal haul transportation route (Map 4.7). Cumulative impacts to transportation could occur from a combination of land uses and permitted actions. Past and present actions have contributed to the existing LOS in the area of analysis. These include the use of an existing transportation route (US-89 to SR-20 to I-15 to Iron Springs along U.S. Route 56 for transporting coal from the Coal Hollow Mine to market), and tourist traffic associated with improved recreational opportunities in the region. Future actions that would contribute to cumulative impacts to transportation include expanding US-89, oil and gas development, locatable mineral development, salable mineral development, energy corridor development, wind energy development, and water projects.

The Proposed Action, Alternative C, or Alternative K1 would all cause incremental increases in traffic density; however, none would result in substantial decreases to LOS. Under the Proposed Action, the Alton Coal Tract would continue to contribute to increased traffic levels on surface roads in the CIAA over the next 25 years. Alternative C would contribute increased traffic levels in the CIAA for the next 20 years. Alternative K1 would contribute increased traffic levels in the CIAA for the next 16 years. The expansion of US-89 is expected to improve LOS on portions of the coal haul transportation route and would mitigate the incremental increases in traffic density resulting from the Proposed Action, Alternative C, or Alternative K1.

4.19.2.15 VEGETATION

The CIAA for vegetation is the BLM-KFO (see Map 4.6). Past fire suppression has contributed to increasing pinyon-juniper encroachment in the CIAA, as well as a concurrent decrease in aspen and ponderosa pine communities. Current fire use and vegetation treatments would generally maintain or improve vegetation communities by removing undesired species, increasing species diversity and age class, improving vegetation composition and structure, and increasing vegetation cover. Minerals development, such as copper and uranium mining, has occurred across this region in the past. The spatial layout of oil and gas facilities and access roads also disturbs a large proportion of vegetation when considered across the landscape. Each disturbed area increases the opportunity for weed invasions and disrupts the spatial continuity of vegetation communities. The combined amount of surface disturbance of these past and present actions is detrimental to vegetation resources.

The overall cumulative impact of activities proposed for all resource decisions on vegetation resources in the CIAA includes short-term detrimental impacts and long-term improvements. Major contributors to detrimental impacts include continuing or increasing OHV activities throughout most of the area, and degradation to vegetation and habitats from mineral development–related activities. However, of the estimated 75,815 acres of surface disturbance as a result of RFFAs in the CIAA, approximately 60,000 acres (or 79% of the total 75,815 acres) are anticipated to be for vegetation treatments intended to create desired vegetation communities such as stable sagebrush stands. An additional 4,666 acres of disturbance would be a result of wildfire, wildfire use, and prescribed fire. Although impacts related to fire are adverse to vegetation in the short term, in the long term, fire results in beneficial impacts to vegetation by culling out decadent and decaying plant material and returning vegetation communities to historical fire return intervals that promote vegetation community vigor.

Resource decisions from mining activities on the tract under the Proposed Action or Alternative C would combine with other past, present, and RFFAs to produce cumulative impacts to vegetation resources in the CIAA. Past and present actions in the CIAA have resulted in the current vegetation conditions as described in Section 3.15. The Proposed Action would disturb 1,993 surface acres, a 2.6% increase in surface disturbance in the CIAA. Alternative C would disturb 1,662 acres, a 2.2% increase in total CIAA surface disturbance. Alternative K1 would disturb 1,012 acres, a 1.3% increase in total CIAA surface

disturbance. Surface disturbance associated with consumptive uses such as oil, gas, and other minerals development, and forage use by livestock and wildlife species would result in cumulative impacts over a larger landscape scale than analyzed in this document.

Though coal mining activities on the Alton Coal Tract would result in short-term adverse impacts to vegetation as described, in the long term, reclamation activities would restore native and suitable non-native plants to the landscape in arrangements beneficial to the vegetation communities themselves and to the wildlife that depend on these communities for habitat.

4.19.2.16 WATER RESOURCES

The CIAA for water resources is the BLM-KFO (see Map 4.6). Past and present activities in the CIAA that have resulted in the current conditions for water resources as described in Section 3.16 include mineral development, transmission projects, road construction, rerouting and improvements, OHV use, and grazing. RFFAs that would result in incremental impacts associated with localized erosion and sediment loading that could degrade downstream water quality include the northern private coal area, construction and development of the Lake Powell pipeline, development of the West-wide Energy Corridor, and oil and gas development. RFFAs in the CIAA, which have the potential to impact water resources, would impact approximately 75,815 acres. The Proposed Action would increase surface disturbance, and could increase adverse impacts to water quality and/or quantity, by 2.6%, Alternative C would increase the total disturbance by 2.2%, and Alternative K1 would increase the total disturbance by 1.3% in the CIAA.

However, projects occurring on BLM-administered land must comply with BLM-permitted activities and would comply with permit stipulations that would minimize soil erosion and degradation of water quality and quantity. These permitted activities are not expected to contribute to the overall cumulative impact to water quality and quantity from past, present, and reasonably foreseeable actions.

Several actions identified by the BLM as reasonably foreseeable actions, such as fire use and vegetation treatments, would incrementally improve watershed health in the long term, though short-term impacts on water quality from these activities would be adverse.

Pursuant to an Exploration Agreement and Option to Lease between ACD and SITLA, exploration and possible underground coal mining operations in Kane County could result in a maximum of approximately 1,255 acres of subsidence impacts. The level of subsidence generally depends on the thickness of the coal extracted and the thickness of the overburden, as well as other geological factors. These mining operations and the resulting subsidence have the potential to impact water resources in the area mined, if any water resources are present. At this time, there are not enough details known about these potential mining activities to estimate the level of subsidence that would result. Underground mining and subsidence on the tract would add approximately 62.1% to the cumulative water resource impacts of mining activities associated with mining the SITLA coal.

The Coal Hollow Mine is adjacent to the tract and is currently in operation. The total acreage of the Coal Hollow Mine permit is 424 acres. Mining at the Coal Hollow Mine began in late 2010 and mining activities are ongoing as of early 2014.

The results of water monitoring activities at the Coal Hollow Mine have not indicated unexpected impacts to the quality or quantity of water resources surrounding the mine area. Discharge rates in springs and streams continue at rates similar to those observed prior to mining. The water quality of groundwaters and surface-waters is also generally similar to pre-mining conditions. As anticipated, where the mine pits have been excavated, alluvial groundwaters present in the overburden above pit areas have been removed together with the overburden as mining has progressed. Similarly, as anticipated, water levels in the Smirl

Coal Zone in and near mine pit areas have declined in response to the removal of the coal. Alluvial groundwater levels and spring discharge rates near the groundwater production well in Sink Valley (which pumps at approximately 50 gpm for mine operational use) remain at levels similar to those measured before mining activity began.

The rates at which groundwater has been intercepted by the mine pits have not been large, averaging less than approximately 20 gpm inflow to the mine from all groundwater sources (ACD 2009). Some of the groundwater intercepted within the mine pits is used for dust suppression activities. Consequently, discharge of water from the Coal Hollow Mine has been infrequent, with no discharges occurring in the previous two years (2012–2013). As discussed in Section 4.16.4.1, discharges of water from the Coal Hollow Mine have occurred on a few occasions where the total iron or total suspended sediments concentrations exceeded the UPDES effluent limitations. However, UPDES discharges of water from the mine have been infrequent, and the discharge rates have ranged from 1.3 gpm to 15 gpm.

It is anticipated that the effects on water resources resulting from future mining at the Coal Hollow Mine would be generally similar to those experienced previously at the mine. Similarly, assuming that a future coal mine within the tract would be operated in a manner similar to the Coal Hollow Mine, similar incremental effects to water resources in the tract area would be anticipated.

Probable AVFs have been identified along Kanab Creek upstream and downstream of the tract area. A probable AVF has also been identified in Sink Valley wash below the tract area. These areas have been determined to be probable AVFs based primarily on their relatively flat landforms and the possible availability of water in streams for irrigation use (Petersen Hydrologic 2008). No impacts to the water supplies of the probable AVFs have occurred from mining operations at the Coal Hollow Mine. Impacts to the water supplies of these probable AVFs are not expected from proposed mining activities in the tract.

4.19.2.17 WILDLIFE: GENERAL

The CIAA for general wildlife species comprises the BLM-KFO (Map 4.6). The current environmental condition of the wildlife habitat on the tract is described in Sections 3.17 and 3.18. These conditions have occurred as a result of past and present actions in the CIAA. Past and present activities that impact wildlife in the CIAA include activities such as mineral development, energy projects (e.g., transmission lines), water projects (e.g., pipelines), highway construction and road improvement projects, vegetation treatments, OHV use, and range improvements. These activities impact wildlife through the long-term removal and short-term degradation of habitat, as well as habitat fragmentation and increased human-induced disturbances. Present vegetation treatments consist of those associated with the adjacent Coal Hollow Mine, as well as 26,996 acres of treatments completed by the BLM in the areas assessed by the *Upper Kanab Creek Watershed Vegetation Management Project Environmental Assessment* (BLM 2010d) and the *South Canyon Vegetation Enhancement Environmental Assessment* (BLM 2010c) (see Map 3.23). These vegetation treatments consist of removing conifer trees that have encroached upon sagebrush habitat. The treatments are detrimental to species that use conifer habitats (e.g., Sharp-shinned Hawk, Cooper's Hawk, and Pinyon Jay). However, these vegetation treatments are beneficial for species that use sagebrush habitat for all or part of its lifecycle (e.g., many big game species, Sage Sparrow, Sage Thrasher).

RFFAs that could impact wildlife in the CIAA include ongoing and increasing mineral development, ongoing energy projects, road improvement projects, ongoing and increasing OHV use, increased vegetation treatments, and increased range improvements, which would have the same nature of impacts as described in Section 4.17.4.2. RFFAs in the CIAA, which have the potential to impact wildlife, would impact approximately 75,815 acres. Additionally, pursuant to an Exploration Agreement and Option to

Lease between ACD and SITLA, exploration and possible underground coal mining operations in Kane County could result in a maximum of approximately 1,255 acres of subsidence impacts. The level of subsidence generally depends on the thickness of the coal extracted and the thickness of the overburden, as well as other geological factors. These mining operations are not likely to affect wildlife directly, but may adversely affect wildlife if any water resources that wildlife relies on decrease in volume due to subsidence. Additionally, direct or indirect impacts to wildlife and their habitats would occur from collapse of surface topography, such as rock walls or cliffs, resulting in a potential loss of nesting or roosting habitat. At this time, there are not enough details known about these potential mining activities to estimate the level of subsidence that would result. The potential impact on wildlife from underground mining and subsidence would generally be small when compared to potential impacts from surface mining, but would add incrementally to the cumulative disturbance to wildlife from other mining activities in the CIAA.

The overall cumulative impact of activities proposed for the Alton Coal Tract and surrounding planning areas on wildlife includes short-term detrimental impacts and long-term improvements to habitats that are degraded from conifer encroachment before mining begins. Surface disturbance associated with oil, gas, and other minerals development, and forage use by livestock, would result in cumulative impacts over a larger area than is analyzed in this document. The combined surface disturbance of past, present, and reasonably foreseeable future development would be detrimental to wildlife due to fragmentation and destruction of habitat. Detrimental impacts include ongoing or increasing OHV use, loss and degradation of habitat due to mineral development, and disruption of daily and seasonal animal movement and habitat use due to increased human presence, increased traffic volume and speeds, and noise and light pollution. Each disturbed area increases habitat fragmentation, reduces the connectivity and integrity of habitats, and displaces wildlife over the short and long term. The nature of these impacts on wildlife is also described in Section 4.17.4.2.

The Proposed Action would increase total surface disturbance in the CIAA by 2.6% (1,993 acres). Alternative C would increase the total surface disturbance by 2.2% (1,662 acres) in the CIAA. Alternative K1 would increase the total surface disturbance by 1.3% (1,012 acres) in the CIAA. These increases in total surface disturbance also have the potential to adversely impact wildlife in the CIAA in the ways described in Section 4.17.4.2.

Furthermore, the Proposed Action would increase existing traffic rates on the reasonably foreseeable coal haul transportation route by 4% (including a 33% increase in heavy truck traffic) for 25 years. Impacts due to coal hauling from Alternative C and K1 would be identical to the Proposed Action, except the impacts would occur over a 21-year period and 16-year period, respectively. Impacts from coal hauling that would contribute cumulatively to past, present, and reasonably foreseeable impacts consist of increased potential for mortality due to collisions with vehicles, disruptions in typical wildlife habitat use and migratory patterns due to the barrier effect of heavily used roads, increased raptor activity due to carrion increasing predation pressures on adjacent prey species, and the population-level impacts resulting from these impacts. Transportation impacts are described in greater detail in Section 4.17.5.

4.19.2.18 WILDLIFE: SPECIAL STATUS SPECIES

The CIAA for all special status wildlife species except Greater Sage-Grouse consists of the BLM-KFO (Map 4.6). The Greater Sage-Grouse CIAA is identical to the Greater Sage-Grouse analysis area, as portrayed on Map 3.21. Cumulative impacts on special status wildlife species would be the same as those described for other wildlife (Section 4.19.3.17), with the following additions and clarifications.

4.19.2.18.1 Utah Prairie Dog

The Utah prairie dog does not occur in the tract, but occurs along approximately 50 miles (42%) of the reasonably foreseeable coal haul transportation route (see Section 3.18.2.2). Past and present activities that impact the Utah prairie dog in the CIAA consist of those described for general wildlife in Section 4.19.2.7. These activities impact Utah prairie dogs through the long-term removal and short-term degradation of habitat, as well as habitat fragmentation and increased human-induced disturbances. RFFAs consist of those listed in Table 4.19.1, totaling 75,815 acres of disturbance consisting of ongoing and increasing mineral development, ongoing energy projects, road improvement projects, ongoing and increasing OHV use, increased vegetation treatments, and increased range improvements. The nature of impacts on Utah prairie dogs from RFFAs would be similar to that described for past and present activities.

The Proposed Action would increase existing traffic rates on the reasonably foreseeable coal haul transportation route by 4% (including a 33% increase in heavy truck traffic) for 25 years. Impacts due to coal hauling from Alternative C and K1 would be identical to the Proposed Action, except the impacts would occur over a 21-year period and 16-year period, respectively. Increased traffic on the reasonably foreseeable coal haul route due to each alternative, coupled with current and reasonably foreseeable levels of traffic, would increase levels of mortality currently experienced by Utah prairie dog colonies that occur along the roadside. In addition, the effects of road barrier impacts would be amplified, discouraging some individuals from crossing the road, leading to higher potential for some colonies to become genetically isolated and ultimately lost. Genetic fragmentation and isolation would reduce the health of the entire population.

4.19.2.18.2 Greater Sage-Grouse

The Greater Sage-Grouse CIAA is the same as the analysis area as defined in Section 3.18.3. The CIAA consists of the geographical boundary surrounding the Panguitch sage-grouse population. The current environmental condition of the sage-grouse habitat on the tract is described in Section 3.18.3. These conditions have occurred as a result of past and present actions in the CIAA. In addition to the actions listed for general wildlife, quantifiable past and present activities that impact sage-grouse in the CIAA stem primarily from vegetation treatments and mining activities. Past and present vegetation treatments consist of those associated with the adjacent Coal Hollow Mine as well as 26,996 acres of treatments completed by the BLM in the areas assessed by the *Upper Kanab Creek Watershed Vegetation Management Project Environmental Assessment* (BLM 2010d) and the *South Canyon Vegetation Enhancement Environmental Assessment* (BLM 2010c) (see Map 3.23), all of which are described in detail in Section 3.18.3.4.2. These vegetation treatments consist of removing conifer trees that have encroached on sagebrush habitat. This type of vegetation treatment is generally thought to provide a timely and effective increase of available habitat for local sage-grouse (Baruch-Mordo et al. 2013; Commons et al. 1999), and this available habitat has been observed to be used by grouse in the Alton–Sink Valley during the year following treatment (Frey 2008, 2010; Frey et al. 2013). In general, these vegetation treatments have improved grouse habitat and connectivity between populations in the CIAA.

An additional present action impacting grouse in the CIAA is the ongoing coal mining on the Coal Hollow parcel, as described in Section 3.18.3.4.3. It is possible that the local sage-grouse have adapted and become habituated to mining activities, because there have been repeated observations of grouse close to mining equipment. However, exact impacts on the grouse remain unclear due to the potential for a time-lag effect on grouse behavior (Harju et al. 2010).

Of the estimated 75,815 acres of surface disturbance from RFFAs in the CIAA, approximately 60,000 acres (or 79% of the total 75,815 acres) are anticipated to undergo additional vegetation treatments similar to those described above. These treatments would further increase habitat availability and connectivity for the Panguitch sage-grouse population. The remaining 15,815 acres of RFFAs consist of actions that would contribute to habitat destruction, disturbance, and fragmentation for the sage-grouse population, the nature of which is described in Section 4.18.2.4.2.

Under the Proposed Action, approximately 1,992 acres of occupied sage-grouse habitat would undergo surface-disturbing activities over the life of the mine (51% of the tract, 0.7% of the CIAA). Impacts to grouse from mining activities are described in detail in Section 4.18.2.4.2. The design features described in that section would apply to all alternatives. These design features would require pre-mining vegetation treatment, reclamation, and on- and off-tract mitigation measures to be carried out. Off-tract mitigation would require that vegetation treatment projects are completed that create sage-grouse habitat at a rate of 4 acres of treated habitat for every 1 acre disturbed. These treatments must be completed no more than one year after the corresponding on-tract surface disturbance occurs. The complete list of design features ensures compliance with the IM 2012-043 requirement to "cumulatively maintain and enhance Greater Sage-Grouse habitat" by instituting requirements centered on maintaining and creating sage-grouse habitat in the CIAA. The anticipated results from the combined pre-mining vegetation treatment, reclamation, and mitigation actions are based on observations from previously conducted telemetry observations, reclamation projects, and vegetation treatments in the KFO, and are described in detail in Section 4.18.2.1.2.1.

Although 1,992 acres of surface disturbance would occur under the Proposed Action, the required design feature for off-site vegetation treatments at a 4:1 ratio coupled with the required timing of treatment completion (no more than one year after the corresponding disturbance) and the high probability that grouse would use treated habitat would off-set the surface disturbances in the short term. The required tract reclamation measures would off-set long-term impacts by requiring that the tract is restored to functioning sage-grouse habitat. Because the habitat of the tract is currently experiencing a high degree of conifer encroachment, tract reclamation would increase the quality of available sage-grouse habitat in the CIAA in the long term and ultimately have a beneficial effect on sage-grouse.

Alternatives C and K1 would contribute an additional 1,661 acres (0.6% of the CIAA) and 1,012 acres (0.4% of the CIAA), respectively, of surface disturbance to the past, present, and RFFAs in the CIAA. The required design features described in Section 4.18.2.4.2 would apply to all alternatives. The short- and long-term impacts from pre-mining vegetation treatment, reclamation standards, and on- and off-tract mitigation would be the same under all alternatives except that due to the tract size and corresponding amount of surface disturbance, more vegetation treatments would be required under the Proposed Action than under Alternatives C and K1, as displayed in Table 4.19.15.

Table 4.19.15. Required Acres of Mitigation Vegetation Treatments Based on 4:1 Mitigation Ratio Requirement by Alternative

	Alternative A (No Action)	Alternative B (Proposed Action)	Alternative C (Reduced Tract Acreage and Seasonal Restrictions)	Alternative K1 (Reduced Tract Acreage)
Occupied habitat	0	7,258.0	6,051.6	3,656.4

Note: Data from this table are based on acres of direct disturbance by alternative, as displayed in Table 1.1.1.

Compliance with these requirements would ensure there would be no net loss of habitat for Greater Sage-Grouse, and would lead to a cumulative net increase of available habitat for the population as a whole in both the short and long term. Many of the locations that would be enhanced, reclaimed, and treated may not otherwise be completed without the funding made available by mining activities. In the long term, the enhanced habitats of the tract, mined areas reclaimed to sagebrush, and increased availability of habitat population-wide would further BLM's objectives of maintaining and enhancing habitat for Greater Sage-Grouse, and would thereby aid in the stabilization or increase of the Panguitch population. The ability to increase habitat availability and connectivity between breeding groups would increase the health and resiliency of the group breeding near the tract, as well as increase the capacity for the population as a whole to increase.

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CHAPTER 5. CONSULTATION AND COORDINATION

CHAPTER 5. CONSULTATION AND COORDINATION

CEQ regulations implementing NEPA require that federal agencies provide meaningful opportunities for the public and stakeholders to provide input and to identify their concerns during an EIS process. Federal laws such as the ESA, the CWA, and the NHPA mandate public involvement and consultation with agencies or federally recognized tribal governments.

This chapter documents the specific consultation and coordination efforts undertaken by the BLM throughout the entire process of developing this SDEIS. It also includes a list of agencies and individuals on the document distribution list.

5.1 Public Notice and Involvement

5.1.1 Notice of Intent and Public Scoping

The public scoping process was initiated on November 28, 2006, when the BLM published an NOI to prepare an EIS to offer the Alton Coal Tract for competitive leasing. Public scoping meetings were advertised in a variety of formats, at least two weeks prior to their scheduled dates (Table 5.1.1). In each format, the advertisements provided logistics, explained the purpose of the public meetings, gave the schedule for the public comment (scoping) period, outlined additional ways to comment, and provided methods of obtaining additional information.

Table 5.1.1. Meeting Advertisement Locations

Publicity Item	Venue		
NOI	*Federal Register*		
Fliers/Posters	Posted in the following communities in the given locations two weeks before the scheduled meetings:		
	Cedar City • Festival Hall Convention Center • Library • Walmart **Kanab** • Post office • Library • County offices • BLM-KFO • Grand Staircase-Escalante National Monument headquarters • Grand Staircase-Escalante National Monument visitors' center in Kanab	**Mt. Carmel** • Thunderbird Inn/Restaurant • Kane County Mobile Library **Orderville** • Post office • Grocery store **Glendale** • Post office **Hatch** • Restaurant/resort	**Panguitch** • Ace Hardware • Chevron station • City Hall • County Courthouse • County Clerk • Conoco station • Dixie National Forest Ranger Station • Garfield Memorial Healthcare Foundation Thrift Shop • Ice cream parlor • Library • Main Street Market • NAPA auto parts store • Post office • Sinclair Station • State liquor store • Cowboy Corner • C Stop Pizza • Country Corner I • Ice cream shop
Press Release	**Newspaper** • Deseret News • Garfield County Insider • Salt Lake Tribune • Southern Utah News • Spectrum	**Television** • KSL-TV Channel 5 • KUTV Channel 2 • KTVX Channel 4 • KSTU Channel 13	**Radio** • KXAZ 93.3 FM • KPGE 1340 AM

Five public scoping meetings were held at various locations and dates (Table 5.1.2). Each meeting was conducted in an open-house format, with BLM and ACD personnel present to answer questions and provide information. Other resources available at the public scoping meetings included informational display boards, one video explaining the conceptual mining and reclamation sequence, one video explaining a potential transportation route including truck details, and comment forms on which to submit comments at the meetings. Informational display boards and comment forms are available in the *Alton Coal Tract LBA EIS Public Scoping Report* (SWCA 2007a) prepared following completion of the scoping process. Copies of the videos are available at the BLM-KFO. The 90-day scoping period closed on February 26, 2007.

Table 5.1.2. Public Scoping Meeting Dates, Times, and Locations

Date	Time	City	Address
January 30, 2007	5:00–8:00 p.m.	Alton	Alton Town Hall 11 South 100 West, Alton, Utah 84710
January 31, 2007	5:00–8:00 p.m.	Kanab	Kanab City Library 374 North Main Street, Kanab, Utah 84741
February 1, 2007	5:00–8:00 p.m.	Panguitch	Triple C Arena 50 East 900 North, Panguitch, Utah 84759
February 6, 2007	5:00–8:00 p.m.	Cedar City	Cedar City Library 303 North 100 East, Cedar City, Utah 84720
February 7, 2007	5:00–8:00 p.m.	Salt Lake City	Salt Lake City Public Library 210 East 400 South, Salt Lake City, Utah 84111

Opportunities for public comment during the public scoping period consisted of the following:

- Public scoping meeting attendees could write comments on pre-addressed comment forms and submit them at the meeting (or mail at a later date).
- Emails could be sent to a dedicated email address: UT_Kanab_Altoncoal@blm.gov (please note that a new email address is being used for comments on the SDEIS: blm_ut_kn_altoncoal@blm.gov).
- Public letters could be mailed to BLM-KFO, Attention: Keith Rigtrup, 318 North 100 East, Kanab, Utah 84741 (please note that the Kanab Field Office's new address is 669 South Highway 89A, Kanab, Utah, 84741).
- Public letters could be faxed to Keith Rigtrup at (435) 644-4620.

At the end of the public scoping period, 7,788 responses were received. The bulk of these (7,352) were form letters received by email. The remainder were unique emails (167), email form letters with additional text (178), and letters received by mail, fax, or at scoping meetings (91). For a complete listing of responses received and descriptions of the scoping comment analysis process and scoping comments received, a copy of the *Alton Coal Tract LBA EIS Public Scoping Report* (SWCA 2007a) is available at the BLM-KFO and the BLM Utah State Office.

5.1.2 Notice of Availability and Public Comment Process on the Draft Environmental Impact Statement

Concurrent with publication and release of the DEIS, the EPA and BLM each published an NOA for the DEIS in the *Federal Register* on Friday, November 4, 2011 (*Federal Register* 76: 68501-68502). Public meetings were advertised in a variety of formats prior to their scheduled dates (Table 5.1.3). This NOA also included a notice of public hearing on the maximum economic recovery and fair market value associated with the proposed lease sale pursuant to 43 CFR 3425.4. This public hearing was held at the Festival Hall Convention Center public meeting in Cedar City, Utah, on December 6, 2011.

Table 5.1.3. Draft Environmental Impact Statement Public Meeting Advertisement Locations

Publicity Item	Venue		
NOA	*Federal Register*		
Fliers/Posters	Posted in the following communities in the given locations two weeks before the scheduled meetings:		
	Alton • Alton Town Hall **Cedar City** • Post office • Library • Walmart **Kanab** • Post office • Library • BLM-KFO • Grand Staircase-Escalante National Monument headquarters • Grand Staircase-Escalante National Monument visitors' center in Kanab • Honey's Marketplace • Glazier's Marketplace • Kanab Sinclair	**Mt. Carmel** • Mt. Carmel Junction Subway **Orderville** • Post office • Grocery store (Terry's Food and Drug) **Glendale** • Post office **Hatch** • Post office **Hwy 89/SR 14** • Tod's Country Store	**Panguitch** • City Hall • Library • Owen's Travel Center • Orton's Farm Center • Main Street Market • Silver Eagle Fuel Station Post office • KB Express • Cowboy store
Press Release	**Newspaper** • Deseret News • Salt Lake Tribune • Adventure Journal • Yahoo News/Associated Press	**Television** • KCSG TV	**Radio** • KCPW Public Radio 88.3 FM and 105.3 FM • KUER 90.1 FM

Five public meetings on the DEIS, including the public hearing on the maximum economic recovery and fair market value associated with the proposed lease sale, were held at various locations and dates (Table 5.1.4). The details of the public hearing were transcribed. Each meeting was conducted in an open-house format, with BLM personnel present to answer questions and provide information. Other resources available at the public meetings on the DEIS included 21 informational display boards used to help explain the NEPA process and describe the impacts of the Proposed Action in more detail. Handouts of these posters were also available for the public to review. Attendees were provided 1) comment forms on which to submit comments at the meetings, and 2) advice, based on BLM NEPA Handbook guidance, on how to comment effectively on an EIS document. Hard copies and CDs of the DEIS were available for review during the meeting and available to attendees upon request.

The original comment period on the DEIS of 60 days from NOA issuance was extended to 85 days due to public requests to extend the comment period. The comment period on the DEIS started November 4, 2011, and ended January 27, 2012.

Table 5.1.4. Draft Environmental Impact Statement Public Meeting Dates, Times, and Locations

Date	Time	City	Address
November 29, 2011	6:00–8:00 p.m.	Alton	Alton Town Hall 11 South 100 West, Alton, Utah 84710
November 30, 2011	6:00–8:00 p.m.	Kanab	Kanab City Library 374 North Main Street, Kanab, Utah 84741
December 1, 2011	6:00–8:00 p.m.	Panguitch	Panguitch City Hall and Library 25 South 200 East, Panguitch, Utah 84759
December 6, 2011 Included public hearing	6:00–8:00 p.m.	Cedar City	Festival Hall Convention Center 96 North Main, Cedar City, Utah 84720
December 7, 2011	6:00–8:00 p.m.	Salt Lake City	Salt Lake City Public Library 210 East 400 South, Salt Lake City, Utah 84111

Opportunities for public comment during the public comment period consisted of the following:

- Public meeting attendees could write comments on pre-addressed comment forms and submit them at the meeting (or mail at a later date).
- Emails could be sent to a dedicated email address: UT_Kanab_Altoncoal@blm.gov (please note that a new email address is being used for comments on the SDEIS: blm_ut_kn_altoncoal@blm.gov).
- Pubic letters could be mailed to BLM-KFO, Attention: Keith Rigtrup, 318 North 100 East, Kanab, Utah 84741 (please note that the Kanab Field Office's new address is 669 South Highway 89A, Kanab, Utah, 84741).
- Public letters could be faxed to Keith Rigtrup at (435) 644-4620.

5.1.2.1 SUMMARY OF PUBLIC COMMENT ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT

During the 85-day comment period, the KFO received 154,194 comment submittals on the DEIS. The bulk of these (144,146) were form letters (seven types). The BLM received a total of 933 unique (nonform) submittals, and 9,115 form letters that had additional unique text. Submittals were received by email, mail, facsimile, or by written comment at public meetings. Submittals were also received by transcript during the public hearing that took place on December 6, 2011, in Cedar City (see Section 5.1.2).

In all, the 154,194 submittals received resulted in 15,053 comments. Approximately half of the comments (7,145) indicated general opposition to the lease, whereas 130 indicated general support of the lease. Of the 7,145 comments in general opposition to the lease, over half (4,391 or 61%) indicated that their opposition was primarily due to the proposed tract's proximity to Bryce Canyon National Park. Approximately 3,300 comments received (22%) were out of the scope of the decision to be made by the BLM, primarily because many of these comments cited the need for renewable energy development on public land rather than further fossil fuel resource extraction.

Substantive and non-substantive comments received by the BLM on various topics focused on either resource concerns or the BLM's decision process. See Table 5.1.5 for a full count of comments (substantive and non-substantive) received on the DEIS by subject category.

Table 5.1.5. Comments Received on the Draft Environmental Impact Statement by Subject Category

Subject Category	Number of Comments	Subject Category	Number of Comments
Socioeconomics	925	Visual resources	45
Air resources	696	Proposed Action	36
Multiple resources	607	Public involvement	33
Bryce Canyon/national parks	382	Effects analysis	31
Water resources	256	Noise	22
Decision process	246	Land use and access	16
Public health and safety	218	Soils	15
Transportation	170	Geology and minerals	13
Special status species	163	Aesthetic resources	11
Cultural resources	96	Paleontology	11
Wildlife	95	Natural resources	5
Alternatives	84	Hazardous materials	3
Night sky	74	Livestock grazing	3
Purpose and need	70	Fire management	2
Vegetation	65	Special designations	1
Recreation	50	Miscellaneous*	10,609

* Miscellaneous comments include comments in support or opposition to the lease and comments out of the scope of the decisions to be made by the BLM.

All substantive public comments received on the DEIS were considered in the development of the SDEIS; however, a full listing of comments and responses will not be provided until the FEIS is released to the public.

The BLM's original intent was that an FEIS would be prepared following the public comment and response period on the DEIS, in which all responses to comments on the DEIS would be published in table format. However, because of the nature of comments received on the DEIS, the BLM made the decision to issue a detailed SDEIS (which includes a 60-day public comment period) followed by an FEIS. As a result, the BLM has addressed the substantive comments received on the DEIS in the text, content, and analyses presented in this SDEIS, but will only provide DEIS and SDEIS responses to comments in the FEIS.

5.1.3 Notice of Availability and Public Comment Process on the Supplemental Draft Environmental Impact Statement

Concurrent with publication and release of the SDEIS, the EPA and BLM each publish an NOA for the SDEIS in the *Federal Register*. The BLM NOA would typically also include a notice of public hearing on the maximum economic recovery and fair market value associated with the proposed lease sale pursuant to 43 CFR 3425.4; however, the BLM fulfilled its obligation to do so as part of the DEIS public involvement process (see Section 5.1.2). Public meetings on the SDEIS are scheduled to take place in the same locations as those that occurred for the DEIS: Alton, Kanab, Panguitch, Cedar City, and Salt Lake City, Utah. The comment period on the SDEIS will be 60 days from the NOA publication date.

Parties on the distribution lists for the DEIS and those who requested copies of the FEIS have been sent copies of the SDEIS and will be sent copies of the FEIS when it is completed. Also, the EPA and BLM will each publish an NOA for the FEIS. After a 30-day availability period, the BLM will make a decision to hold or not to hold a competitive lease sale for the federal coal in the tract, and a ROD for the tract will be issued. If the decision is to hold a competitive lease sale, the BLM will also decide what lease stipulations to attach to the lease. Copies of the ROD will be mailed to parties on the mailing list and others who commented during the NEPA process. There will be a 30-day appeal period after the ROD is signed but before the ROD is implemented.

5.2 Coordination and Consultation

5.2.1 Cooperating Agency Involvement

In fall 2006, the BLM invited the OSM to participate in the EIS process as a cooperating agency. Following the scoping process, cooperating agency status was also extended to the State of Utah (including its agencies). After publication of the DEIS, the following entities were added as formal cooperating agencies for the EIS process pursuant to NEPA: EPA, NPS (Bryce Canyon National Park), and Kane County. The offer of cooperating agency status was extended to USFWS, USACE, and Garfield County, but no formal responses were received by the BLM to confirm acceptance. Although not formal cooperators, the USFWS, USACE, and Garfield County have had the opportunity to participate in stakeholder and working group processes as well as to review the analysis in the administrative draft version of this EIS prior to public release (in addition to the ability to provide scoping comments and public comments on the DEIS and SDEIS during their respective public comment periods). All cooperating agencies have also been encouraged to participate in the aforementioned processes and reviews.

5.2.2 Section 106 and Government-to-government Consultations

The BLM is engaged in Section 106 and formal government-to-government consultation with several parties with interest in the tract and has prepared a PA for the Alton Coal Tract LBA as required by NHPA Section 106 regulations in 36 CFR 800.14.

Section 106 of the NHPA requires that federal agencies consider the effects of their actions on cultural resources, following regulation in 36 CFR 800. Under these regulations, consultation for effects to historic properties is required. Historic properties under the NHPA are properties that are included in the NRHP or that meet the criteria for the NRHP. Section 106 of the NHPA requires that a federal agency, upon determining that activities under its control could affect historic properties, consult with the Advisory Council on Historic Preservation, the appropriate SHPO officer and/or tribal historic preservation officer, and with consulting parties as defined by 36 CFR 800.2. Under NEPA, any impacts to tribal, cultural, or other treaty resources must be analyzed and mitigated.

5.2.2.1 SECTION 106 CONSULTATION

The BLM initiated Section 106 consultation regarding archaeological sites located within the tract with the SHPO in 2007 by email correspondence and telephone communication. An inventory report (Report U-05-1568-b, p) for private and BLM lands was provided to SHPO on July 11, 2007. SHPO's reply on August 29, 2007, (by email) began the consultation process regarding the eligibility of sites for the NRHP. Report U-07-BL-0969-b, a BLM cultural resources inventory report covering additional BLM lands, was provided to SHPO on September 25, 2007. Following consultation with SHPO and a field meeting on October 23, 2007, concurrence on site eligibility was provided by email on November 16, 2007. The final version of Report U-05-MQ-1568b.p. with all site eligibility determinations agreed upon by the BLM and SHPO was provided on January 9, 2008. A separate cultural resources inventory and report (Report U-05-MQ-0346-p), related only to the Coal Hollow Mine, was completed and submitted to SHPO on March 10, 2006. The BLM reviewed this report but otherwise had no involvement in its production or submittal to SHPO, because no BLM-managed surface or sub-surface is present in this area. The BLM has no record of the SHPO's reply to this report. An additional private land report (Report U-08-MQ-0539) was provided to SHPO that also does not apply to the BLM action, and there is no BLM record of the SHPO's reply in this case either.

The Class III cultural resource surveys that were conducted on the tract resulted in the documentation of 113 cultural resources, consisting of five historic sites, six multicomponent prehistoric/historic sites, and 102 prehistoric sites. Of these, 92 have been determined to be eligible for the NRHP.

The BLM understands that the Coal Hollow Mine and the Alton Coal Tract leasing processes are related activities (though not connected actions under NEPA), and because they are related, the BLM began to develop a combined CRMP. This proposed CRMP was briefly outlined in the DEIS. The draft CRMP, however, did not adequately address historic property types other than archaeological sites, was geographically limited to only the tract, and did not fully involve consulting parties as required by 36 CFR 800. Accordingly, the BLM and OSM, in consultation with SHPO, decided to develop a PA pursuant to 36 CFR 800.14 that would provide for a comprehensive consideration of possible effects to historic properties.

The process to develop this PA was initiated in a meeting between the BLM, OSM, and SHPO on December 8, 2011. At that meeting, the BLM, in consultation with SHPO, developed a plan to involve the public and identified potential consulting parties. Potentially interested consulting parties were contacted by a letter dated March 6, 2012, and were invited to participate in the development of a PA. Meetings with consulting parties were held on March 22, 2012, May 16, 2012, October 4, 2012, December 13, 2012, and February 21, 2013, to discuss details of the PA.

The PA developed for the Alton Coal Tract LBA

- requires ongoing consultation with Indian tribes;
- defines the APE and provides processes for identification of historic properties;
- details reporting requirements and report review periods for historic property inventories and mitigation reports;
- specifies that a HPTP be developed that addresses adverse effects to historic properties and that provides measures to avoid, minimize, or mitigate those effects; and
- provides for ongoing involvement of consulting parties.

5.2.2.2 GOVERNMENT-TO-GOVERNMENT CONSULTATION

In August 2005, the BLM sent tribal consultation letters to the tribes list in Table 5.2.1. Of these, the Hopi, Zuni, and Paiute Indian Tribe of Utah have responded in writing to date. They requested copies of the cultural resources survey reports and indicated that they will continue formal consultation if any prehistoric cultural resources would be adversely affected by mining on the tract. As part of the government-to-government consultation process, the BLM also conducted a field visit with the Kaibab Band of Paiute Indians. Additionally, tribes were invited to participate as consulting parties in development of the PA by letter dated March 6, 2012, though none elected to participate.

Table 5.2.1. Tribes Receiving Tribal Consultation Letters

Cedar Band of Paiutes	Navajo Nation – Cameron Chapter	Navajo Nation – Olijato Chapter
Hopi Tribe	Navajo Nation – Coalmine Canyon Chapter	Navajo Nation – Tuba City Chapter
Indian Peak Band of Paiutes	Navajo Nation – Coppermine Chapter	Navajo Nation – Window Rock, AZ
Kaibab-Paiute Tribe	Navajo Nation – Historic Preservation Department	Paiute Tribes of Utah
Kanosh Band of Paiutes	Navajo Nation – Kaibeto Chapter	Pueblo of Zuni
Koosharem Band of Paiutes	Navajo Nation – Lechee Chapter	San Juan Southern Paiute
Navajo Nation – Bodaway/Gap Chapter	Navajo Nation – Navajo Mountain Chapter	Shivwits Band of Paiutes
Ute Cultural Rights and Preservation	–	–

5.2.3 U.S. Fish and Wildlife Service Section 7 Consultation

Section 7 of the ESA requires federal agencies to ensure that their actions do not jeopardize the continued existence of threatened or endangered species or result in the destruction of their designated critical habitat. It also requires consultation with the USFWS in making that determination.

The BLM has initiated consultation with the USFWS by informal email correspondence and teleconference meetings. The BLM obtained from the Utah Ecological Services Field Office of the USFWS a list of endangered or threatened species (or species proposed for listing) that may occur on the tract or that may be affected by mining on the tract. The BLM is currently preparing a biological assessment to determine if the development and/or operation of the tract would have any effects on those species. Additional information with respect to the evaluation of potential impacts to endangered or threatened species is contained in Appendix I.

5.2.4 U.S. Army Corps of Engineers

The USACE contacted the BLM in September 2009 to express their interest in the Alton Coal Tract LBA. The USACE was invited to participate in bi-weekly teleconferences with the BLM and cooperating agencies. Following publication of the DEIS, the USACE was invited by the BLM to be a formal cooperator, but USACE did not accept the invitation. In response to the BLM's invitation to participate as a consulting party in the development of the PA described above, the USACE provided the following response in writing:

> In response to your March 6, 2012 invitation to participate as a consulting party under Section 106 of the National Historic Preservation Act, and the possible future applicant request for Department of the Army (DA) authorization, for unavoidable discharges of dredged or fill material into waters of the United States at Alton Coal Tract, we hereby designate Bureau of Land Management as the lead federal agency to act on our behalf for purposes of compliance with the Section 7 of the Endangered Species Act and Section 106 of the National Historic Preservation Act (NHPA). (USACE 2012c)

A third-party contractor, Frontier Corporation, conducted wetland delineation and waters of the U.S. fieldwork and data analysis for the approximately 3,580-acre tract, and as a result produced a wetland and stream channel delineation report (see Appendix I). The USACE issued a preliminary JD concurring with the results of the delineation report (amount and location of wetlands and/or other water bodies on the site) on November 6, 2012. As per CWA Section 404 consultation, the preliminary determination was conducted to identify the potential limits of wetlands and other water bodies that may be subject to USACE's jurisdiction.

5.2.5 Air Resources Stakeholder Group

In November 2008, the BLM created an Air Resource Stakeholder Group. This group comprised participants from the EPA, OSM, State of Utah (DOGM, State Attorney General's Office, Public Lands Policy Coordination Office, and Division of Air Quality), NPS, ACD (including its contractors), and the BLM. Third-party contractor representatives also participated in the stakeholder group as the analysis team. This stakeholder group provided input to the development of the air resources analysis protocol that was used as the basis for the emissions inventory and the analysis of potential air resources impacts in the DEIS. Section 4.3 of the DEIS contains the results of the analysis, whereas the technical support document, which provides additional details on methodologies and results, can be found in Appendix K of the DEIS.

The Air Resources Stakeholder Group was reinitiated following publication of the DEIS to determine which changes should be made to the air resources modeling, analysis, and approach in the SDEIS to adequately address public and agency comments on the DEIS. The stakeholder group comprised participants from the BLM, EPA, OSM, State of Utah (DOGM, State Attorney General's Office, Public Lands Policy Coordination Office, and Division of Air Quality), NPS (Bryce Canyon and Zion National Parks, Air Resources Division), USACE, ACD (including its contractors), and third-party contractor representatives. From December 2012 through June 2013, the stakeholder group worked on a revised approach for the technical report and SDEIS, mitigation measures, and monitoring plans. Modifications to the air resources analysis are detailed in Section 3.3 and 4.3 and in the *Supplement to Air Resources Impact Assessment Technical Report for the Alton Coal Lease by Application*, found in Appendix K. Project design features, the adaptive management strategy (including monitoring), and potential mitigation measures can be found in Sections 4.3.1, 4.3.1.1, and 4.3.5 respectively. Section 5.4 provides a full listing of participants and contributors to the Air Resources Stakeholder Group.

5.2.6 Night Sky Impact Assessment and Mitigation Working Group

In September 2008, the BLM engaged the NPS Night Sky Program Manager, Chad Moore, to assist with the impact analysis for night sky. A night sky analysis contractor, Dark Sky Partners (an LLC-based in Arizona), was also engaged in this process as a subconsultant to the BLM's third-party contractor (SWCA). Together, the BLM, NPS, ACD, Dark Sky Partners, and SWCA agreed on the impact analysis approach for the DEIS, including observation points and model inputs. The impact analysis for the DEIS was evaluated by NPS, and the results are detailed in Section 4.2 and Appendix J of the SDEIS.

In May 2012, the BLM reconvened a Night Sky Working Group comprising the BLM, NPS, Dark Sky Partners, Kane County, and SWCA to address comments on the Alton Coal Tract LBA DEIS and to address issues requiring agency coordination in regard to impacts to dark skies. In response to comments on the DEIS, the primary objectives of the group were to update the modeling and technical analyses and approach and update the technical report for publication in the SDEIS. The updated technical report was completed in early 2014 (see Appendix J). In addition, as a result of discussions and addressing comments, the group produced a mitigation memorandum outlining strategies for avoiding and reducing impacts, where possible, to the region's dark skies as a result of leasing and mining the Alton Coal Tract. The results of this memorandum are reflected in the mitigation strategies presented in Section 4.2.5 of the SDEIS. See Section 5.4 for a list of working group participants.

5.2.7 Greater Sage-grouse Mitigation Planning Working Group

A large number of comments were received on the DEIS concerning potential impacts to the Greater Sage-grouse as a result of leasing and mining the tract. The BLM decided to address public and agency concerns regarding sage-grouse by a formal working group process that began in April 2012. The working group was directed to produce a plan describing a strategy for avoiding and reducing impacts, where possible, to the sage-grouse populations potentially affected by leasing and mining the Alton Coal Tract. A formal sage-grouse mitigation plan was developed for inclusion in the SDEIS (see Appendix E). Updates to the SDEIS sage-grouse analysis were also made as a result of the working group process, and can be found in Section 3.18 and 4.18. See Section 5.4 for a list of working group participants and contributors to the plan.

5.2.8 Noise Modeling Working Group

Following publication of the DEIS, a working group was established to address and respond to comments received on the DEIS regarding concern for noise-related resource impacts as a result of leasing and mining the tract. The purpose of the working group was to establish a modeling approach and protocol, to model potential changes in ambient noise conditions as a result of leasing and mining the tract, and to

produce a technical report for inclusion in the SDEIS (see Appendix L). The working group included participants from the BLM, NPS, USFWS, Kane County, and SWCA. See Section 5.4 below for a full list of participants.

5.2.9 Socioeconomics and Environmental Justice Working Group

A working group was established to address the EPA's comments on revising the socioeconomic analysis to properly characterize impacts to potential EJ communities as a result of leasing and mining the tract. The working group included participants from the BLM, EPA, and SWCA to address the EPA's comments on the DEIS by establishing an approach and protocol for identifying potential EJ communities by using the most current census data (at the time of publication of the DEIS, 2010 Census Data had just been released and were only partially processed for local government and census boundary units). The EPA and BLM agreed on an appropriate data source as well as the analysis approach, which is reflected in Section 3.12 and 4.12. See Section 5.4 below for a full list of participants.

5.2.10 Water Resources Working Group

In April 2013, a working group was formed to address and respond to comments on the DEIS related to water resources impacts as a result of leasing and mining the tract. This working group included participants from the BLM, DOGM, and third-party contractor representatives (SWCA and Erik Petersen). The group, which comprised individuals with special knowledge of hydrology and hydrogeology in general and related specifically to the tract, worked to appropriately update the analysis to address comments on the DEIS (see Section 3.16 and 4.16). See Section 5.4 below for a full list of participants.

5.3 Department of Justice Consultation

If the BLM decision is to hold a competitive lease sale for the federal coal in the tract after the competitive coal lease sale but prior to issuance of a lease, the BLM will solicit the opinion of the DOJ on whether the planned lease issuance creates a situation inconsistent with federal anti-trust laws. The DOJ is allowed 30 days to make this determination. If the DOJ has not responded in writing within the 30-day period, the BLM can proceed with issuance of the lease.

5.4 List of Preparers, Reviewers, and Contributors

This EIS was prepared by SWCA, a third-party contractor, under the direction of the BLM. Representatives from cooperating and contributing agencies also prepared, reviewed, and contributed to the EIS. Table 5.4.1 provides a list of cooperators, contributors, and reviewers from federal, state, and local agencies. Table 5.4.2 provides a list of BLM personnel who prepared, reviewed, and contributed to this EIS. Table 5.4.3 provides a list of the third-party contractor personnel, including subcontractors, who prepared, reviewed, and contributed to this EIS. Table 5.4.4 provides a list of other contractors who conducted field studies, authored reports, and/or reviewed sections of the EIS.

Table 5.4.1. Cooperators, Contributors, and Reviewers from Federal, State, and Local Agencies

Name	Organization/Entity	Project Responsibility
Abate-Adams, April	DOGM	Cooperator; Water Resources Working Group
Allen, Dana	EPA	Cooperator; Air Resources Stakeholder Group; Socioeconomics and Environmental Justice Working Group
Baza, John	DOGM	Cooperator; document review
Black, Jon	Utah Department of Environmental Quality, Division of Air Quality	Cooperator; Air Resources Stakeholder Group
Bohan, Suzanne	EPA	Cooperator; document review
Boswell, Rhett	UDWR	Cooperator; Sage-Grouse Mitigation Planning Working Group
Bradybaugh, Jeff	Bryce Canyon National Park	Cooperator; Air Resources Stakeholder Group; Night Sky Working Group; Sage-Grouse Mitigation Planning Working Group; Noise Modeling Working Group
Bremner, Brian	Garfield County	Sage-Grouse Mitigation Planning Working Group
Burton, Priscilla	DOGM	Cooperator; document review, Air Resources Stakeholder Group
Calle, Marcello	OSM	Document review
Clarke, Kathleen	Utah Public Lands Policy Coordination Office	Cooperator; Air Resources Stakeholder Group
Clementsen, Karen	USACE	Wetland preliminary jurisdictional determination
Dean, Dana	DOGM	Cooperator; document review
DeFreese, Amy	USFWS	Document review; Night Sky Working Group; Sage-Grouse Mitigation Planning Working Group; Noise Modeling Working Group
Distler, Ken	EPA	Cooperator; Air Resources Stakeholder Group
Frey, Nicki	CoCARM	Sage-Grouse Mitigation Planning Working Group
Furhmann, Kelly	Bryce Canyon National Park	Cooperator; Air Resources Stakeholder Group
George, Mike	NPS - Air Resource Division	Cooperator; Air Resources Stakeholder Group
Golden, Kevin	EPA	Cooperator; Air Resources Stakeholder Group
Haddock, Daron	DOGM	Cooperator; Water Resources Working Group
Haas, Sarah	Bryce Canyon National Park	Cooperator; Air Resources Stakeholder Group; Noise Modeling Working Group
Hanley, James	EPA	Cooperator; Air Resources Stakeholder Group
Harja, John	Utah Public Lands Policy Coordination Office	Cooperator; Air Resources Stakeholder Group
Helfrich, Joe	DOGM	Cooperator; Air Resources Stakeholder Group
Hoffman, Ken	DOGM	Cooperator; Water Resources Working Group
Holland, James	Grand Staircase-Escalante National Monument	Document review
Hunsaker, Lori	Utah SHPO	Programmatic Agreement
Hyatt, Kim	Bryce Canyon National Park	Cooperator; Night Sky Working Group
Johnson, Katie	Bryce Canyon National Park	Cooperator; Air Resources Stakeholder Group; Night Sky Working Group
Johnson, Susan	NPS - Air Resource Division	Cooperator; Air Resources Stakeholder Group

Table 5.4.1. Cooperators, Contributors, and Reviewers from Federal, State, and Local Agencies

Name	Organization/Entity	Project Responsibility
Kershaw, Byard	Kane County	Cooperator; Air Resources Stakeholder Group; Night Sky Working Group; Sage-Grouse Mitigation Planning Working Group; Noise Modeling Working Group
Kirby, Foster	OSM	Cooperator; EIS project coordinator; document review; Air Resources Stakeholder Group; Night Sky Working Group; Sage-Grouse Mitigation Planning Working Group
Legg, Kristin	Zion National Park	Cooperator; Air Resources Stakeholder Group
Matson, Jim	Kane County Commission	Cooperator; Air Resources Stakeholder Group; Night Sky Working Group; Sage-Grouse Mitigation Planning Working Group; Noise Modeling Working Group
McQueary, Pat	USACE	Air Resources Stakeholder Group; wetland preliminary jurisdictional determination
Moore, Chad	NPS Night Sky Team	Cooperator; Night Sky Working Group
Nielsen, Kezia	Zion National Park	Cooperator; Air Resources Stakeholder Group
Notar, John	NPS - Air Resource Division	Cooperator; Air Resources Stakeholder Group
Payne, Val	Utah Public Lands Policy Coordination Office	Cooperator; EIS coordinator
Poe, Kevin	Bryce Canyon National Park	Cooperator; Night Sky Working Group
Pranger, Hal	OSM	Cooperator; document review
Razzazian, Christopher	EPA	Cooperator; Air Resources Stakeholder Group; Socioeconomics and Environmental Justice Working Group
Rathbun, Richard	State of Utah, Attorney General's Office	Cooperator; Air Resources Stakeholder Group
Ray, John	NPS - Air Resource Division	Cooperator; Air Resources Stakeholder Group
Schaible, Dustin	UDWR	Cooperator; Sage-Grouse Mitigation Planning Working Group
Schichtel, Bret	NPS - Air Resource Division	Cooperator; Air Resources Stakeholder Group
Schrage, Laura	Bryce Canyon National Park	Cooperator; Air Resources Stakeholder Group
Sharrow, Dave	Zion National Park	Cooperator: Air Resources Stakeholder Group
Sorenson, Nile	UDWR, NRCS	Cooperator; Sage-Grouse Mitigation Planning Working Group
Stacy, Andrea	NPS - Air Resource Division	Cooperator; Air Resources Stakeholder Group
Truskowski, Brent	EPA	Cooperator; document review
Turina, Frank	NPS - Policy, Planning, and Compliance	Cooperator: Noise Modeling Working Group
Vaughan, Molly	EPA	Cooperator; document review
Vimont, John	NPS - Air Resource Division	Cooperator; Air Resources Stakeholder Group
White, Susan	DOGM	Cooperator; document review
Yoder, David	Utah Public Lands Policy Coordination Office	Cooperator; Air Resources Stakeholder Group

Table 5.4.2. BLM Personnel Who Prepared, Reviewed, and Contributed to this Environmental Impact Statement

Name	Title, Education	Project Responsibility
Alberts, Dan	GIS Analyst	GIS analysis and mapping
Ashcroft, Tyler	Utah State Office, Planning & Environmental Coordination Specialist	NEPA oversight, EIS review
Bankert, Roger	Utah State Office Division of Lands & Minerals, Minerals Support Supervisor	EIS review
Barber, Harry	KFO Field Manager; B.S., Wildlife Range Science; M.S., Wildlife	Air Resources Stakeholder Group, Sage-Grouse Mitigation Planning Working Group
Beckstrand, Randy	Utah State Office; B.S., Range Science Currently Dixie National Forest range specialist	EIS review
Bryant, Lisa	Utah State Office; B.S., General Agriculture; M.S., Social Science Currently Moab Field Office assistant field manager	EIS review, Air Resources Stakeholder Group
Caplan, Susan	BLM National Operations Center, Air Quality; B.S., Meteorology and Mathematics; M.S., Air Resource Management	Air Resources Stakeholder Group
Chi, Renee	Utah State Office; Wildlife Biologist	EIS review
Christensen, Tom	Outdoor Recreation Planner; B.S., Forestry; M.S., Forest Recreation	Recreation, aesthetic resources (visual, noise, night sky), Sage-Grouse Mitigation Planning Working Group
Church, Lisa	Wildlife Biologist; B.S., Wildlife; B.S., Fisheries Ecology	Threatened, endangered, or candidate wildlife species, wetlands/riparian zones, fish and wildlife, Sage-Grouse Mitigation Planning Working Group
Glasson, Mike	Price Field Office Coal Group	Recoverable coal estimates
Gubler, Carson	Range Specialist; B.S., Biology/Botany	Air quality; floodplains; invasive, non-native species; threatened, endangered, or candidate plant species; water quality (drinking/ground); rangeland health standards and guidelines; fuels/fire management
Herr, Leonard	Utah State Office Air Quality Specialist; B.S., Natural Resources	Air Resources Stakeholder Group
Holland, James	KFO Geologist	Air Resources Stakeholder Group, Water Resources Working Group
Jarnecke, Jeremy	Utah State Office; Hydrologist	EIS review
Jarnecke, Pam	Utah State Office; Supervisory Planning & Coordination	EIS review
Leverette, Mitchell	Division Chief; BLM Washington Office, Division of Solid Minerals	Geology/mineral resources
Lewis, John	Mining Engineer, BLM Washington Office, Division of Solid Minerals	Geology/mineral resources
McKenzie, Jeff	Utah State Office Solid Minerals Group; M.B.A., Finance; B.S., Mining Engineering	EIS review, Air Resources Stakeholder Group, Night Sky Working Group, Sage-Grouse Mitigation Planning Working Group, Noise Modeling Working Group, Water Resources Working Group
McKinley, Mike	Utah State Office; Environmental Scientist	EIS review
Nicholls, Craig	BLM National Operations Center, Air Quality	Air Resources Stakeholder Group
Perkes, Stan	Utah State Office Solid Minerals Group; B.S., Mining Engineering	EIS review

Table 5.4.2. BLM Personnel Who Prepared, Reviewed, and Contributed to this Environmental Impact Statement

Pope, Dennis	KFO Assistant Field Manager (Retired)	EIS review, Air Resources Stakeholder Group
Powell, J. Doug	Geologist; B.S., Geology; Graduate Certificate-Hazardous Waste Control (no longer with the BLM)	Wastes (hazardous or solid); geology/mineral resources
Radden-Lesage, Bill	Mining Engineer, BLM Washington Office, Division of Solid Minerals	Geology/mineral resources
Reese, John	Range Specialist; B.S., Rangeland Resources	Livestock grazing woodland/forestry, vegetation, soils
Rigtrup, Keith	Color Country District Office Environmental Coordinator; B.A., Economics	EIS project manager, Air Resources Stakeholder Group, Night Sky Working Group, Sage-Grouse Mitigation Planning Working Group, Socioeconomics and Environmental Justice Working Group, Water Resources Working Group
Suhr-Pierce, Julie	Utah State Office; Socioeconomist; Ph.D.	EIS review
Summers, Paul	NOC Geologist; B.S., Geology	EIS review
Thayne, Greg	Utah State Office NEPA Coordinator (retired)	EIS review
Thomas, Nate	Archaeologist	PA
Titus, Alan	Paleontologist; B.S., Geology; M.S., Geology; Ph.D., Geology	Paleontology
Wolfe, Hugh	Realty Specialist	Lands and access
Zweifel, Matt	Archaeologist; B.S., Anthropology; M.A., Archeology	Cultural resources, Native American religious concerns, Section 106 consultation, government-to-government consultation

Table 5.4.3. Third-party Contractor Personnel, including Subcontractors, who Prepared, Reviewed, and Contributed to this Environmental Impact Statement

Name	**Education/Experience**	**Project Responsibility**
SWCA		
Bollong, Chuck	Ph.D., Anthropology; M.A., Anthropology; M.A., Archaeology; B.A., Archaeology; 27 years of experience	Cultural resources
Beck, Kelly	Ph.D. (candidate), Anthropology; M.A., Anthropology; B.S., Anthropology; 18 years of experience	Cultural resources, PA
Cannon, Mike	Ph.D., Anthropology; M.A., Anthropology; B.A., Anthropology; B.A., English; 18 years of experience	Cultural resources
Childs, Amanda	B.S., Environmental Studies; 16 years of experience	Document review and preparation
Christensen, John	M.S., Geology; B.S., Geology; 31 years of experience	Water resources
Eyre, Jeremy	B.A., Political Science; J.D., Environmental & Natural Resources Law; 11 years of experience	Geology and minerals, livestock grazing, land use and access, hazardous materials, paleontology, fire management, vegetation and special status species, wildlife and special status species, water resources, report review, stakeholder and working groups
Gaddis, Benjamin	M.E.M., Water Resources; B.S., Environmental Science; 12 years of experience	Project management, public involvement, report preparation and review, EIS preparation and review, stakeholder and working groups

Table 5.4.3. Third-party Contractor Personnel, including Subcontractors, who Prepared, Reviewed, and Contributed to this Environmental Impact Statement

Gaddis, Erica	Ph.D., Natural Resources; M.S., Environmental Science and Policy; B.S., Biology and Environmental Science; 11 years of experience	Water resources
Guinn, Janet	B.S., Psychology and Anthropology; 11 years of experience	Hazardous materials, fire management, public involvement
Hornbeck, Hope	B.A., Environmental Biology; M.S., Plant Biology; 13 years of experience	Vegetation and special status species, wildlife and special status species, soils
Hornung, Elisha	B.S., Environmental Studies; 12 years of experience	Livestock grazing, land use and access, hazardous materials, paleontology, fire management, public involvement
Knox, Steve	B.S., Watershed Management; 36 years of experience	Document review and report preparation, Air Resources Stakeholder Group
Larson, Greg	B.A., Geography; M.S., Watershed Science	Water resources, soils
Leslie, Steve	B.S., Natural Resource Management; 14 years of experience	Aesthetic resources, transportation
Lombardi, Kathy	B.S., Environmental Engineering; M.S., Civil and Environmental Engineering; 19 years of experience	Document review and public scoping
McCulley, Audrey	B.S., Biology; 9 years of experience	Wildlife and vegetation field studies and reporting
Morrow, Dave	B.A., Environmental Studies; 24 years of experience	Air resources, noise
Nelson, Megan	B.A., English; 4 years of experience	Administrative record, document formatting and production, glossary, references
Pecorelli, John	B.S., Journalism; B.S., Physical Anthropology; 18 years of experience	Technical editing, references
Reber, Deb	B.S., Natural Resource Management; 18 years of experience	Soils
Reinhart, Dave	B.A., Anthropology; 12 years of experience	GIS analysis
Semerad, Gretchen	B.S, Biology; M.S. Environmental Science; 10 years of experience	Air resources, soils
Sharp, Thomas	B.S., Biology; M.S., Biology; 18 years of experience	Wildlife and vegetation field studies and reporting
Sohm, Brad	B.S., Chemical and Environmental Engineering; 10 years of experience	Noise analysis
Steed, David	B.S. in Progress, 21 years of experience	Document review
Stutz, Allen	B.S., Biology/Ecology; B.S., Zoology; 13 years of experience	GIS analysis
Summerhays, Jan	B.A., Environmental Studies; 5 years of experience	Vegetation and special status species, fire management
Tucker Burfitt, Linda	B.A., Media Communications; A.F., Forestry, A.S.; Ecosystem Management; 11 years of experience	Formatting, technical editing, publishing
Ulacky, Nicole	B.A., Environmental Policy; M.P.A., Public Administration; 10 years of experience	Aesthetic resources, socioeconomics
Vernon, Laura	B.A., Psychology; M.P.A., Public Administration; 10 years of experience	Socioeconomics
Weekley, George	B.S., Plant and Soil Science; M.S., Forestry; 13 years of experience	Recreation
Whitley, Daniel	B.S., Chemical Engineering; 3 years of experience	Noise analysis
Wilmot, Sue	Ph.D., Human Dimensions of Ecosystem Science and Management; M.E.M., Water Resources; B.S., Biology; 12 years of experience	Soils, livestock grazing, transportation

Table 5.4.3. Third-party Contractor Personnel, including Subcontractors, who Prepared, Reviewed, and Contributed to this Environmental Impact Statement

SUBCONTRACTORS FOR SWCA		
Marquez Environmental Services, Inc.		
Addison, Ted	(Addison Air Consulting subcontracting to Marquez Environmental Services, Inc.) M.S., Environmental Engineering; B.S., Meteorology; 22 years of experience	Air resources analysis
Dismukes, Jerry	(Cornerstone Environmental subcontracting to Marquez Environmental Services, Inc.) M.S., Atmospheric Sciences; B.S., Atmospheric Sciences; 12 years of experience	Air resources analysis
Marquez, Lori	M.S., Environmental Sciences; B.S., Electrical Engineering; 18 years of experience	Air resources analysis
Zimmer, Robert	B.S., Mathematics; 32 years of experience	Air resources analysis
Dark Sky Partners, LLC		
Davis, Don	Ph.D., Physics; B.S., Physics; 45 years of experience	Night sky analysis, Night Sky Working Group
Luginbuhl, Chris	B.S., Physics; 32 years of experience	Night sky analysis, Night Sky Working Group
Fehr & Peers Transportation Consultants		
Nepstad, Jon	B.A., Liberal Arts; M.S., Urban Planning; 23 years of experience	Public involvement, report review
Stinger, Preston	B.S., Civil Engineering; 6 years of experience	Report preparation and review

Table 5.4.4. Other Contractors Who Conducted Field Studies, Authored Reports, and/or Reviewed Environmental Impact Statement Sections

Name	Education and Experience	Project Responsibility
Boice, Jeff (Frontier Corporation USA)	Wetlands Scientist	Wetland field studies and reporting
Collins, Patrick (Mt. Nebo Scientific, Inc.)	Ph.D., Botany; B.A., M.S., Biology; 35 years of experience	Wildlife and vegetation field studies and report review, sandloving penstemon field studies and reporting, wetland field studies and reporting
Covington, Collin (Frontier Corporation USA)	Wetlands Scientist	Wetland field studies and reporting
Dragoo, Denise	Snell & Wilmer	Document review
Johnson, Chris (JBR)	B.S., Meteorology; 32 years of experience	Air quality
Petersen, Erik (Petersen Hydrologic)	M.S., Hydrogeology; B.S., Geology; 21 years of experience	AVFs reconnaissance survey and reporting, water resources, and geology and minerals review
Strom, Dave (JBR)	B.S., Meteorology; 12 years of experience	Air quality
Wenger, Dennis (Frontier Corporation USA)	Sr. Wetlands Ecologist	Wetland field studies and reporting

5.5 Distribution

Pursuant to 40 CFR 1502.19, the BLM circulated the DEIS, is circulating this SDEIS, and will circulate the FEIS to 1) agencies having jurisdiction by law or special expertise with respect to any environmental impact involved and any appropriate federal, state, or local agency authorized to develop and enforce environmental standards, 2) the applicant; 3) any agencies, organizations, or individuals requesting a copy of the document. In regard to 40 CFR 1502.19(d), which requires circulation of an FEIS to any person, organization, or agency that submitted substantive comments on the draft, the SDEIS and FEIS will be published in their entirety online in conjunction with required public announcements of their availability for review and details regarding the opportunity for public comments.

5.5.1 Draft Environmental Impact Statement Distribution List

The Alton DEIS distribution list was developed from the stakeholder lists compiled prior to and during the scoping process and then supplemented throughout the planning process.

Table 5.5.1 lists the individuals that requested copies of the DEIS either during the scoping process, in their public comments, or on the sign-up sheet at the public meetings. Requests were made for a hardcopy, a CD, or both. Additionally, it was required that the DEIS be sent to certain agencies. Agencies (along with the appropriate individual, if known) that received copies of the DEIS are listed in Table 5.5.2. Finally, organizations and businesses (along with the appropriate individual) that received copies of the DEIS are listed in Table 5.5.3.

Table 5.5.1. List of Individuals that received Copies of the Draft Environmental Impact Statement

Last Name	First Name	Last Name	First Name
Allbright	Gina	Herrmann	Betsy
Andersen	Arthur	Hiscock	Tracy
Avenido	Caralyn	Hodge	Gary
Barton	DeLynn	Ives	Catherine
Blackett	Robert	Johnson	Colby
Boron	Erik	Johnson	Jim
Brinkerhuff	Dale	Judd	Brent
Brown	Neal	Kershaw	Byard
Brunnel	Dixie	Kim	Jun
Bryant	Bobbi	Kollander	Linda
Campbell	Vane	Kolle	Liz
Case	Jim	Larson	Marilyn
Cearn	Randy	Lynd	Truman
Chamberlain	Cloyd	MacDonald	No First Name
Channey	Sky	Malin	Luci
Childs	Jason	Maximenko	Lori
Christensen	Scott	McKee	Norma

Table 5.5.1. List of Individuals that received Copies of the Draft Environmental Impact Statement

Last Name	First Name	Last Name	First Name
Costigan	Richard	Miller	Ryan
Cox	Dave	Moore	Gaylen
Cox	Duke	Murray	Marilee
Cox	Dustin	Nelson	Terry
Cox	Mel	Nichols	Brian
Cox	Paul	Nichols	Frank
Decantu	Trudy	Nielson	Martin
Dhieux	Joyel	No Last Name	Charley
Doddi	Wally	No Last Name	Doug
Dodds	D. Meloy	No Last Name	Mark
Drummond	Jerry	No Last Name	Mike
Egan	Peggy	No Last Name	Rich
Fertig	Laura	Nobibins	Ed
Firmage	Ed	Orme	Del
Flatberg	John	Osterhout	Andy
Forsythe	Tom	Owens	David
Frey	Jeff	Pace	Jay
Frummond	Jan	Page	Mark
Ghosh	Sam	Palmer	Cindy
Gilberl	Allen	Palmer	Dilbert
Goldsmith	David	Palmer	Mark
Goldsmith	Melissa	Pugh	Roger
Goodell	John	Ruple	John
Gorrell	Mike	Salt	Jeff
Hand	Susan	Salvato	Vince
Harnes	Mark	Schoppe	Jake
Harris	Bert	Scribner	John
Havnes	Mark	Sortomme	James
Heaton	Darol	Spencer	Dale
Heaton	Heam	Stewart	Margaret
Heaton	Julie	Stewart	Monte
Heaton	Kari	Stewart	Phyllis
Heaton	Kevin	Stoenworth	Anne
Heaton	Leonard	Swapp	Patricia
Heaton	No First Name	Thebean	Dan
Heaton	Richard	Veranth	John

Table 5.5.1. List of Individuals that received Copies of the Draft Environmental Impact Statement

Last Name	First Name	Last Name	First Name
Heaton	Vaughn	Warky	Laner
Heaton	Wade	Wells	Jim
Helsley	Mary	Wood	Heather
Henrie	Allen	Wood	Jim
Henrie	Pat	Wren	Monica

Table 5.5.2. List of Agencies and Officials (including individual, if known) that received Copies of the Draft Environmental Impact Statement

Agency/Official	Last Name	First Name
DOGM	Burton	Priscilla
NPS, Bryce Canyon National Park	Legg	Kristin
	Bradybaugh	Jeff
Office of the Governor	Harja	John
Utah Public Lands Policy Coordination Office	Payne	Val
City of Alton Mayor	Heaton	Claren
Mayor of Panguitch	Cooper	Art
UDWR	Bonzo	Teresa
EPA	Svoboda	Larry

Table 5.5.3. List of Organizations and Businesses (including individual, if known) that received Copies of the Draft Environmental Impact Statement

Organization	Last Name	First Name
Garkane Energy	Shakespear	Bryant
National Parks Conservation Association	Nimkin	David
Southern Utah Wilderness Alliance	Bloch	Steve
Utah Mining Association	Litvin	David

5.5.2 Supplemental Draft Environmental Impact Statement Distribution List

The Alton EIS distribution lists are developed from stakeholder lists compiled before and during the scoping process and from lists compiled during the public comment periods. They have been supplemented throughout the planning process.

Table 5.5.1 lists individuals who requested copies of EIS documents prior to the publication of the DEIS, whereas Table 5.5.4 lists individuals that requested copies of the FEIS in their public comments on the DEIS or on sign-up sheets at the public meetings. Requests were made for a hardcopy, a CD, or both. By default, individuals who requested copies of the FEIS will receive copies of the SDEIS, and individuals who requested copies of the DEIS will also receive copies of the SDEIS and FEIS. Additionally, it is required that the SDEIS and FEIS be sent to certain agencies. Agencies (along with the appropriate individual, if known) who will receive copies of the SDEIS and FEIS are listed in Table 5.5.5. Finally, organizations and businesses (along with the appropriate individual) that will receive copies of the SDEIS are listed in Table 5.5.6.

Table 5.5.4 List of Individuals that will receive Copies of the Supplemental Draft Environmental Impact Statement and Final Environmental Impact Statement

Last Name	First Name	Last Name	First Name
Ahlgreen	Steve	Johnson	John
Albany	Kathryn	Johnson	Linda
Allen	Mike	Judd	Debra
Anders	Brock	Judd	Brent & Marcie
Anderson	Arthur	Keeler	John
Anderson	Kelly	Keene	Richard
Andrade	Joe	Klement	Eric
Andrus	Dixie	Kursar	Tom
Auguello	Fares	Lewis	Emilie
Baldwin	Elaine	Madson	Greg
Barlow	Kyle	Marasco	T
Barnes	William	McTeer	Mike
Barney	Brad	Micheline Sedlar	Trude
Barney	Tyler	Milan	Steve
Beale	Leon	Miller	Rick
Beck	Larry	Mitchley	Rochelle & David
Bergan	Larry	Morast	Michael
Bird	Scott	Morgan	Janine
Booker	William	Moyer	Sheila
Brinkerhoff	Charles	Neal	Charles
Brinklehoff	Darlene	Nelson	Nicola
Brinley	Skyler	Nichols	Barry
Brister	Bob	Nuttall	Ezra
Brown	Nathan	Ober	Stephen
Burton	Priscilla	Ootting	Mack
Carter	Tom	Palmer	Eric
Cather	James	Parius	Jerome
Chaney	Sky	Pedersen	Tristan & Trish

Table 5.5.4 List of Individuals that will receive Copies of the Supplemental Draft Environmental Impact Statement and Final Environmental Impact Statement

Last Name	First Name	Last Name	First Name
Christensen	Alicia	Poe	Kevin
Collins	Rachel	Porcher	John
Cowley	Cris	Rasmussen	Rebecca
Cox	Russel	Redstone	Cori
Cronin	Mary Lou	Richman	Jana
Csenge	Debra	Ritchey	Steve
Dalley	Brent	Robinson	Mickey
Defa	Steve	Rosseau	Nathan
Dennis	Kathleen	Sahatz	Vince
Dodds	Wally	Saint	Sandra
Dove	Jeff	Scott	Kathleen
Drove	Kathy	Sharifan	Sina
Fisher	Rachael	Smith	Tiffany
Fisher	Carl	Smith	Karmen
Fox	Don	Spanne	Laurence and Patricia
Gregory	Joan	Stanworth	Anne
Heaton	Coleen	Stark	Douglas
Heaton	Kale	Stewar	Susan
Heaton	Ferril & Dot	Stork	Graham
Hebard	Ford	Sykes	Eliot
Helfrich	Joe	Thevenin	Paul
Holmes	Ashley	Torrence	Tonia
Holmstead	Shidasha	Turner	John
Hoppe	Isaac	Tyler	Henry
Hoverman	Roger	Udall	Cherise
Hunson	Jake	Van Dame	Kathy
Huntington	Wes	Walls	Jim
Isaacs	Carole	Webster	Dan
Joan	Thatcher	Wilson	Clint
Johnson	Jean	Woods	Coralee

Table 5.5.5. List of Agencies and Officials (including individual, if known) that will receive Copies of the Supplemental Draft Environmental Impact Statement and Final Environmental Impact Statement

Agency/Official	Last Name	First Name
NPS, Zion National Park	Whitworth	Jock
Office of the Governor	–	–
USACE	McQueary	Patricia
Utah Public Lands Policy Coordination Office	Clarke	Kathleen
City of Alton Mayor	Walker	Brant
Kane County	Matson	Jim
Mayor of Panguitch	Houston	Eric
City of Panguitch	Talbot	Lori
Congressman Jim Matheson	Empey	Mike
UDWR	Boswell	Rhett
USFWS	DeFreese	Amy
NPS, Bryce Canyon National Park	Bradybaugh	Jeff
EPA	Vaughn	Molly
	Allen	Dana
OSM	Kirby	Foster
Iron County	Brinkerhoff	Dale
Kanab	Robinson	Mac
Kanab City Council	Sorenson	Jim
Kane County	Burggraaf	Kent
	Kershaw	Byard
Panguitch Utah Conservation Districts	Palmer	Tyce
Reservation	Csenge	Debra
	McTeer	Tana
	Saba	Charlie
State of Utah, District 72	Vickers	Evan
UDWR	Boswell	Rhett
USFWS	Brown	Nathan
DOGM	Burton	Priscilla
	Helfrich	Joe
	Lewis	Emilie
	Haddock	Daron
Washington County	Anders	Brock
Senator Mike Lee	Schunk	Ellen V.
Senator Orrin. G. Hatch	Swadley	William
Congressman Chris Stewart	Smith	Dell
Senator Ralph Okerlund	–	–
Representative Michael Noel	–	–

Table 5.5.6. List of Organizations and Businesses (including individual, if known) that will receive Copies of the Supplemental Draft Environmental Impact Statement and Final Environmental Impact Statement

Organization	Last Name	First Name
Alton Coal	Adams	Jay
	Nicholes	Kirk
American Clean Energy Resources Trust	Hill	Pamela
Aquadesign, Inc.	Peterson	Richard
Barney Trucking	Barney	Craig
	Johnson	Dennis
	Kimball	Keith
	Payne	Craig
	Scow	Lynn
	Williams	Craig
Center for Education, Business, and the Arts	Stowell	Kelly
Colorado State University/NPS	KellerLynn	Katie
Cowboy Collectibles by CZR	Yard	Randy and Becky
Dept. of Biology, University of Utah	Coley	Phyllis
Escalante Outfitters	Roberts	Steve
Grand Canyon Trust	Peterson	Tim
Grand Canyon Wildlands Council	Crumbo	Kim
Heaton Bros LLC	Heaton	Eric
High Desert Supply	Jared	Pace
	Pace	Gale
Human Systems Design Program	Taft Jacobs	Reed
IPA	Lee	Lance
KB Oil	Bettridge	Stacey
Komatsu	Barrie	Pete
	Baxendale	Trent
	Thompson	Jayson
KSUB	Holmes	Chris
League of Utah Voters	Thompson	Georgia
League of Women Voters	Clark	Linda
PAS, PC	Shea	Pat
Peaceful Uprising	Andreason	David
	Schneider	Dylan
Physicians for a Healthy Environment (UPHE)	Moench	Brian
Post Carbon Salt Lake	Mielke	Michael

Table 5.5.6. List of Organizations and Businesses (including individual, if known) that will receive Copies of the Supplemental Draft Environmental Impact Statement and Final Environmental Impact Statement

Organization	Last Name	First Name
Quaker Earthcare	Stockbridge	Allen
Rocking V Café	Cooper	Victor
Sierra Club	Mayhew	Dan
	Wagner	Tim
Southern Utah Wilderness Alliance	Bloch	Steve
TDS Tires	Wilson	Clint
	Morast	Michael
	Rosseau	Nathan
Taxpayer Association of Kane County	Chaney	Sky
University of Utah	Dove	Jeff
University of Utah, Environmental Studies	Hebard	Ford
Upper Sevier	Dodds	Wally
Utah Clean Air Alliance	Marasco	T
Utah Environmental Congress	Brister	Bob
Utah Farm Bureau Federation	Keeler	John
Utah Moms for Clean Air	Udall	Cherise
utahipl.org	Ritchey	Steve
Wasatch Clean Air Coalition	Van Dame	Kathy
Wheeler Machinery	Klement	Eric
	Madson	Greg

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CHAPTER 7. GLOSSARY

CHAPTER 7. ABBREVIATIONS AND GLOSSARY

7.1. Abbreviations

μm	micrometer
°C	degrees Celsius
°F	degrees Fahrenheit
μS/cm	micro-Siemens per centimeter
AADT	average annual daily traffic
ACD	Alton Coal Development, LLC
ACS	American Community Survey
ADT	average daily traffic
ALED	amber light–emitting diode
AOC	approximate original contour
APE	area of potential effects
AQRV	air quality–related values
ARTAG	Air Resource Technical Advisory Group
ASL	average sky luminance
AUM	animal unit month
AVF	alluvial valley floor
BCC	birds of conservation concern
BGEPA	Bald and Golden Eagle Protection Act
BLM	Bureau of Land Management
BLM-KFO	Bureau of Land Management-Kanab Field Office
BMP	best management practices
BP	before present
BTU	British thermal units
C	central (geographic section of tract)
CAA	Clean Air Act
CASTNet	EPA Clean Air Status and Trends Network
CCSP	U.S. Climate Change Science Program
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations

cfs	cubic feet per second
CH_4	methane
CHIA	cumulative hydrologic impact assessment
CIAA	cumulative impact assessment area
CIB	Community Impact Fund Board
cm	centimeter
cm^3	cubic centimeter
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
CoCARM	Color Country Adaptive Resource Management Local Working Group
CS	Species receiving special management under a conservation agreement to preclude the need for federal listing
CWA	Clean Water Act
CWMU	cooperative wildlife management unit
CWN	central western north (geographic section of tract)
CWS	central western south (geographic section of tract)
DAT	deposition analysis thresholds
dB	decibel
dBA	A-weighted decibel
dBC	C-weighted sound levels
DEIS	draft environmental impact statement
DEM	digital elevation model
DOE	U.S. Department of Energy
DOGM	Utah Division of Oil, Gas and Mining
DOI	Department of the Interior
DOJ	Department of Justice
DSP	Dark Sky Partners
EC	elemental carbon
EIA	Energy Information Administration
EIS	environmental impact statement
EJ	environmental justice
EO	executive order
EODA	external overburden disposal area

EPA	Environmental Protection Agency
ERMA	Extensive Recreation Management Area
ESA	Endangered Species Act
FCAOG	Five County Association of Governments
FEIS	final environmental impacts statement
FHWA	Federal Highway Administration
FLAG	Federal Land Managers Air Quality Related Values Work Group
FLED	filtered white light–emitting diode
FLPMA	Federal Land Policy and Management Act
FMU	fire management units
FRCC	fire regime conditions class
g	gram
g/s	grams per second
GCVTC	Grand Canyon Visibility Transport Commission
GHG	greenhouse gas
GIS	geographic information systems
GOPB	Utah Governor's Office of Planning and Budget
gpm	gallons per minute
GWP	global warming potential
H1H	highest first-high
ha	hectare
HAP	hazardous air pollutants
HID	high-intensity discharge
HMU	herd management unit
HNO_3	nitric acid
HPS	high-pressure sodium
HPTP	historic properties treatment plan
HUD	U.S. Department of Housing and Urban Development
Hz	hertz
I-15	Interstate 15
IDA	International Dark-Sky Association
IM	instruction memorandum
IMPROVE	Interagency Monitoring of Protected Visual Environments

IPCC	Intergovernmental Panel on Climate Change
JD	jurisdictional determination
KFO	Kanab Field Office
kg	kilogram
kg	kilogram
km	kilometer
KOP	key observation points
L_{Aeq1h}	one-hour equivalent sound level
LBA	lease by application
L_{dn}	day-night sound level
L_{eq}	equivalent continuous sound level
L_{nat}	Natural ambient sound levels
LOS	level of service
LPS	low-pressure sodium
m	meter
MBTA	Migratory Bird Treaty Act of 1918
MEI	maximally exposed individual
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
mg/m^3	milligrams per cubic meter
MgCl	magnesium chloride
MH	metal halide
MLA	Mineral Leasing Act
MLE	most likely exposure
mm	millimeter
mm/s	millimeters per second
mmhos	units of millimhos (a measure of electrical conductivity that is used to describe soil salinity)
MMTPY	million tons per year
MOU	memorandum of understanding
MOVES	Motor Vehicle Emission Simulation
mph	miles per hour
MRP	mining and reclamation plan
MSDS	Material Safety Data Sheet

MSHA	Mine Safety and Health Administration
Mw	megawatt
N_20	nitrous oxide
NAAQS	National Ambient Air Quality Standards
NAD	North American Datum
NAPD	National Atmospheric Deposition Program
NCDC	National Climatic Data Center
NEPA	National Environmental Policy Act
NH_4	methane
NHPA	National Historic Preservation Act
NIOSH	National Institute for Occupational Health and Safety
nL	nanoLamberts
NO_2	nitrogen dioxide
NO_3	nitrate
NOA	notice of availability
NOAA	National Oceanic and Atmospheric Administration
NOI	notice of intent
NO_x	nitrogen oxides
NPS	National Parks Service
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NW	northwest
O_3	ozone
OHV	off-highway vehicle
ONRR	Office of Natural Resources Revenue
OSHA	Occupational Safety and Health Administration
OSM	Office of Surface Mining Reclamation and Enforcement
PA	programmatic agreement
PAP	permit application package
Pb	lead
PFC	proper functioning condition
PGMA	Preliminary General Management Areas
Ph	measure of the acidity or basicity of a solution

PIF	(Utah) Partners in Flight
PL	Public Law
PM	particulate matter
PM_{10}	particulate matter, having particles of 10 micrometers or less
$PM_{2.5}$	particulate matter, having particles less than 2.5 micrometers
PMT	post-mine topography
ppb	parts per billion
ppm	parts per million
PPMA	Paunsaugunt Plateau Management Area
PRISM	Parameter-elevation Regressions on Independent Slopes Model
PSD	prevention of significant deterioration
Q/D	emissions/distance
R2P2	Resource Recovery and Protection Plan
REL	recommended exposure limit
RfC	reference concentration
RFD	reasonably foreseeable development
RFFA	reasonably foreseeable future action
RH	relative humidity
RMP	resource management plan
ROD	record of decision
ROS	recreation opportunity spectrum
ROW	right(s)-of-way
RS	revised statue
RWPP	*Southwest Utah Regional Wildfire Protection Plan*
S	southern (geographic section of tract)
Sa	southern no-coal zone (geographic section of tract)
SDEIS	supplemental draft environmental impact statement
SESA	socioeconomic study area
SGMA	sage-grouse management area
SHPO	State Historic Preservation Office
SITLA	Utah State Institutional and Trust Lands Administration
SLAMS	state and local air monitoring stations
SMCL	secondary maximum contaminant level

SMCRA	Surface Mining Control and Reclamation Act
SO_2	sulfur dioxide
SOP	standard operating procedure(s)
SOx	sulfur oxides
SPC	(wildlife) species of concern
SPC	species of concern
SR	State Road (e.g., SR-20)
SSURGO	Soil Survey Geographic database
SWCA	SWCA Environmental Consultants
SWReGAP	Southwest Regional Gap Analysis Project
TCP	traditional cultural properties
TDS	total dissolved solids
TPY	tons per year
TSL	toxic screening level
TSS	total suspended solids
U.S. Census	census
U.S. Highway 89	US-89
UAC	Utah Administrative Code
UDAQ	Utah Division of Air Quality
UDEQ	Utah Department of Environmental Quality
UDNR	Utah Department of Natural Resources
UDOT	Utah Department of Transportation
UDWR	Utah Division of Wildlife Resources
UDWS	Utah Department of Workforce Services
ug/m^3	micrograms per cubic meter
UII	Utah International Inc.
UMNH	Utah Museum of Natural History
UNLV	University of Nevada, Las Vegas
UPDES	Utah Pollution Discharge Elimination System
USACE	U.S. Army Corps of Engineers
USC	United States Code
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service

USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UTM	Universal Transverse Mercator
VOC	volatile organic compound
VRM	visual resource management
wLED	white light–emitting diode
WRAP	Western Regional Air Partnership
WRCC	Western Regional Climate Center
WSA	wilderness study area
WUI	wildland-urban interface
ZA	zenith angle

7.2. Glossary

adverse impacts	An apparent direct or indirect detrimental effect.
airshed	A part of the atmosphere that responds in a coherent way with respect to the dispersion of emissions.
alkalinity	The degree to which the pH of a substance is greater than 7.
alluvial deposits	Deposits of clay, silt, sand, gravel, and/or other materials carried by moving surface water such as streams, and deposited at points of weak water flow; alluvium.
alluvial valley floor	An area of unconsolidated stream-laid deposits holding streams with water availability sufficient for sub-irrigation or flood irrigation agricultural activities (see 30 CFR 701.5).
alluvium	Sorted or semi-sorted sediment consisting of clay, silt, sand, gravel, or other unconsolidated rock material deposited in comparatively recent geologic time by a stream or other body of running water in the bed of that stream or on its floodplain or delta.
alternative	In terms of the National Environmental Policy Act, one of several substitute or alternate proposals being considered by a federal agency in an environmental analysis.
ambient	Surrounding conditions (or environment) in a given place and time.
ammonite	Extinct externally shelled cephalopod related to modern squid and cuttlefish.
angle of influence	Defines the extent of the surface area affected by ground movement that occurs as a result of removing coal from an underground mine where overlying rock layers are no longer supported by underlying coal removed during mining.

annual precipitation	The quantity of water that falls yearly in the form of rain, hail, sleet, and snow.
Aquatic	Living or growing in or on the water.
aquifer	A layer of permeable rock, sand, or gravel that stores and transmits water in sufficient quantities for a specific use. In hydrology, a rock layer or sequence that contains water and releases it in appreciable amounts. The rocks contain water-filled pores that, when connected, allow water to flow through their matrix. A confined aquifer is overlain by a rock layer that does not transmit water in any appreciable amount or that is impermeable. There probably are few truly confined aquifers. In an unconfined aquifer, the upper surface (water table) is open to the atmosphere through permeable overlying material. An aquifer also may be called a water-bearing stratum, lens, or zone.
ash	The residual non-combustible matter in coal that comes from included silt, clay, silica, or other substances. The lower the ash content, the better the coal quality.
backfill	The act of refilling an excavation. Also, the material placed in an excavation when it is refilled.
baseline	Conditions, including trends, existing in the human environment before a proposed action has started; a benchmark state from which the environmental consequences of an action are forecast; the No Action Alternative.
beneficial impact	An apparent direct or indirect advantageous effect.
bentonite	An absorptive and colloidal clay used especially as a sealing agent or suspending agent formed by the decomposition of volcanic ash that has the ability to absorb large amounts of water and to expand to several times its normal volume; used in adhesives, cements and ceramic fillers.
big game	Indigenous ungulate wildlife species that are hunted (e.g., elk, deer, bison, bighorn sheep, and pronghorn).
biological soil crust (or cryptobiotic crust)	Biological communities that form a surface layer or crust on some soils. These communities consist of cyanobacteria (blue-green bacteria), micro fungi, mosses, lichens, and green algae, and perform many important functions, including fixing nitrogen and carbon, maintaining soil surface stability, and preventing erosion. Biological soil crusts also influence the nutrient levels of soils and the status and germination of plants in the desert. These crusts are slow to recover after severe disturbance.
bonus bid	That value in excess of the rentals and royalties that is paid to the United States as part of the consideration for receiving a lease for publicly owned minerals (see 43 CFR 3400.0-5(c)).
buffer zone	An area between two different land uses that is intended to resist, absorb, or otherwise preclude development or intrusion between the two use areas.

Category 1	Substantial biological information on file to support the appropriateness of proposing to list as endangered or threatened.
Category 2	Current information indicates that proposing to list as endangered or threatened is possibly appropriate, but substantial biological information is not on file to support an immediate ruling (USFWS).
Cenomanian	The first of six main divisions (in ascending order) in the Upper Cretaceous series, representing rocks deposited worldwide during the Cenomanian Age, which occurred 99.6 to 93.5 million years ago during the Cretaceous Period. Rocks of the Cenomanian overlie those of the Albian and underlie rocks of the Turonian ages.
Class I areas (air quality)	Airsheds of special national or regional natural, scenic, recreational, or historic value for which the PSD regulations provide special protection (e.g., little to no development). Class I areas include national parks larger than 6,000 acres, national wilderness areas larger than 5,000 acres, and international parks and national memorial parks larger than 5,000 acres.
Class II areas (air quality)	All other clean airsheds (in attainment of the NAAQS) where development is permitted under state authority.
coal bed CH_4	Natural gas (CH_4) that is generated during the coal-forming process.
colluvium	Rock fragments, sand, or soil material that accumulates at the base of slopes; slope wash.
confluence	The point at which two or more streams meet.
conglomerate	A rock that contains rounded rock fragments or pebbles cemented together by another mineral substance.
conservation agreement	A formal written document agreed to by the USFWS and/or the National Marine Fisheries Service and another federal agency, state agency, local government, or private organization to achieve the conservation of candidate species or other special status species through voluntary cooperation. It documents the specific actions and responsibilities to which each party agrees to be accountable. The objective of a conservation agreement is to reduce threats to a special status species or its habitat. An effective conservation agreement may lower a species' listing priority or eliminate the need for listing.
conservation strategy	A strategy outlining current activities or threats that are contributing to the decline of a species, along with the actions or strategies needed to reverse or eliminate such a decline or threats. Conservation strategies are generally developed for species of plants and animals that are designated as Bureau of Land Management–sensitive species or that USFWS or NOAA Fisheries have determined to be federal candidates under the ESA.
contiguous	Lands or legal subdivisions having a common boundary (lands having only a common corner are not contiguous).

cooperating agency	An agency that has jurisdiction by law in an action being analyzed in an environmental document and that is requested to participate in the NEPA process by the agency that is responsible for preparing the environmental document (see 40 CFR 1501.6 and 1508.5).
Cretaceous	Of or belonging to the geologic time, system of rocks, and sedimentary deposits of the third and last period of the Mesozoic Era, characterized by the development of flowering plants and ending with the sudden extinction of the dinosaurs and many other forms of life.
crucial habitat	Any particular range or habitat component that directly limits a community, population, or subpopulation to reproduce and maintain itself at a certain level over the long term. Such habitat includes sensitive use areas that, because of limited abundance and/or unique qualities, constitute irreplaceable critical requirements for high-interest wildlife. It may also include highly sensitive habitats, including fragile soils that have little or no reclamation potential. Restoration or replacement of these habitats may not be possible. Examples include the most crucial (critical) summer and/or winter range or concentration areas; critical movement corridors; breeding and rearing complexes; spawning areas; developed wetlands; Class 1 and 2 streams, lakes, ponds, or reservoirs; and riparian habitats critical to high-interest wildlife.
crucial wildlife habitat	Parts of the habitat necessary to sustain a wildlife population during periods of their life cycle. It may be a limiting factor on the population, such as nesting habitat or winter habitat.
crucial winter range	The portion of the winter range to which a wildlife species is confined during periods of heaviest snow cover.
cultural resources	The remains of human activity, occupation, or endeavor reflected in districts, sites, structures, buildings, objects, artifacts, ruins, works of art, architecture, and natural features that reveal the nature of historic and prehistoric human events. These resources consist of 1) physical remains, 2) areas where significant human events occurred, and 3) the environment immediately surrounding the resource.
cumulative impact	The impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.7).
decibel	A unit of sound measurement. In general, a sound doubles in loudness for every increase of 10 decibels.
desired wildland fire condition (DWFR)	The desired condition of a vegetative community as it relates to susceptibility from severe fire effects (e.g., the loss of key ecosystem components—soil, vegetation structure, species; or alteration of key ecosystem processes—nutrient cycles, hydrologic regimes).

direct impact	An impact caused by an action that occurs at the same time and place as the action (40 CFR 1508.8).
discharge	Any of the ways that groundwater comes out of the surface, including through springs, creeks, or being pumped from a well.
dispersion model domain	The analysis area for air resources, which consists of an approximately 150-km area surrounding the tract.
endangered species	Any species that is in danger of extinction throughout all or a significant portion of its range (from M6840, Special Status Species Manual).
eocene	Of or belonging to the geologic time, rock series, or sedimentary deposits of the second epoch of the Tertiary Period, characterized by warm climates and the rise of most modern mammalian families.
ephemeral stream	A stream that flows occasionally because of surface runoff, and is not influenced by permanent groundwater.
erosion	The wearing away of the land surface by running water, wind, ice, or other geologic agents.
evapotranspiration	The sum total of water lost from the land by evaporation and plant transpiration.
excavation	The scientifically controlled recovery of subsurface materials and information from a cultural site. Recovery techniques are relevant to research problems and are designed to produce maximum knowledge about the site's use, its relation to other sites and the natural environment, and its significance in the maintenance of the cultural system.
fair market value	The amount in cash (or in terms reasonably equivalent to cash) for which in all probability a coal deposit would be sold or leased by a knowledgeable owner willing, but not obligated, to sell or lease to a knowledgeable purchaser who desires, but is not obligated, to buy or lease.
fire management plan	A plan that identifies and integrates all wildland fire management and related activities within the context of approved land/resource management plans. It defines a program to manage wildland fires (wildfire, prescribed fire, and wildland fire use). The plan is supplemented by operational plans, including, but limited to, preparedness plans, preplanned dispatch plans, and prevention plans. Fire management plans assure that wildland fire management goals and components are coordinated.
fire regime	Description of the patterns of fire occurrences, frequency, size, severity, and sometimes vegetation and fire effects, in a given area or ecosystem. A fire regime is a generalization based on fire histories at individual sites. Fire regimes can often be described as cycles because some parts of the histories usually get repeated, and the repetitions can be counted and measured, such as fire return interval.

fire regime condition class (FRCC)	Depiction of the degree of departure from historical fire regimes, possibly resulting in alternations of key ecosystem components. These classes categorize and describe vegetation composition and structure conditions that currently exist inside the fire regime groups. Based on the coarse-scale national data, they serve as generalized wildfire rankings. The risk of loss of key ecosystem components from wildfires increases from Condition Class 1 (lowest risk) to Condition Class 3 (highest risk).
fixed carbon	In coal, the solid combustible material remaining after removal of moisture, ash, and volatile matter. It is expressed as a percentage.
floodplain	The relatively flat area or lowland adjoining a body of flowing water, such as a river or stream, that is covered with water when the river or stream overflows its banks.
forage	Vegetation used for food by wildlife, particularly big game wildlife, and domestic livestock.
formation	A rock body distinguishable from other rock bodies and useful for mapping or description. Formations may be combined into groups or subdivided into members.
fossil	The remains or traces of an organism or assemblage of organisms that have been preserved by natural processes in the earth's crust. Many minerals that may be of biologic origin are not considered to be fossils (e.g., oil, gas, asphalt, limestone).
fugitive dust	Small-diameter dust particles from the action of prevailing winds, the turbulence caused by moving machinery and trucks, or both.
glare	Compromised vision due to very bright light (such as direct or indirect sunlight or artificial light).
greenhouse gas	A gas in an atmosphere that absorbs and emits radiation within the thermal infrared range; naturally occurring GHGs include water vapor, CO_2, CH_4, nitrous oxide (N_2O), and ozone (O_3).
groundwater	Subsurface water that fills available openings in rock or soil materials to the extent that they are considered water saturated.
grouting	Grouting generally consists of drilling a series of boreholes into the mine voids and filling those voids with a concrete-like mixture that eliminates the likelihood of future subsidence events.
habitat	The place where an organism (plant or animal) lives. There are four major divisions of habitat, namely terrestrial, freshwater, estuarine, and marine.
hazardous air pollutants (HAP)	Air pollutants that are not part of the NAAQS, but are often brought forward for analysis if their levels would be elevated by a proposed project.
hazardous materials	Substance that, because of its potential for corrosivity, toxicity, ignitability, chemical reactivity, or explosiveness, may cause injury to persons or damage to property.

hazardous waste	Those materials defined in Section 101 (14) of the Comprehensive Environmental Response, Compensation and Liability Act of 1980, and listed in 40 CFR 261. A used or discarded material that can damage the environment and be harmful to human health. Hazardous wastes include heavy metals and toxic chemicals used in industrial products and processes as well as infectious medical wastes and radioactive materials such as spent nuclear fuel rods.
high-value habitat	Any particular habitat that sustains a community, population, or subpopulation. It includes intensive use areas that because of relative wide distribution do not constitute crucial (Utah Division of Wildlife Resources critical) values but are highly important to high-interest wildlife. It may also include moderately sensitive habitats of high-interest species that have low reclamation potential, and Class 3 streams, lakes, ponds, or reservoirs. Reconstruction or enhancement of these areas may be possible, but should be avoided if not possible. Examples include less crucial (critical) but more widely distributed summer and/or winter ranges, important feeding areas, areas of high wildlife diversity and/or density of high-interest species, natural wetlands, and all other riparian areas.
Holocene	Of or belonging to the geologic time, rock series, or sedimentary deposits of the more recent of the two epochs of the Quaternary Period, beginning at the end of the last Ice Age approximately 11,000 years ago and characterized by the development of human civilizations.
human environment	The natural and physical environment in which humans preside or have an impact and the relationship of people with the surrounding environment (30 CFR 1508.14).
hydraulic conductivity	The capacity of a medium to transmit water; permeability coefficient. Expressed as the volume of water at the prevailing temperature that will move in unit time under a unit hydraulic gradient through a unit area. Units include gallons per day per square foot, centimeters per second.
hydric soil	A soil that is saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions that favor the growth and regeneration of hydrophytic (water-loving) vegetation. Hydric soils that occur in areas having positive indicators of hydrophytic vegetation and wetland hydrology are wetland soils.
hydrocarbon	Any organic compound, gaseous, liquid, or solid, consisting solely of carbon and hydrogen.
hydrology	The science dealing with the behavior of water as it occurs in the atmosphere, on the surface of the ground, and underground.
hydrophytic vegetation	The plant life growing in water or on a substrate that is at least periodically deficient in oxygen as a result of excessive water content. When hydrophytic vegetation comprises a community where indicators of hydric soils and wetland hydrology also occur, the area has wetland vegetation.

impacts (or effects)	Environmental consequences (the scientific and analytical basis for comparison of alternatives) as a result of a proposed action. Effects may be either direct, which are caused by the action and occur at the same time and place, or indirect, which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable or cumulative.
impermeable	Not capable of transmitting fluids or gasses in appreciable quantities.
incised	Having a margin that is deeply and sharply notched.
indirect impact (or secondary)	A reasonably foreseeable impact resulting from an action but occurring later in time than or removed in distance from that action (40 CFR 1508.8).
initial attack	An aggressive suppression action consistent with fire-fighter and public safety and values to be protected.
in-place coal reserves	The estimated volume of all of the coal reserves in a lease without considering economic or technological factors that might restrict mining.
interburden	A layer of sedimentary rock that separates two mineable coal beds.
interdisciplinary	Characterized by participation or cooperation among two or more disciplines or fields of study.
intermittent stream	A stream that does not flow year-round but has some association with groundwater for surface or subsurface flow.
key observation point	Critical viewpoints of typical landscapes in a project area (in this case, the tract) that have been selected to represent the views of disturbances throughout the life of the mine and that are encountered by the greatest number of people.
Konservat-Lagerstatte	A locality or geologic horizon with exceptionally good fossil preservation, generally exhibiting soft tissue and other organic structures.
land and resource management plan	A land-use plan that directs the use and allocation of USFS lands and resources.
lead agency	The agency or agencies preparing or having taken primary responsibility for preparing an environmental document (40 CFR 1508.16).
lease	A legal document executed between a mineral owner or lessor and another party or lessee that grants the lessee the right to extract minerals from the tract of land for which the lease has been obtained (43 CFR 3400.0-5(r)).
lek	A traditional breeding area for grouse species where territorial males display and establish dominance, or an assembly area where birds, especially Greater Sage-grouse, carry on display and courtship behavior.
lenticular	Term describing a body of rock or earth that thins out in all directions from the center like a double convex optical lens.
lightscape	Characterized by the natural rhythm of sun and moon cycles, clean air, and dark nights unperturbed by artificial lights.

limestone	A sedimentary rock consisting chiefly of calcium carbonate.
lumens	An unit of measurement that measures the power of light perceived by the human eye.
maximum economic recovery	The requirement that based on standard industry operating practices, all profitable portions of a leased federal coal deposit must be mined. MER determinations will consider existing proven technology; commercially available and economically feasible equipment; coal quality, quantity, and marketability; safety, exploration, operating, processing, and transportation costs; and compliance with applicable laws and regulations (43 CFR 3480.0-5(a)(24)).
mesozoic	Of, belonging to, or designating the era of geologic time that includes the Triassic, Jurassic, and Cretaceous periods and is characterized by the development of flying reptiles, birds, and flowering plants, and by the appearance and extinction of dinosaurs.
CH_4	A colorless, odorless, and flammable gaseous hydrocarbon; the simplest hydrocarbon; chemical formula=CH_4. It is the product of decomposition of organic matter and of the carbonization of coal, is used as a fuel and as a starting material in chemical synthesis, and is the simplest of the alkanes. It is a constituent of natural gas and is also found associated with crude oil and coal.
mineable coal	Coal that can be economically mined using present day mining technology.
mining permit	A permit to conduct surface coal mining and reclamation operations issued by the state regulatory authority pursuant to a state program or by the Secretary pursuant to a federal program (30 CFR 701.5).
mitigation	A method or process by which impacts from actions may be made less injurious to the environment through appropriate protective measures. 40 CFR 1508.20 further defines mitigation as 1) avoiding the impact altogether by not taking a certain action or parts of an action; 2) minimizing an impact by limiting the degree or magnitude of the action and its implementation; 3) rectifying the impact by repairing, rehabilitating, or restoring the affected environment; 4) reducing or eliminating the impact over time by preservation and maintenance; and 5) compensating for the impact by replacing or providing substitute resources or environments.
mudstone	A hardened sedimentary rock consisting of clay. It is similar to shale but lacks distinct layers.
National Ambient Air Quality Standards (NAAQS)	Standards set by the Clean Air Act for pollutants considered harmful to public health and the environment. They consist of CO, lead, nitrogen dioxide, PM (PM_{10} and $PM_{2.5}$), ozone, and SO_2.
National Register of Historic Places (NRHP)	A list of districts, sites, buildings, structures, and objects significant in American history, architecture, archeology, and culture maintained by the Secretary of the Interior. Expanded as authorized by Section 2(b) of the Historic Sites Act of 1935 (16 USC 462) and Section 101(a)(1) (A) of the NHPA.

NATIVE species	Wild animals and plants that have evolved in a particular region and environment. Native species are the most adapted to the area and are more disease and drought resistant than non-native species. Native plants provide the greatest benefits to wildlife because the native wildlife evolved with native plants. Often the food provided by native plants is the most nutritious to our native wildlife.
NEPA process	All measures necessary for compliance with the National Environmental Policy Act of 1969 (40 CFR 1508.21).
No Action Alternative	An alternative where no activity would occur. The development of a no action alternative is required by regulations implementing the National Environmental Policy Act (40 CFR 1502.14). The No Action Alternative provides a baseline for estimating the effects of other alternatives.
nonattainment	A designated air quality area or airshed that exceeds a NAAQS. Areas with levels of a criteria pollutant below the health-based standard are designated as “attainment.”
off-highway vehicle (OHV)	Any motorized vehicle capable of, or designed for, travel on or immediately over land, water, or other natural terrain, excluding 1) any non-amphibious registered motorboat; 2) any military, fire, emergency, or law enforcement vehicle while being used for emergency purposes; 3) any vehicle whose use is expressly authorized by the authorized officer or otherwise officially approved; 4) vehicles in official use; and 5) any combat or combat support vehicle when used for national defense (from H-1601-1, BLM Land-use Planning Handbook).
outcrop	A rock formation that appears at or near the surface; the intersection of a rock formation with the surface.
overburden	Overburden is the term used in mining to describe material above (excluding topsoil) the area of economic interest, e.g., the rock and soil above the coal seam. Also known as 'waste'. Overburden is distinct from tailings, the material that remains after economically valuable components have been extracted from the generally finely milled ore. Overburden is removed during surface mining, but is typically not contaminated with toxic components and may be used to restore a mining site to a semblance of its appearance before mining began. Overburden may also be used as a term to describe all soil and ancillary material above the bedrock horizon in a given area.
Paleogene	The older of two subdivisions of the Tertiary period, including the Paleocene, Eocene, and Oligocene Epochs.
paleontological resource	A site containing evidence of plant or non-human animal life of past geological periods, usually in the form of fossil remains.
particulate matter (PM)	Complex mixture of extremely small particles and liquid droplets. Particle pollution is made up of a number of components, including acids (such as nitrates and sulfates), organic chemicals, metals, and soil or dust particles.

peak discharge	The highest discharge of water recorded over a specified period of time at a given stream location; also called maximum flow. Often thought of in terms of spring snowmelt, summer, fall, or winter rainy season flows.
perennial species	Vegetation that lives over from season to season.
perennial stream	A stream or part of a stream that flows continuously during the calendar year as a result of groundwater discharge or surface runoff.
permeability	The ability of rock or soil to transmit a fluid.
permit application package	A proposal to conduct surface coal mining and reclamation operations on federal lands, including an application for a permit, permit revision, or permit renewal and all the information required by SMCRA, the applicable state program, any applicable cooperative agreement, and all other applicable laws and regulations including, with respect to federal leased coal, the MLA and its implementing regulations.
permit area	The area of land, indicated on the approved map submitted by the operator with his or her application, required to be covered by the operator's performance bond under the regulations at 30 CFR 800 and that shall include the area of land upon which the operator proposes to conduct surface coal mining and reclamation operations under the permit, including all disturbed areas (30 CFR 701.5).
physiography	Physical geography
Pleistocene	Of or belonging to the geologic time, rock series, or sedimentary deposits of the earlier of the two epochs of the Quaternary Period, characterized by the alternate appearance and recession of northern glaciation, the appearance and worldwide spread of hominids, and the extinction of numerous land mammals, such as the mammoths, mastodons, and saber-toothed tigers.
predator	An animal that obtains food by killing and consuming other animals.
prescribed burning	Application of prescribed fire.
prescribed fire	The intentional application of fire to wildland fuels in either their natural or modified state under conditions that will allow the fire to be confined to a predetermined area and at the same time to produce the intensity of heat and rate of spread required to further certain planned objectives (i.e., silviculture, wildlife management, etc.). Any fire ignited by management actions under certain, predetermined conditions to meet specific objectives related to hazardous fuels or habitat improvement. A written, approved prescribed fire plan must exist, and NEPA requirements must be met, prior to ignition.
prevention of significant deterioration (PSD)	Regulations promulgated by the EPA to further protect and enhance air quality. They use an incremental approach and are intended to help maintain good air quality in area that attain that NAAQS and to provide special protections for national parks.

Proboscidean	Any member of the elephant family.
proper functioning condition (PFC)	1) An element of the Fundamentals of Rangeland Health for watersheds, and therefore a required element of state or regional standard and guidelines under 43 CFR 4180.2(b). 2) A condition in which vegetation and ground cover maintain soil conditions that can sustain natural biotic communities. For riparian areas, the process of determining function is described in BLM Technical Reference (TR) 1737-9. 3) Riparian-wetland areas are functioning properly when adequate vegetation, landform, or large woody debris is present to dissipate stream energy associated with high water flows, thereby reducing erosion and improving water quality; filter sediment, capture bed load, and aid floodplain development; improve floodwater retention and groundwater recharge; develop root masses that stabilize streambanks against cutting action; develop diverse ponding and channel characteristics to provide the habitat and the water depth, duration, and temperature necessary for fish production, waterfowl breeding, and other uses; and support greater biodiversity. The functioning condition of riparian-wetland areas is influenced by geomorphic features, soil, water, and vegetation. 4) Uplands function properly when the existing vegetation and ground cover maintain soil conditions capable of sustaining natural biotic communities. The functioning condition of uplands is influenced by geomorphic features, soil, water, and vegetation. See also, Nonfunctioning Condition and Functioning at Risk (from H-4180-1, BLM Rangeland Health Standards).
Proposed Action	In terms of NEPA, the project, activity, or action that a federal agency proposes to implement or undertake and that is the subject of an environmental analysis. In this EIS Alternative B is the Proposed Action.
raptor	Bird of prey, such as an eagle, falcon, hawk, owl, or vulture.
recharge	The processes by which groundwater is absorbed into a zone of saturation.
reclamation	Rehabilitation of a disturbed area to make it acceptable for designated uses. This normally involves regrading, replacement of topsoil, revegetation (with native plant life), and other work necessary to restore the disturbed area for post-mining use. In general and where viable, an attempt to put the terrain back to the pre-mining contours is also of paramount importance.
record of decision	A document separate from, but associated with, an EIS that publicly and officially discloses the responsible official's decision on the proposed action (see 40 CFR 1505.2).
recoverable coal	The amount of coal that (is economically feasible to recover) can actually be recovered for sale from the demonstrated coal reserve base.
rental payment	Annual payment from a lessee to a lessor to maintain the lessee’s mineral lease rights.

resource management plan	A land-use plan prescribed by Federal Land Policy and Management Act that directs the use and allocation of public lands and resources managed by BLM. Prior to selection of the RMP, different alternative management plans are compared and evaluated in an EIS to determine which plan will best direct the management of the public lands and resources.
revegetation	The reestablishment and development of self-sustaining plant cover following land disturbance. This may occur through natural processes, or the natural processes may be enhanced by human assistance through seedbed preparation, reseeding, and mulching.
right-of-way (ROW)	The right to pass over property owned by another. The strip of land over which facilities such as roadways, railroads, or power lines are built.
riparian	The area adjacent to rivers and streams that lies between the stream channel and upland terrain and that supports specific vegetation influenced by perennial and/or intermittent water.
riparian area	A form of wetland transition between permanently saturated wetlands and upland areas. A riparian area is defined as an area of land directly influenced by permanent (surface or subsurface) water. Riparian areas exhibit vegetation or physical characteristics that reflect the influence of permanent surface or subsurface water. Typical riparian areas include lands along, adjacent to, or contiguous with perennially and intermittently flowing rivers and streams, hanging gardens, and areas surrounding seeps and springs. Excluded are ephemeral streams or washes that lack vegetation and depend on free water in the soil.
royalty	A share of production that is free of the expense of production. It is generally paid by a lessee to a lessor of a mineral lease as part of the terms of the lease.
runoff	That portion of rainfall that is not absorbed; it may be used by vegetation, lost by evaporation, or it may find its way into streams as surface flow.
salinity	Refers to the solids such as sodium chloride (table salt) and alkali metals that are dissolved in water. In non-saltwater areas, the term “TDS” is often used as an equivalent term.
sandstone	A common sedimentary rock primarily composed of sand grains, mainly quartz, that are cemented together by other mineral material.
scoping	A public informational process required by NEPA to determine private and public concerns, scope of issues, and/or questions regarding a proposed action to be evaluated in an EIS.
sedimentation pond	An impoundment used to remove solids from water to meet water quality standards or effluent limitations before the water leaves the permit area (30 CFR 701.5).
sensitive noise receptor	Receptors that only consider noise as it relates to the human environment, for example, residences, hospitals, libraries, recreation areas, churches, etc.

sensitive species	Those species designated by a state director, usually in cooperation state natural heritage programs and the state agency responsible for managing the species as sensitive. They are those species that 1) could become endangered in or extirpated from a state, or within a significant portion of its distribution; 2) are under status review by USFWS and/or National Marine Fisheries Service; 3) are undergoing significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution; 4) are undergoing significant current or predicted downward trends in population or density such that federal listed, proposed, or candidate or state listed status may become necessary; 5) typically have small and widely dispersed populations; 6) inhabit ecological refugia or other specialized or unique habitats; or 7) are state listed but which may be better conserved through application of BLM sensitive species status.
septarian	Carbonate concretionary mass formed in shale with hollow or crystal filled interiors. Sedimentary equivalent of geodes, which are mostly volcanic in origin.
Sevier Thrust Belt	Zone of low angle faulting- and folding-caused uplift that follows the Wasatch Front and that was active in the Cretaceous.
shale	A very fine-grained clastic rock or sediment consisting predominately of clay-sized particles.
significant impact	A qualitative term used to describe the anticipated importance of impacts to the human and or the environment as a result of a direct or indirect action (or actions).
siltstone	A fine-grained clastic rock consisting predominately of silt-sized particles.
skyglow	The wide-scale illumination of the night sky or parts of it. The most common cause of skyglow is artificial light that emits light pollution.
socioeconomics	The social and economic situation that might be affected by a proposed action.
soil survey	The systematic examination, description, classification, and mapping of soils in an area, usually a county. Soil surveys are classified according to the level of detail of field examination. Order I is the most detailed and Order V is the least detailed.
special status species	Includes proposed species, listed species, and candidate species under the ESA; state-listed species; and BLM state director-designated sensitive species (see BLM Manual 6840, Special Status Species Policy).
stipulations	Requirements that are part of the terms of a mineral lease. Some stipulations are standard on all federal leases. Other stipulations may be applied to specific leases at the discretion of the surface management agency to protect valuable surface resources or uses existing on those leases.

stratigraphic	Of, relating to, or determined by stratigraphy, which is the branch of geology dealing with the study of the nature, distribution, and relations of layered rocks in the earth's crust.
strutting ground	An area used by Greater Sage-Grouse in early spring for elaborate, ritualized courtship displays (see also Lek).
subbituminous	A lower rank of coal (35%–45% carbon) with a heating value between that of bituminous and lignite, usually 8,300 to 11,500 BTU per pound. Sub-bituminous coal contains a high percentage of volatile matter and moisture.
surface disturbance	Greater than casual-use actions created through mechanized or mechanical means that would cause soil mixing and result in alteration or removal of soil and vegetation, exposing the mineral soil to erosive processes to the extent that reclamation may be required. These actions may include the use of mechanized earth-moving equipment; truck-mounted drilling equipment; geophysical exploration; vehicle travel off routes in areas designated as limited or closed to OHV use; placement of surface facilities such as utilities, pipelines, structures, and oil and gas wells; new road construction; and use of pyrotechnics, explosives, and hazardous chemicals.
suspended solids	The very fine soil particles that remain in suspension in water for a considerable period of time without contact with the stream or river channel bottom.
threatened and endangered species	These species of plants or animals classified as threatened or endangered pursuant to Section 4 of the ESA. Any species that is in danger of extinction, or is likely to become so within the foreseeable future.
timing limitation	A fluid minerals leasing constraint that prohibits surface use during specified time periods to protect identified resource values. The constraint does not apply to the operation and maintenance of production facilities unless analysis demonstrates that such constraints are needed and that less stringent, project-specific constraints would be insufficient.
topography	Physical shape of the ground surface; the configuration of land surface including its relief, elevation, and the position of its natural and human-made features.
topsoil	The upper portion of a soil, usually dark colored and rich in organic material. It is more or less equivalent to the upper portion of an A horizon in an ABC soil.
total dissolved solids (TDS)	The total quantity in milligrams per liter of dissolved materials in water.
uranium	A very hard, heavy, metallic element that is crucial to development of atomic energy.
vegetation type	A kind of existing plant community with distinguishable characteristics described in terms of the present vegetation that dominates an area.

vertebrate fossils	The fossilized remains of animals that possessed a backbone; examples are fish, amphibians, reptiles, dinosaurs, birds, and mammals.
visual resource management (VRM)	The systematic means to identify visual values, establish objectives that provide the standards for managing those values, and evaluate the visual impacts of proposed projects to ensure that objectives are met.
visual resources	The physical features of a landscape that can be seen (e.g., land, water, vegetation, structures, and other features).
waterfowl	A bird that frequents water, especially a swimming bird such as a duck or swan.
wetlands	Those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient, under normal circumstances, to support a prevalence of vegetative or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction. Wetlands include marshes, bogs, sloughs, potholes, river overflows, mud flats, wet meadows, seeps, and springs (33 CFR 328.3(a)(7)(b)).
wild and scenic rivers	Rivers or sections of rivers designated by Congressional actions under the 1968 Wild and Scenic Rivers Act as wild, scenic, or recreational by an act of the Legislature of the state or states through which they flow. Wild and scenic rivers may be classified and administered under one or more of the following categories: **Wild river areas**: Rivers or sections of rivers that are free of impoundments and generally inaccessible except by trail, with watersheds or shorelines essentially primitive and waters unpolluted. These represent vestiges of primitive America. **Scenic river areas**: Rivers or sections of rivers that are free of impoundments, with watersheds still largely primitive and shorelines largely undeveloped, but accessible in places by roads. **Recreational river areas**: Rivers or sections of rivers that are readily accessible by road or railroad, that may have some development along their shorelines, and that may have undergone some impoundment or diversion in the past.
wilderness	An area of undeveloped federal land designated wilderness by Congress, retaining its primeval character and influence, without permanent improvements or human habitation, protected and managed to preserve its natural conditions and that 1) generally appears to have been affected primarily by the forces of nature with the imprint of man's work substantially unnoticeable, 2) has outstanding opportunities for solitude or primitive and unconfined recreation, 3) has at least 5,000 acres or is of sufficient size to make practical its preservation and use in an unimpaired condition, and 4) also may contain features that are of ecological, geological, scientific, educational, scenic, or historical value. These characteristics were identified by Congress in the Wilderness Act of 1964.

wildfire	An unplanned, unwanted wildland fire including unauthorized human-caused fires, escaped wildland fire use events, escaped prescribed fire projects, and all other wildland fires where the objective is to put the fire out.
wildfire suppression	An appropriate management response to wildfire, escaped wildland fire use, or prescribed fire that results in curtailment of fire spread and eliminates all identified threats from the particular fire.
wildland fire	A non-structure fire, other than prescribed fire, that occurs in the wildland. Any fire originating from unplanned ignition.
wildland fire use	The application of the appropriate management response to naturally ignited wildland fires to accomplish specific resource management objectives in pre-defined designated areas outlined in fire management plans.
wildland-urban interface (WUI)	The line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels.

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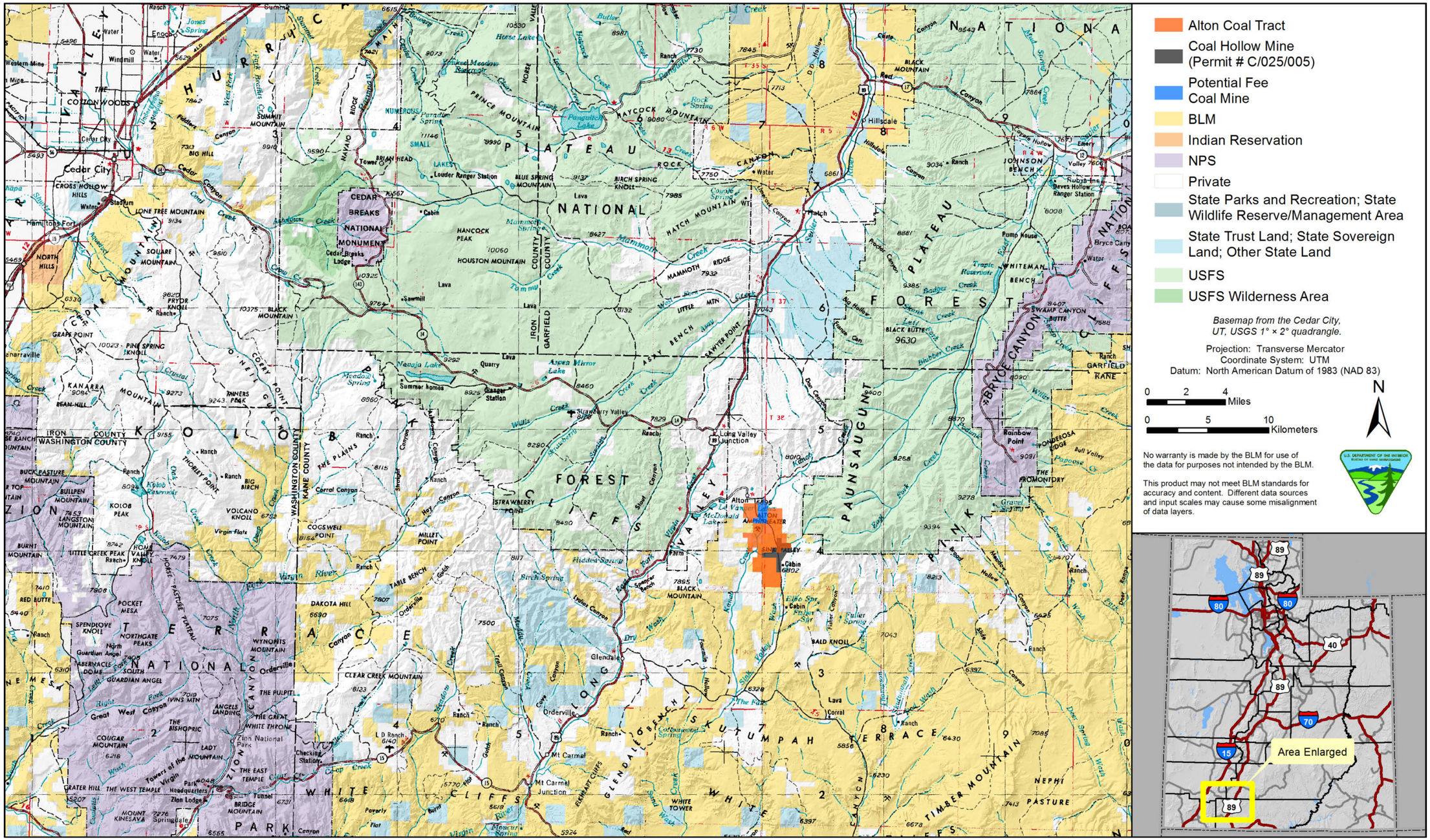
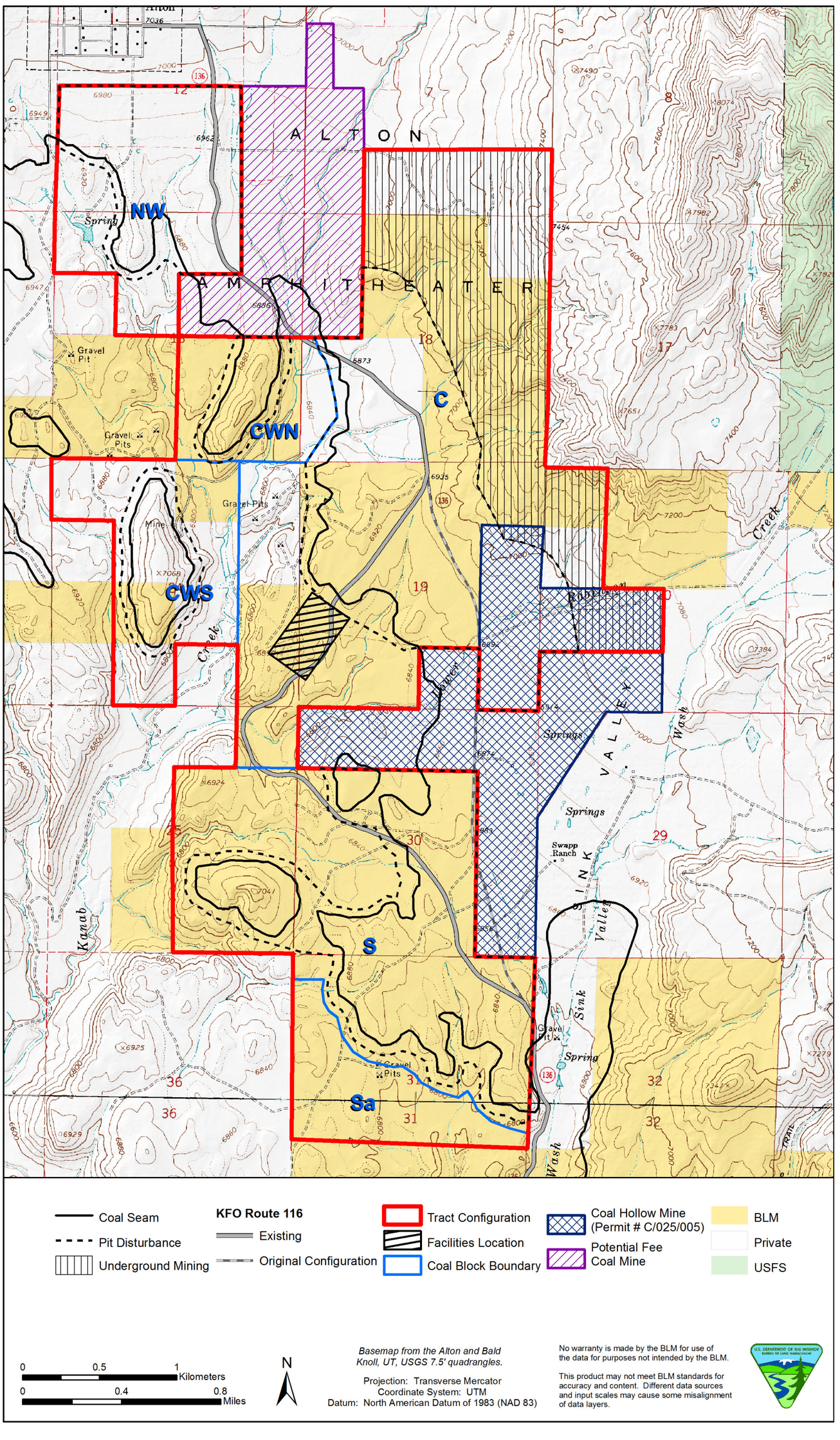
APPENDIX A.
MAPS

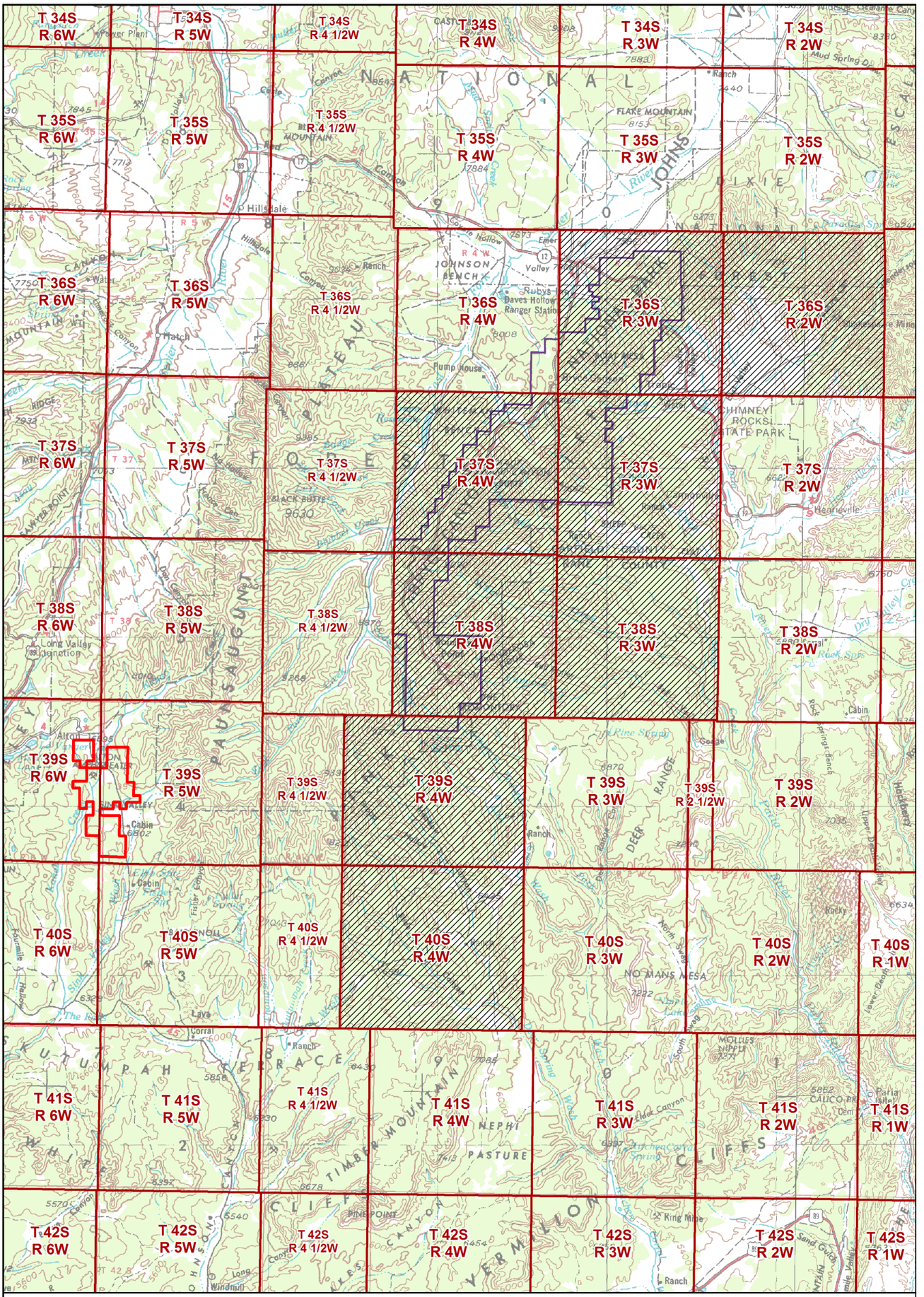


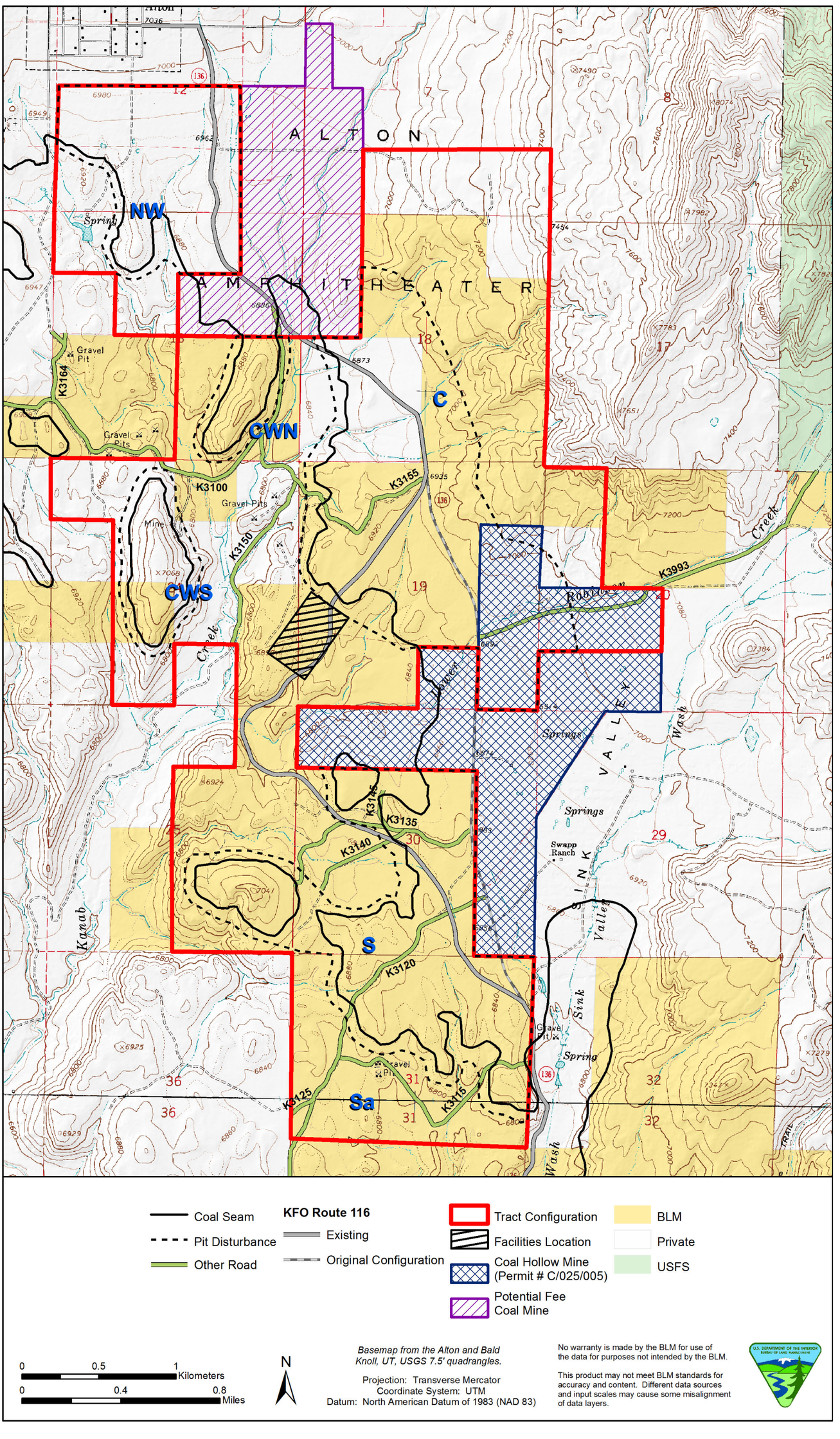
Map 1.1. Alton Coal Tract (Proposed Action) in relation to the Town of Alton and other area landmarks.



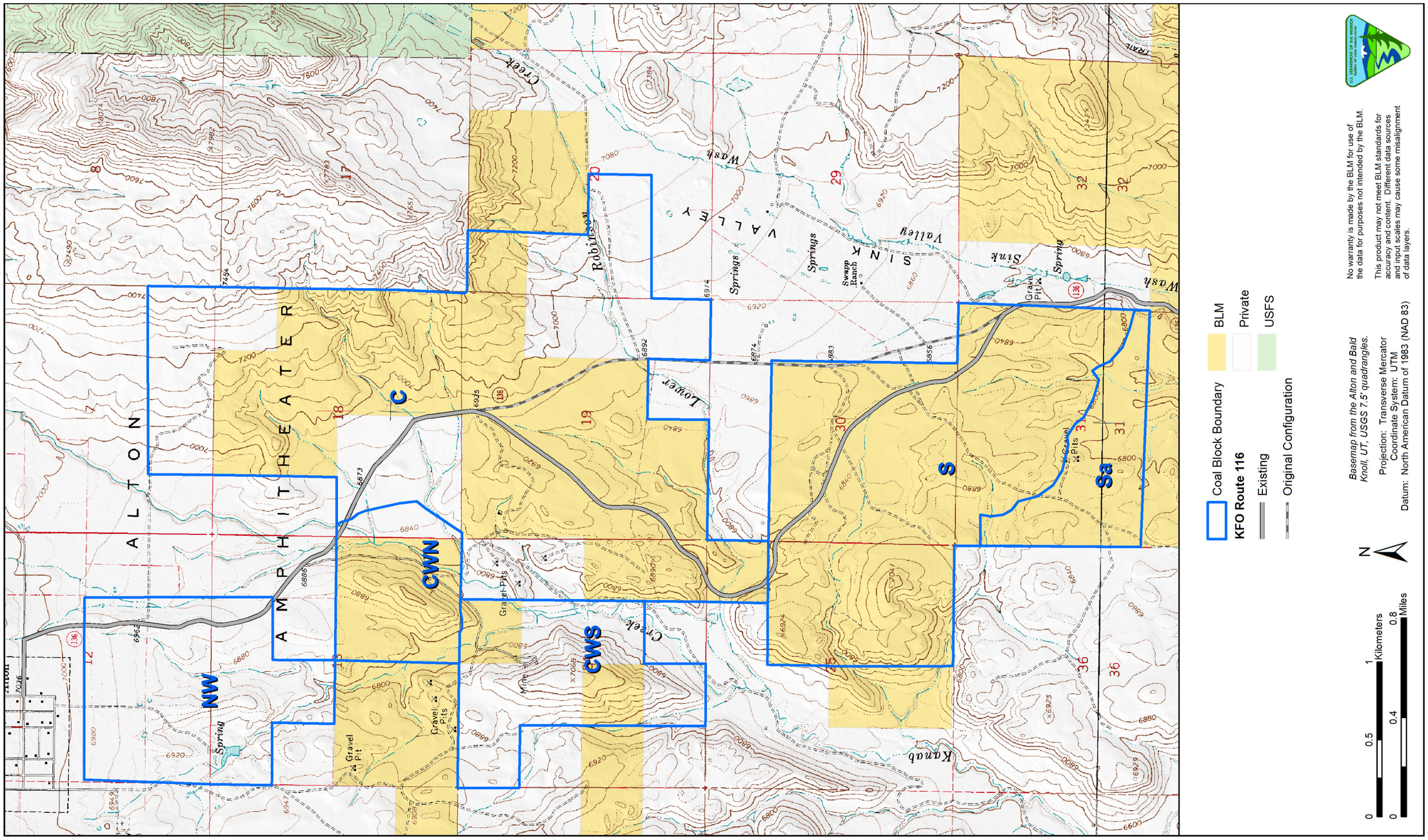
Map 1.2. Alton Coal Tract configuration and land ownership under Alternative B (Proposed Action).

Map 1.3. Alton Coal Tract in relation to areas unsuitable for surface coal mining.



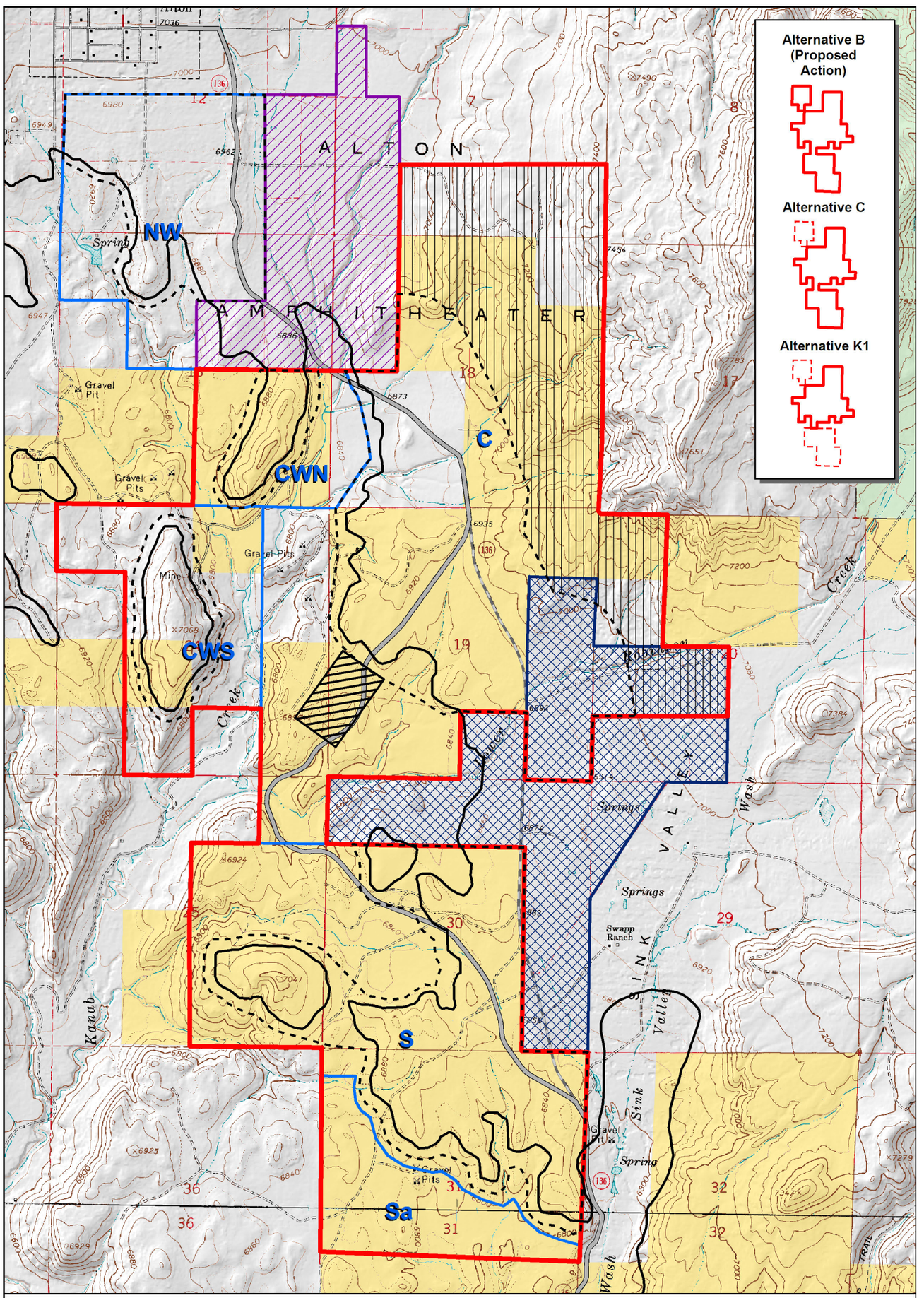


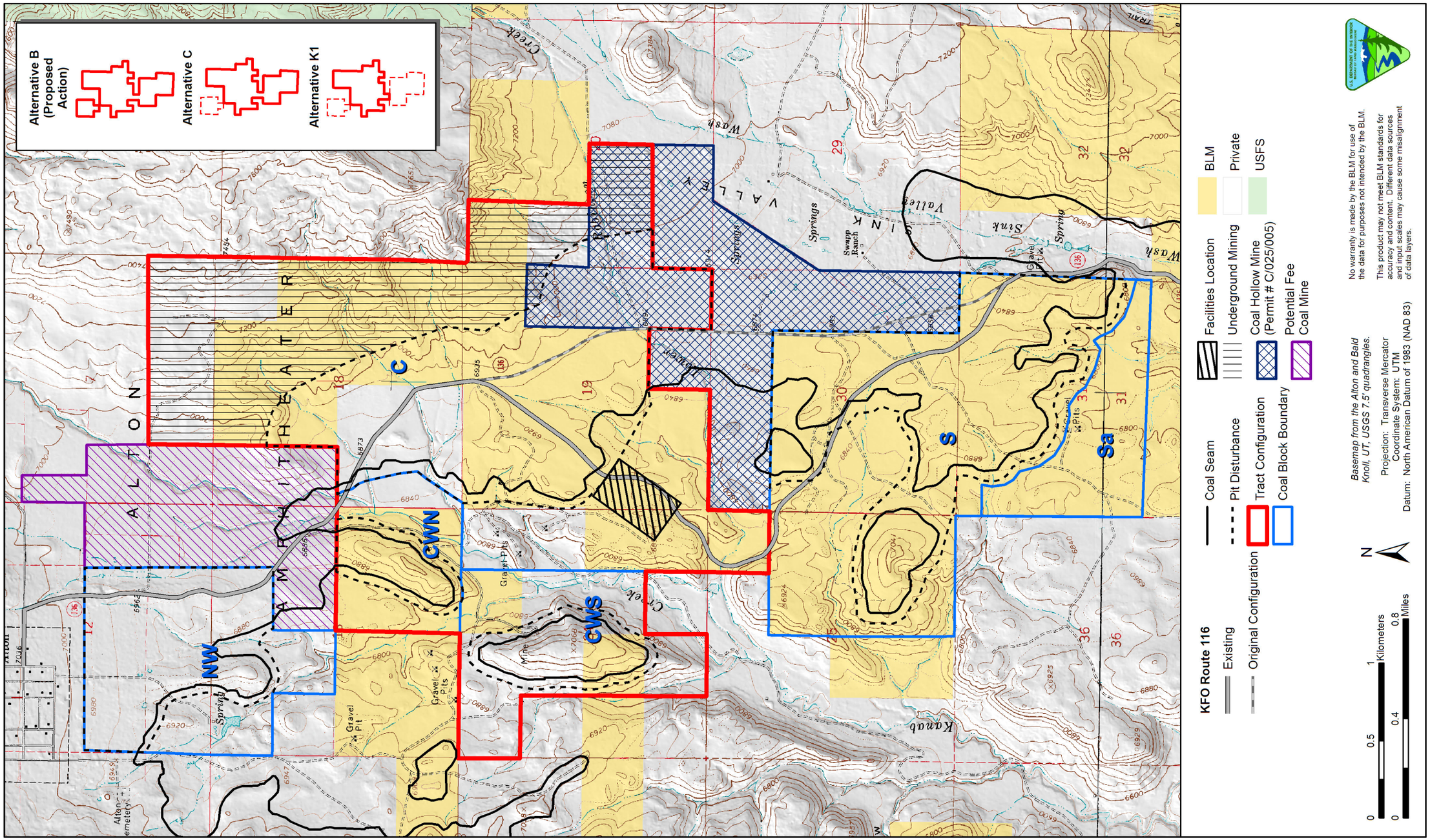
Map 1.4. Other public roads on the Alton Coal Tract.



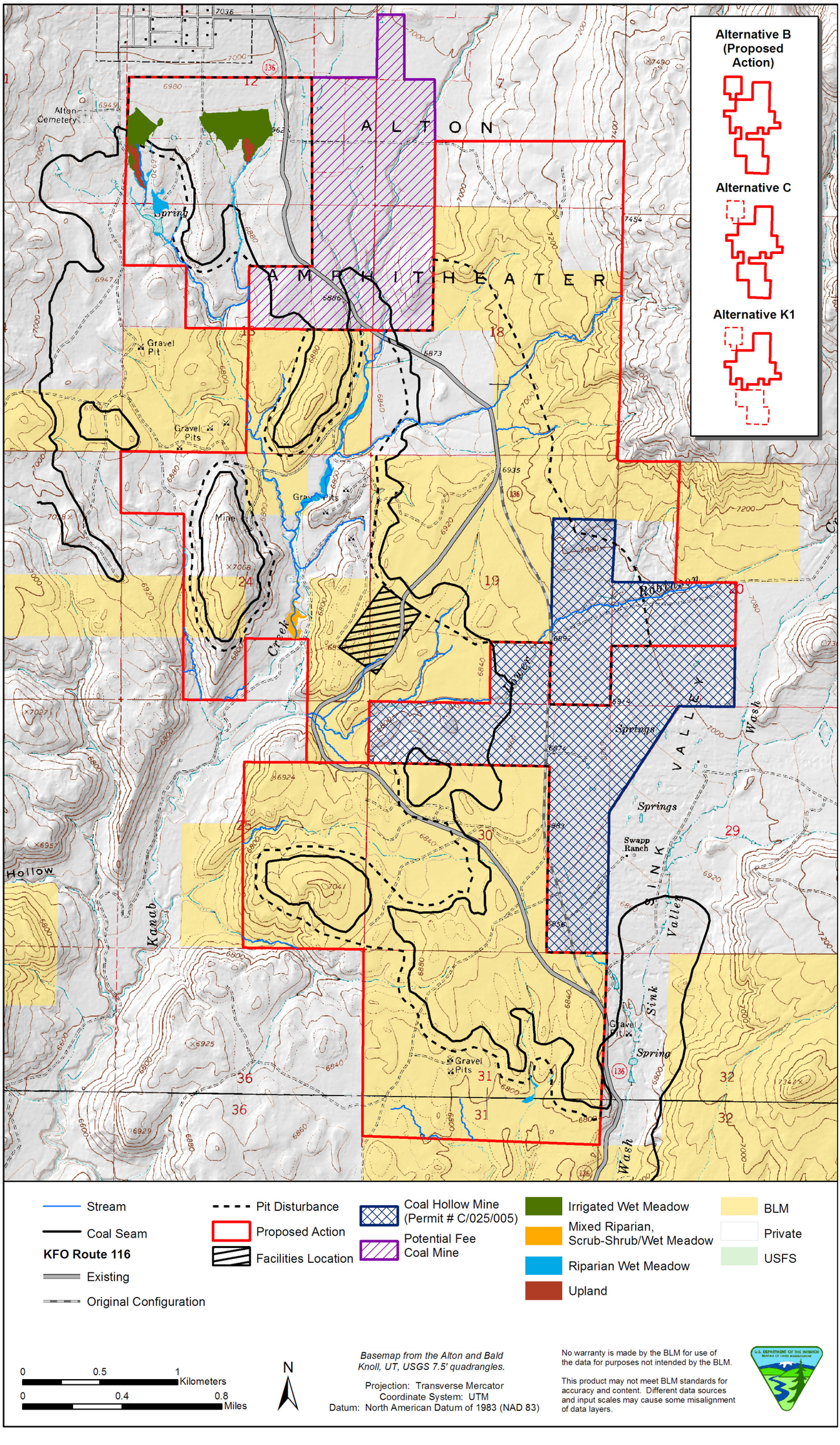
Map 2.1. Coal block boundaries on the Alton Coal Tract.

Map 2.2. Alton Coal Tract configuration and land ownership under Alternative C.

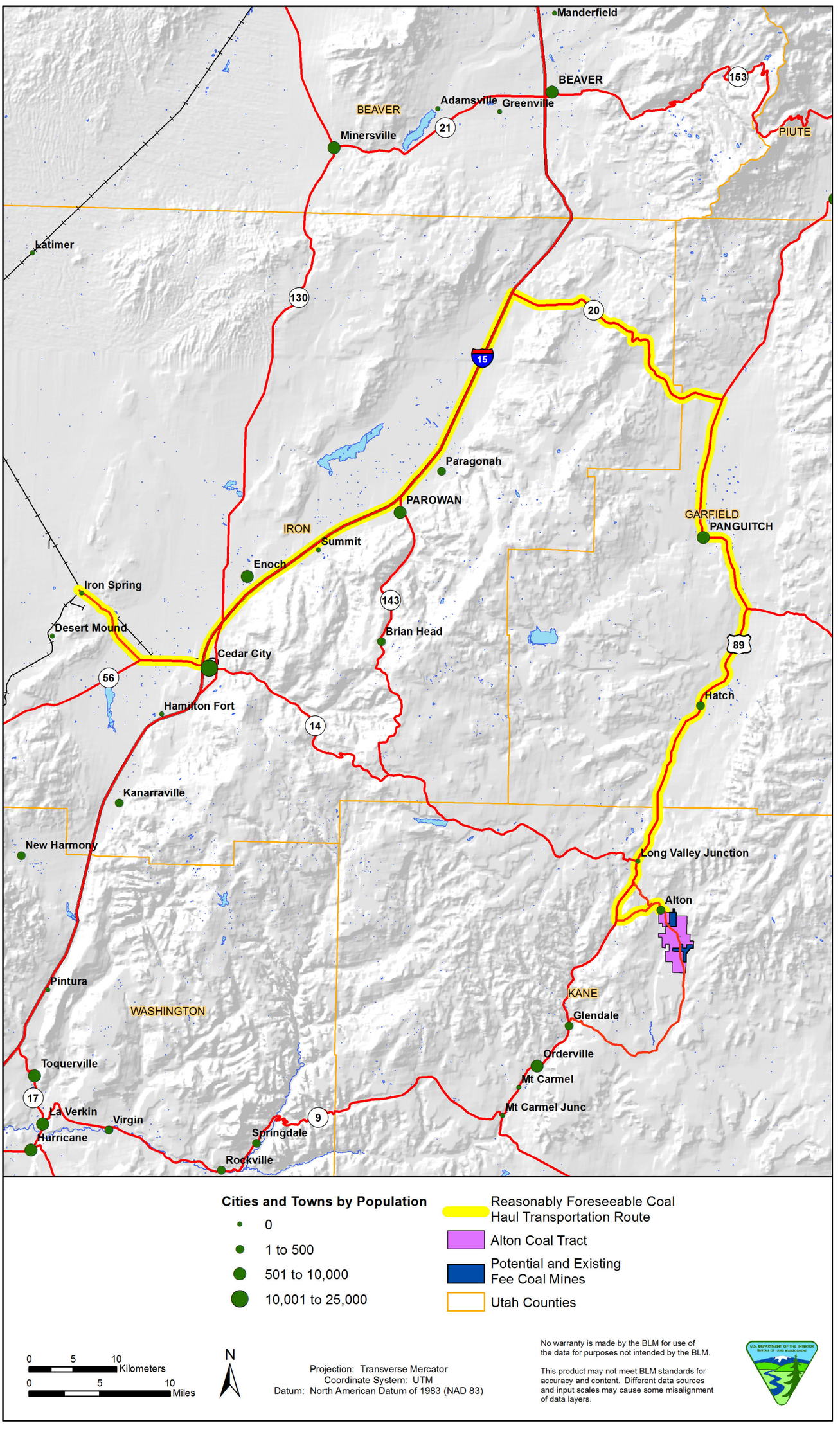




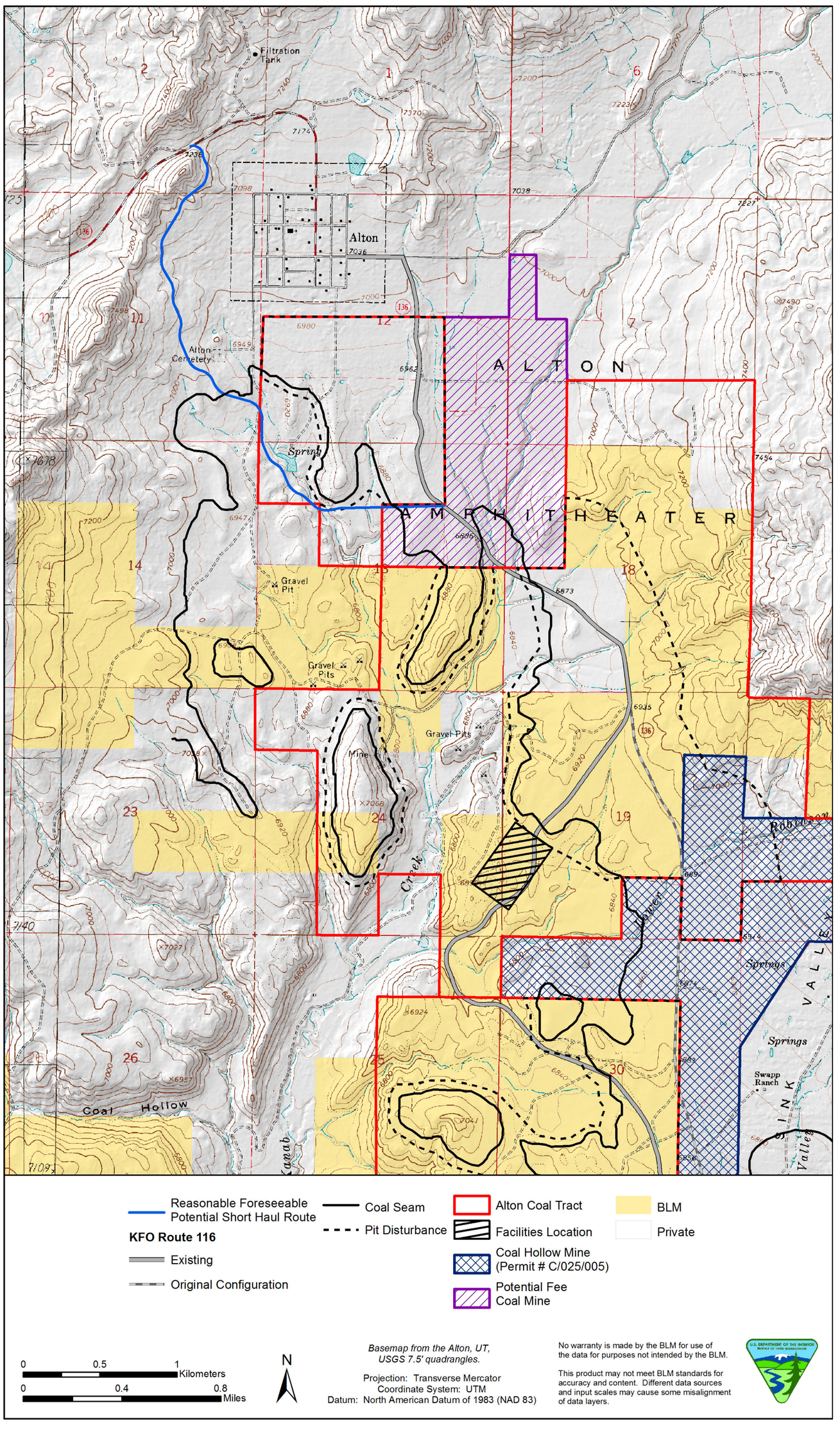
Map 2.3. Alton Coal Tract configuration and land ownership under Alternative K1.



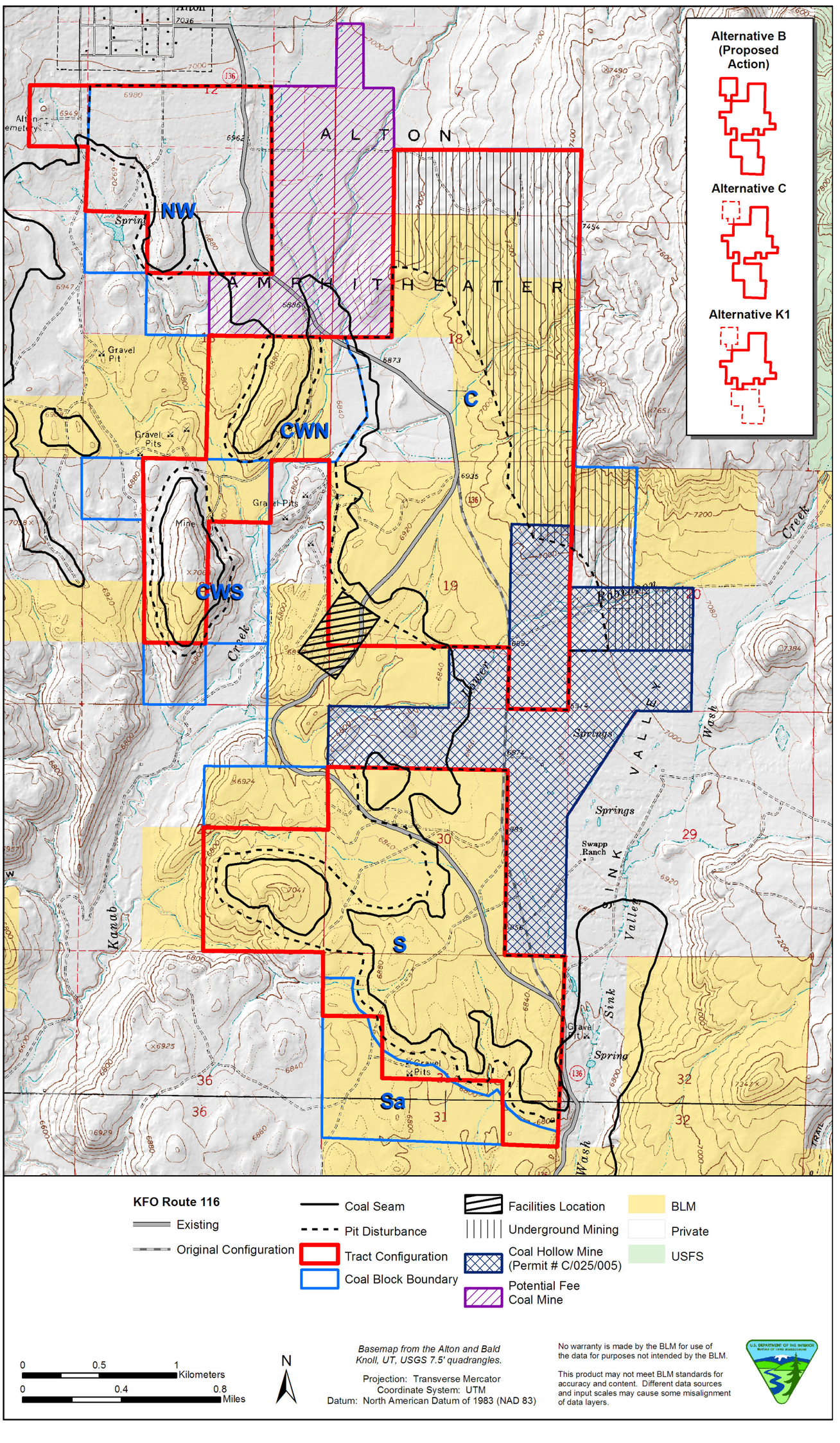
Map 2.4. Potential waters of the U.S. in the Alton Coal Tract.



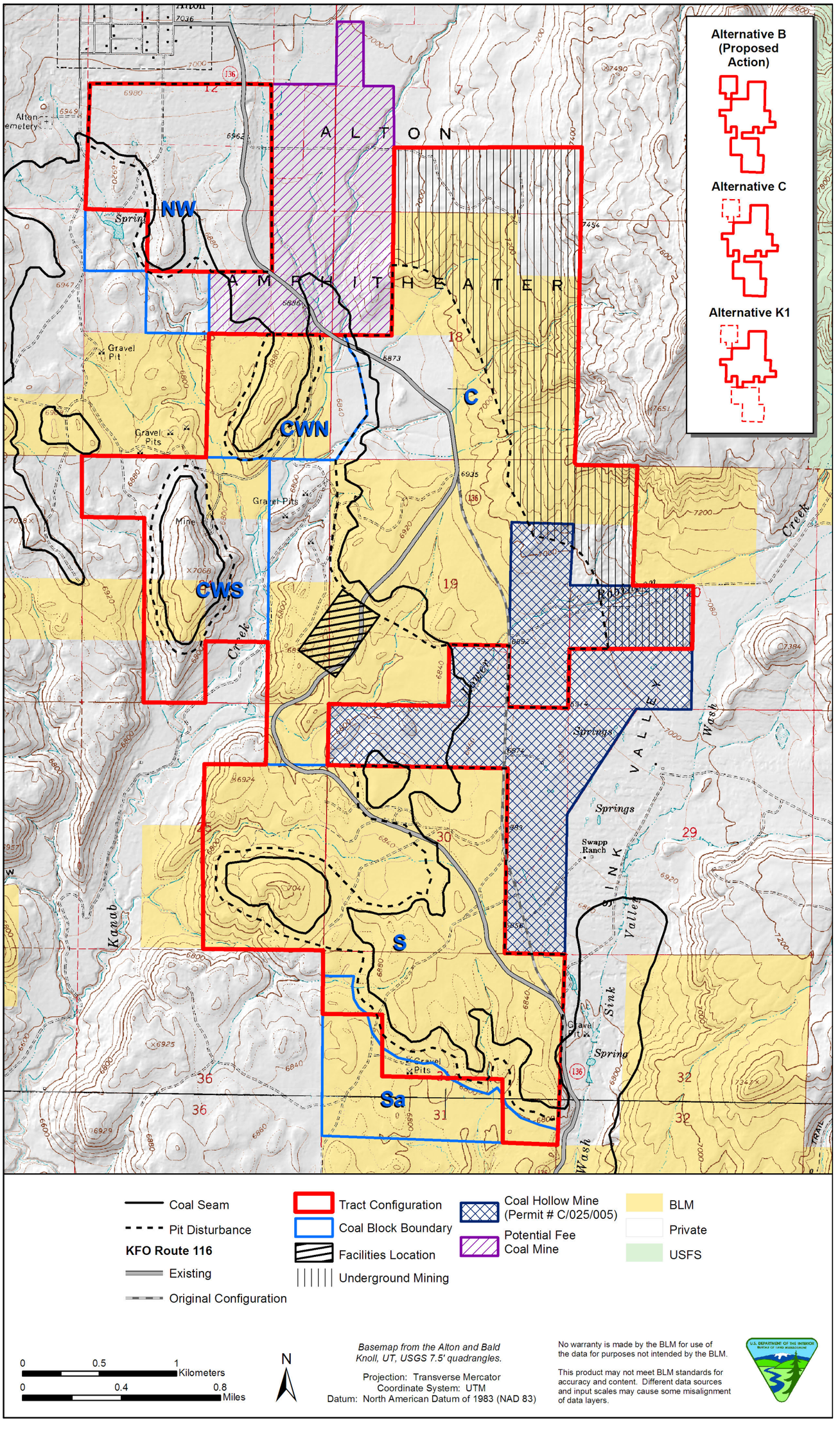
Map 2.5. Reasonably foreseeable coal loadout location and transportation route for delivery of coal from the tract to market.



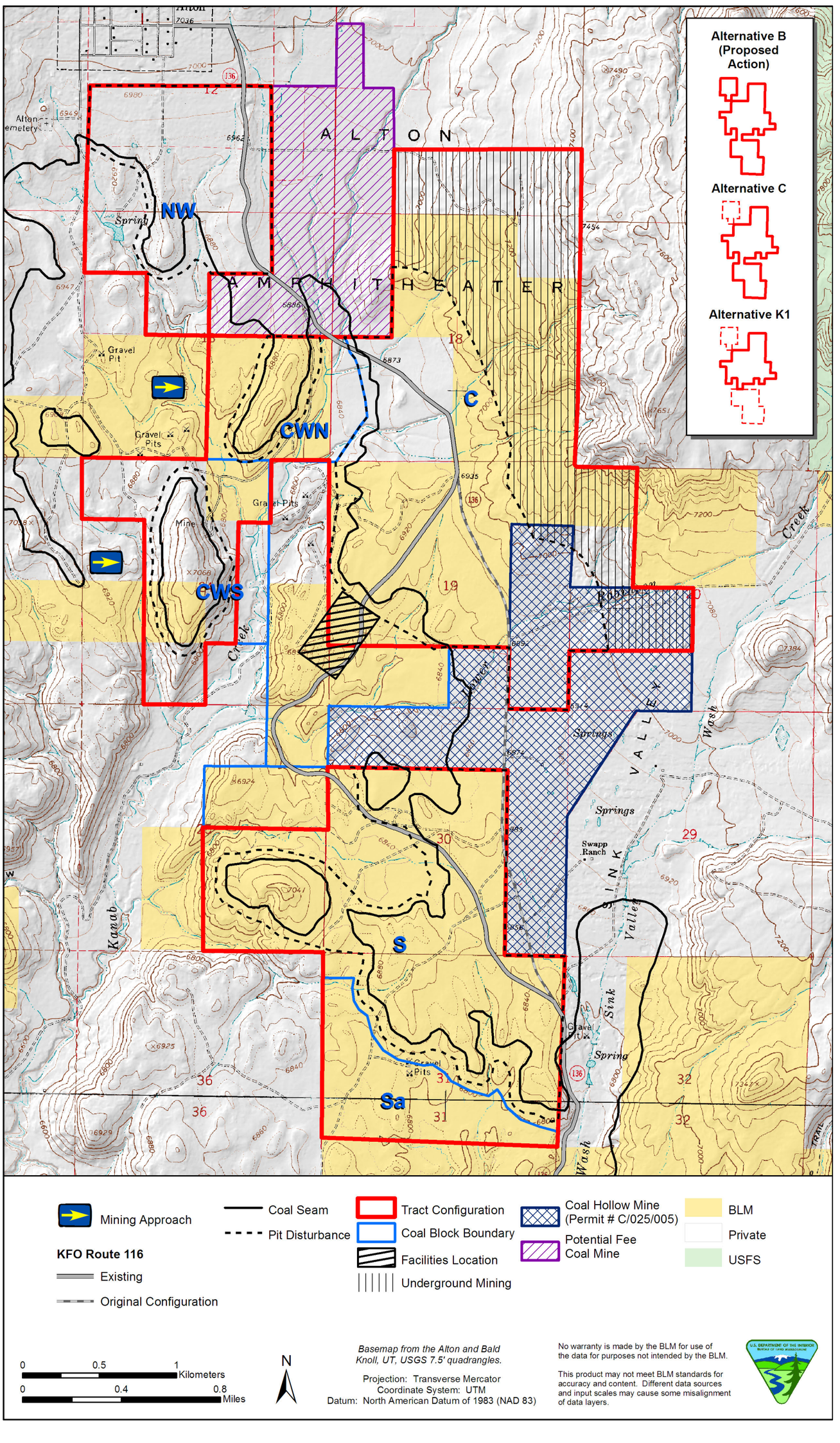
Map 2.6. Reasonably foreseeable potential short haul route.



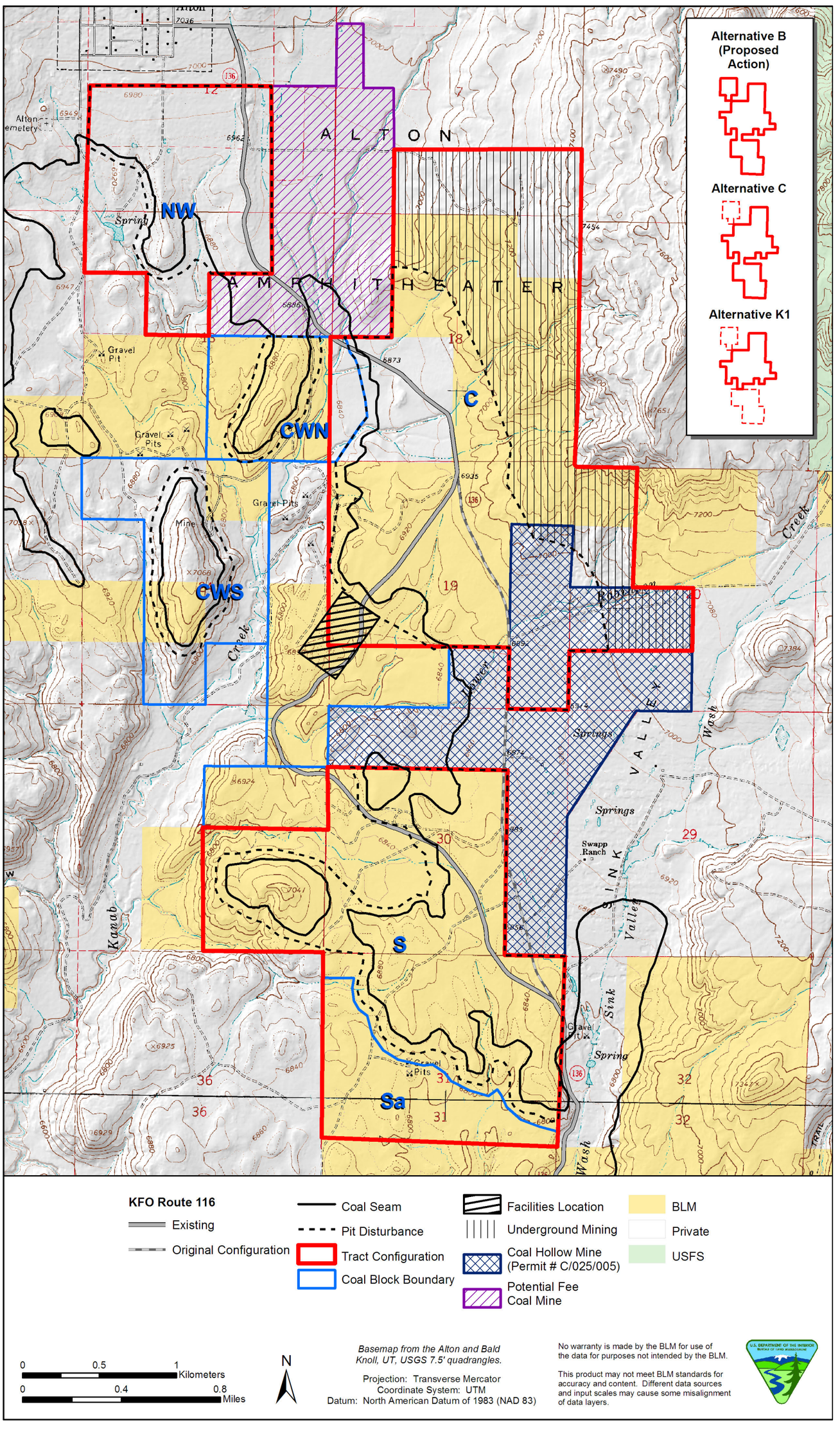
Map 2.7. Alton Coal Tract configuration under Alton Coal Development's original lease by application submittal (Alternative D).



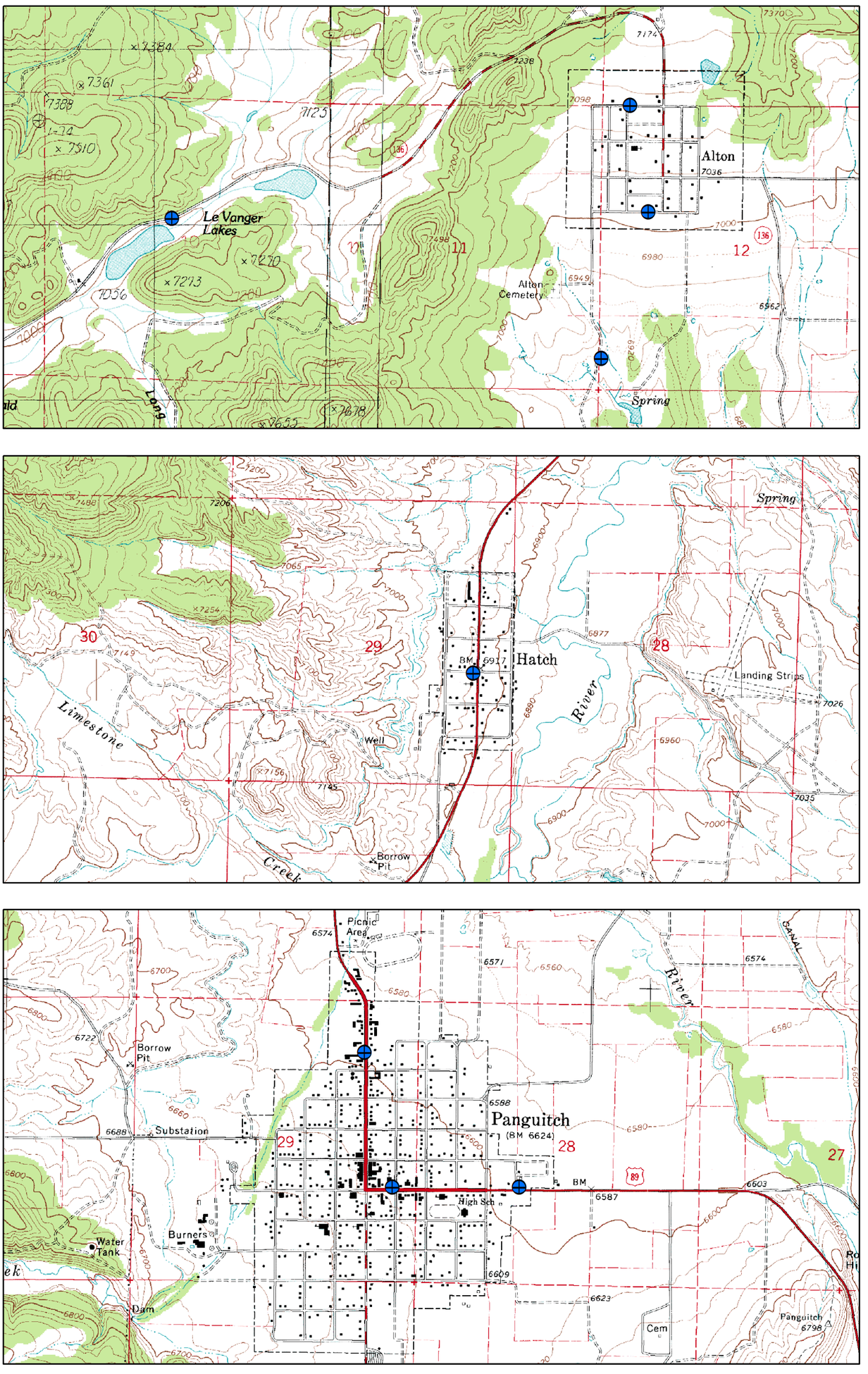
Map 2.8. Alternative K2 with small portions of the tract in Block NW and Block S removed.



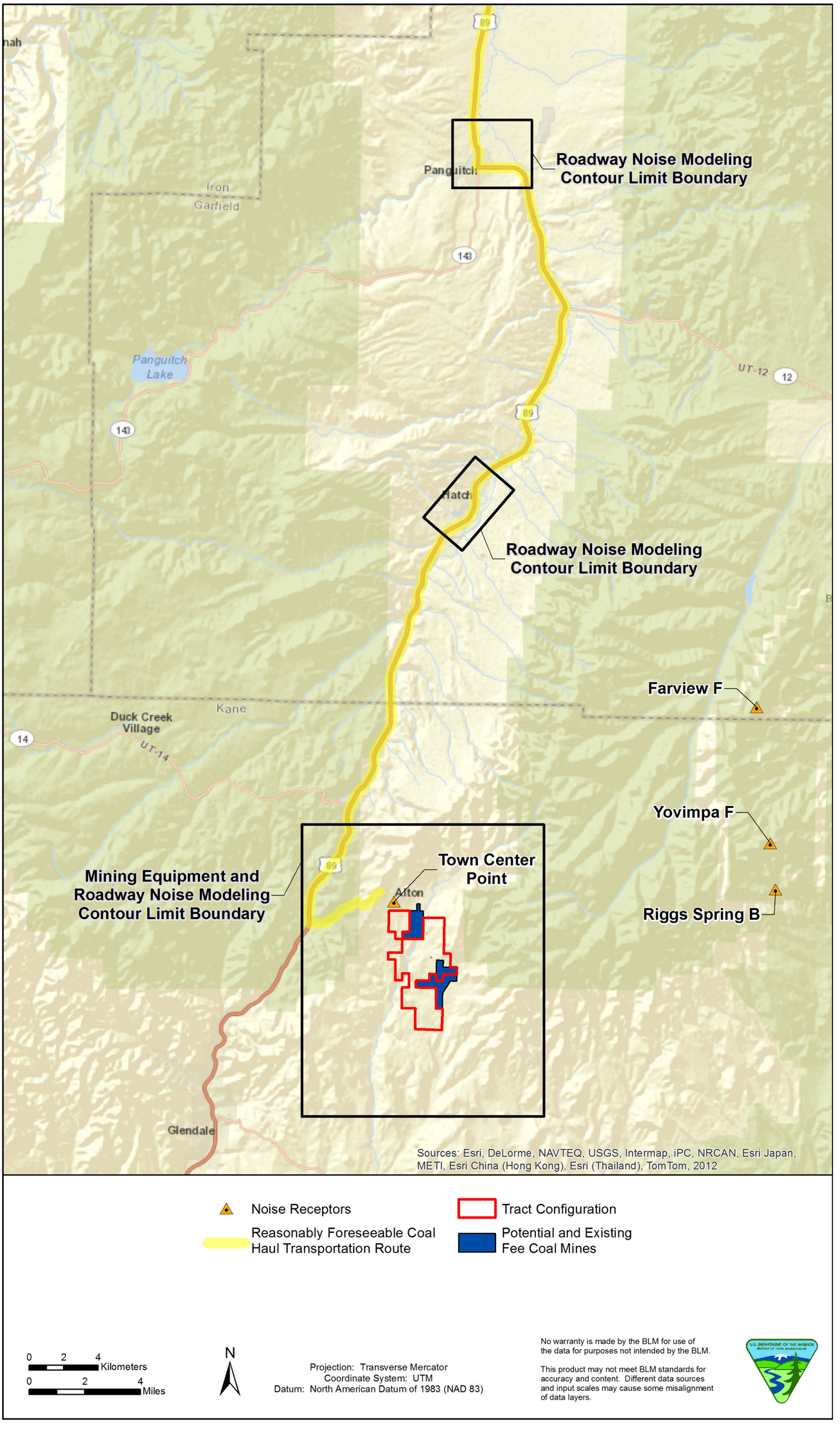
Map 2.9. Alternative L1 would require the mining of Blocks CWN and CWS from west to east and would remove a portion of the tract in the no-coal zone east of these blocks.



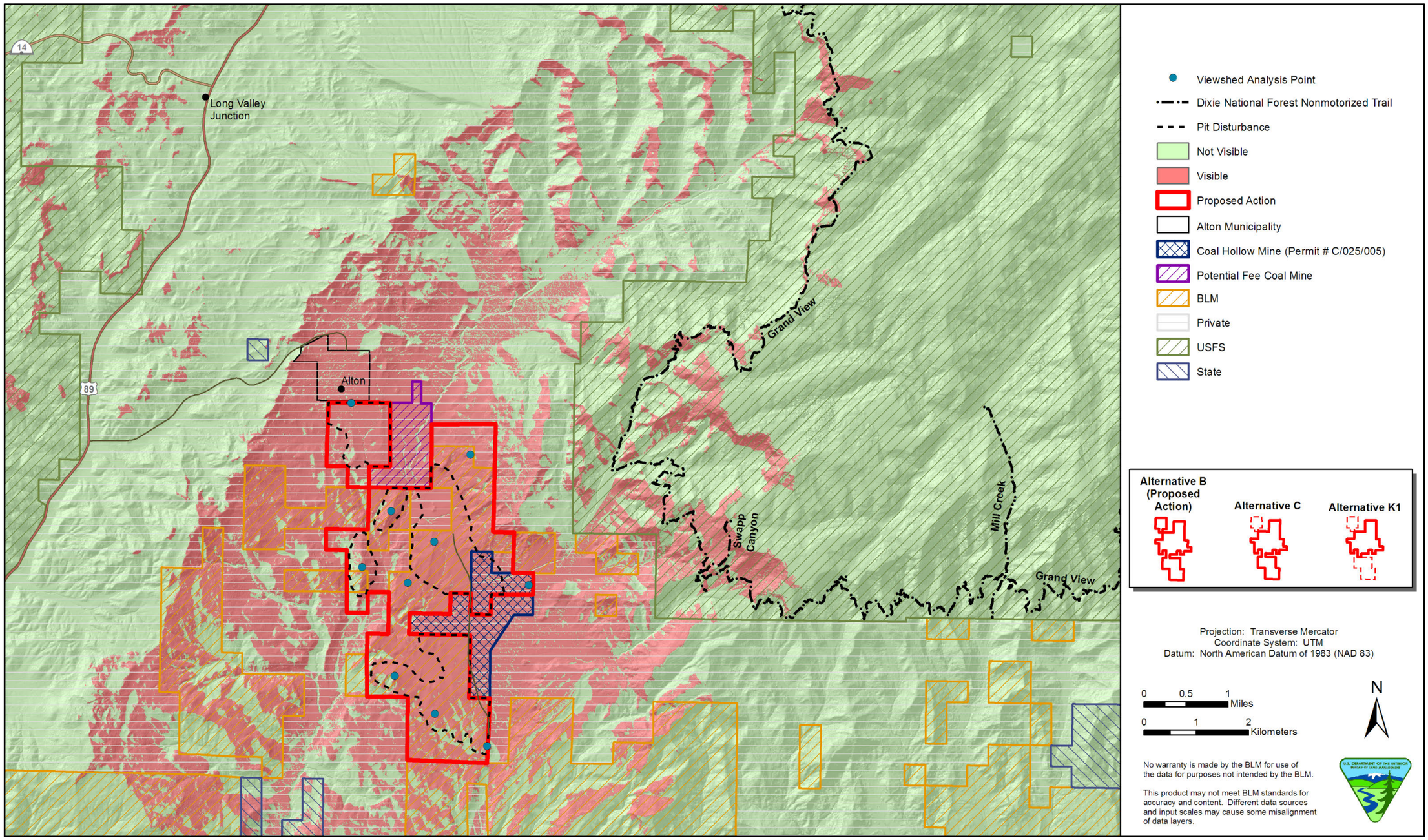
Map 2.10. Alternative L2 would remove Blocks CWN and CWS, including the no-coal zone, from the tract.



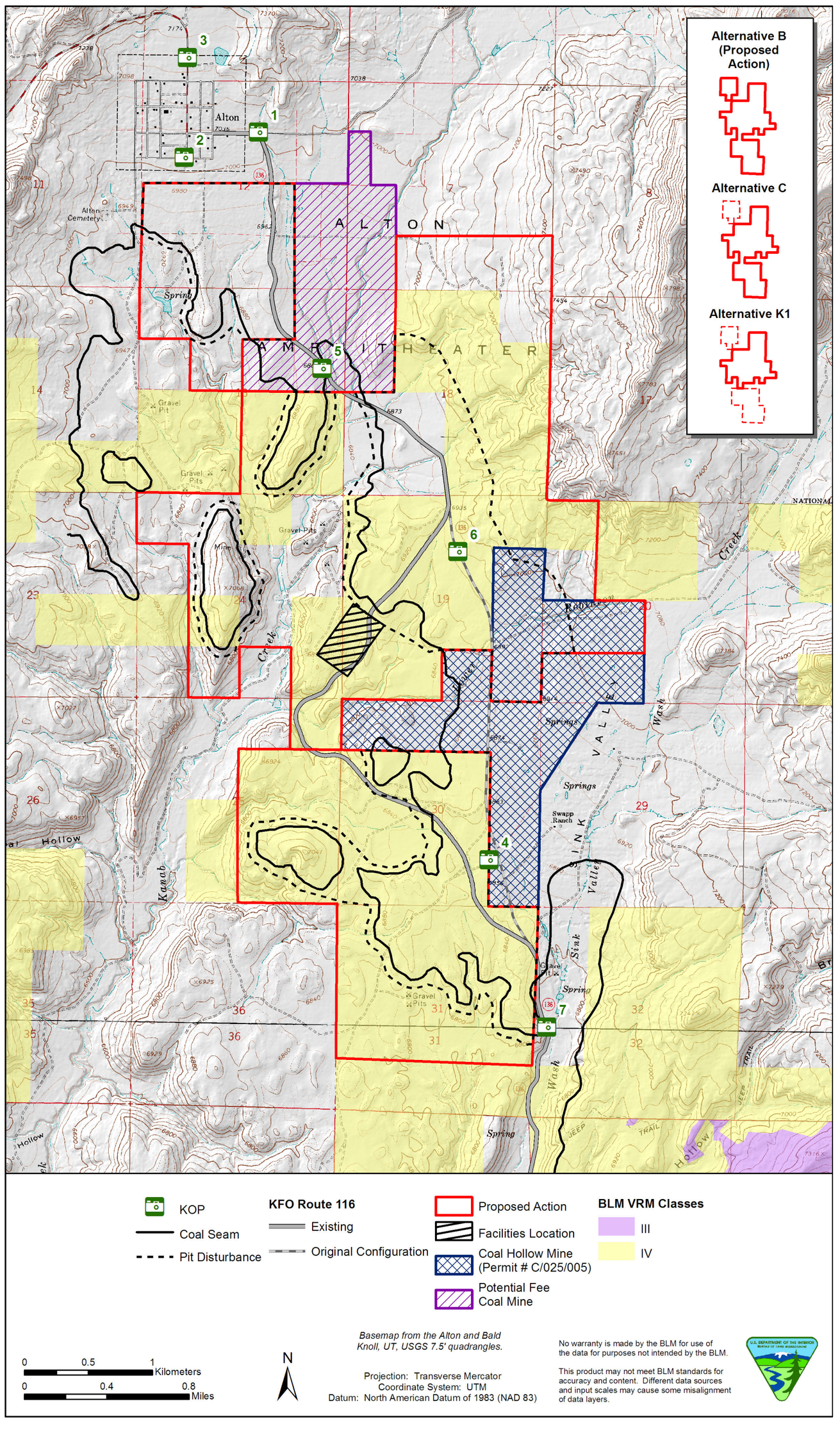
Map 3.1. Measurement points (noise monitors) of outdoor sound levels in Alton, Hatch, and Panguitch.



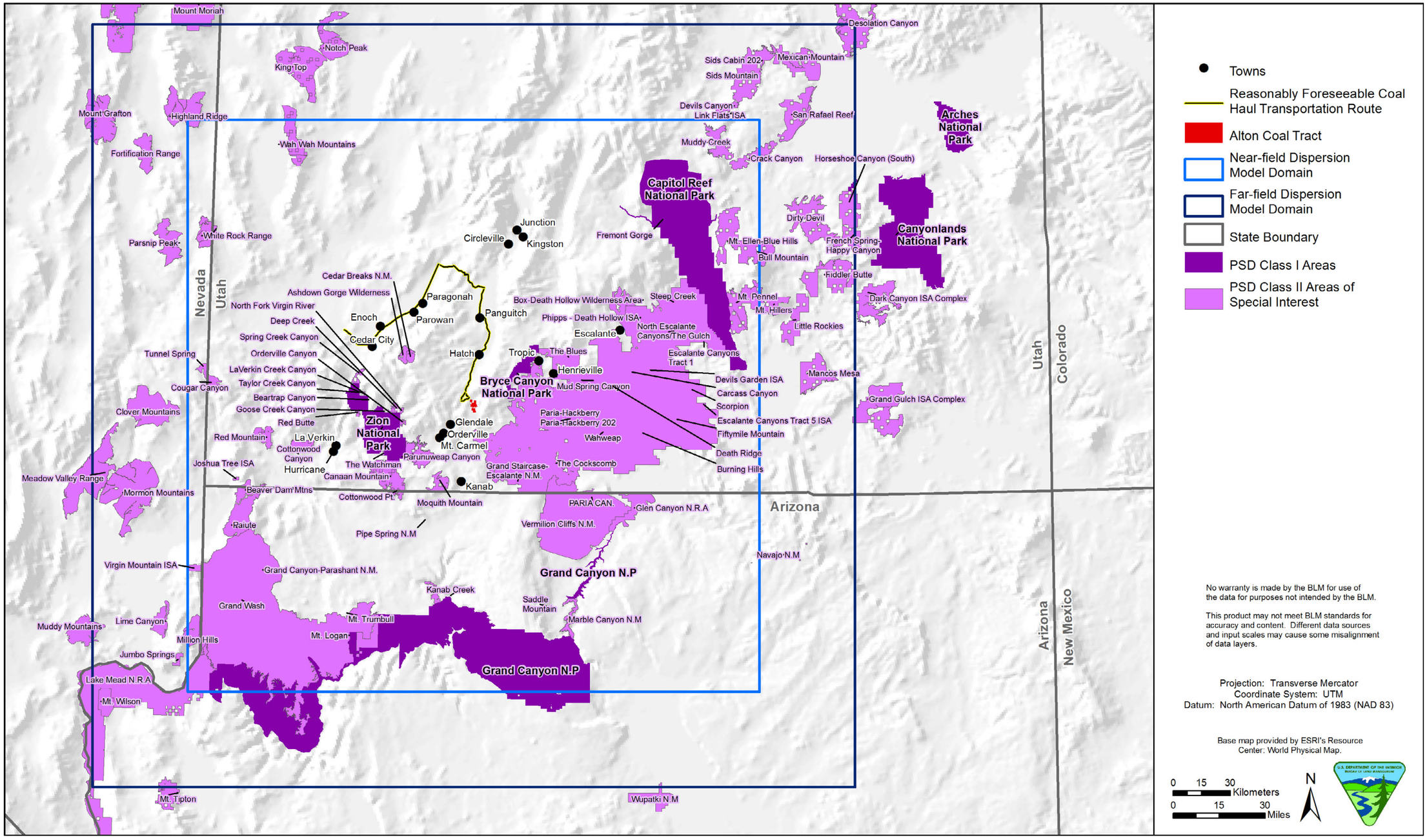
Map 3.2. Noise overview showing noise receptors near the Alton Coal Tract.



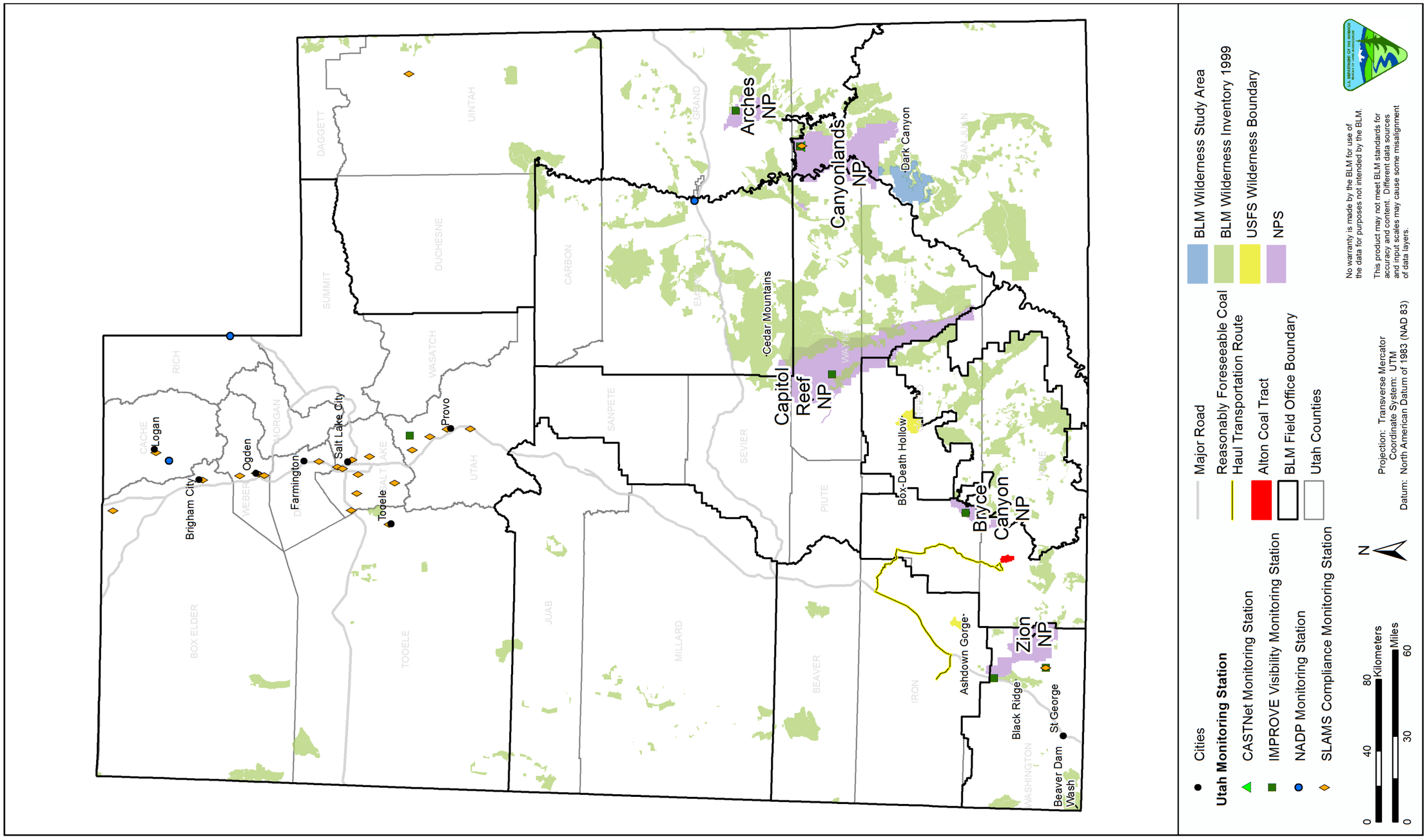
Map 3.3. Proposed Action viewshed with viewshed analysis points.



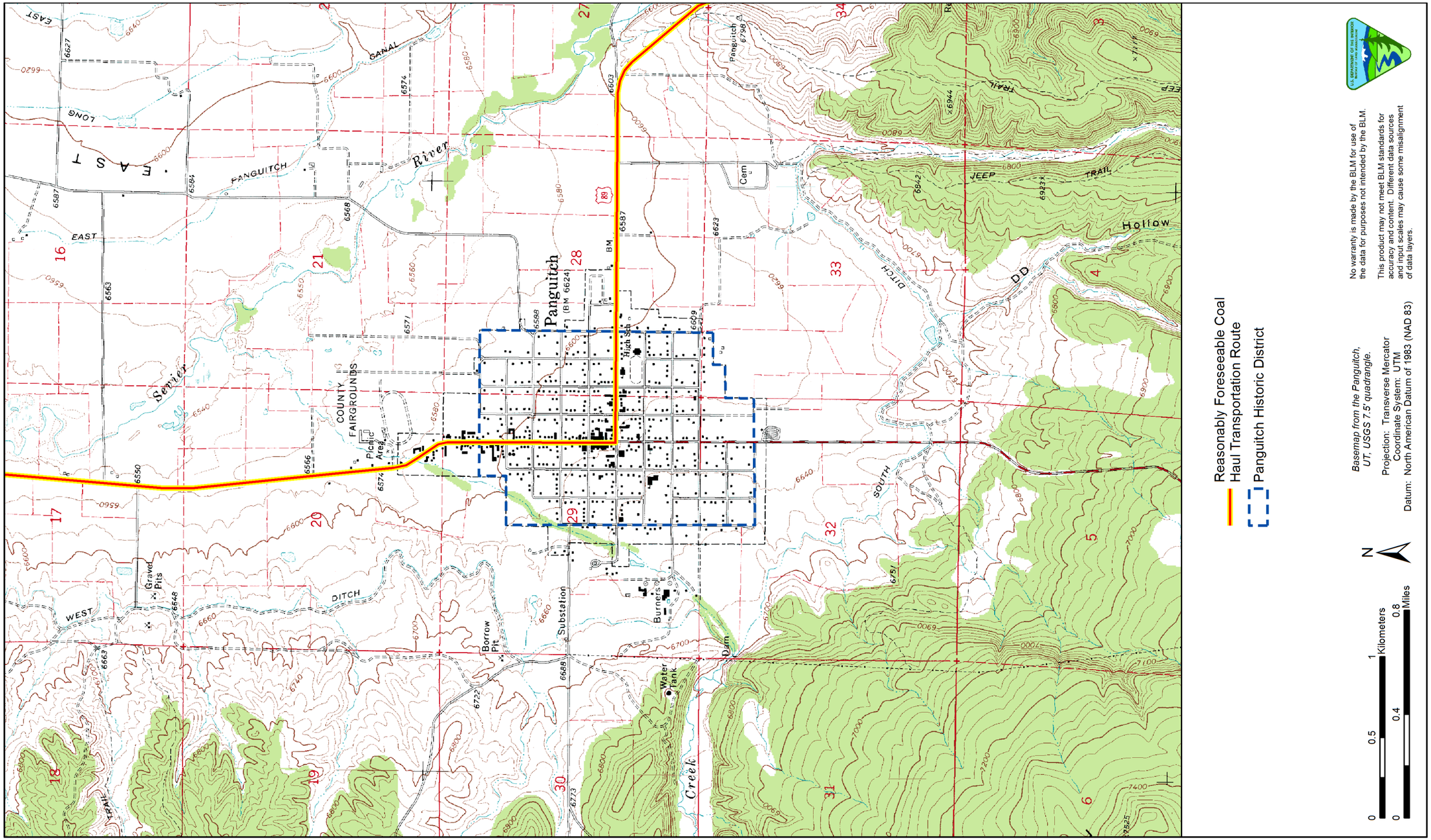
Map 3.4. Visual resources management classes and key observation points on the Alton Coal Tract.



Map 3.5. Air resources analysis area (near- and far-field dispersion model domains).

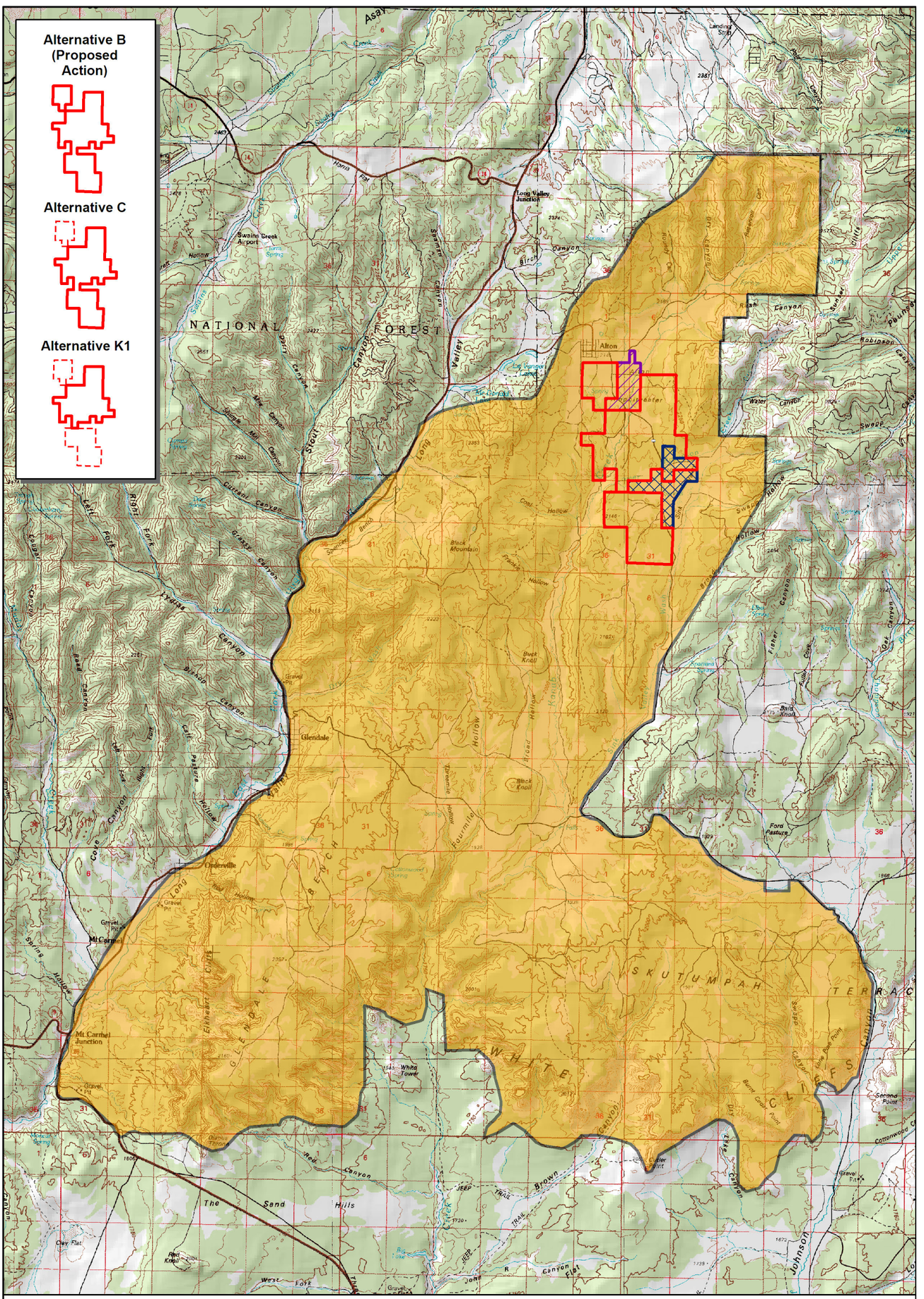


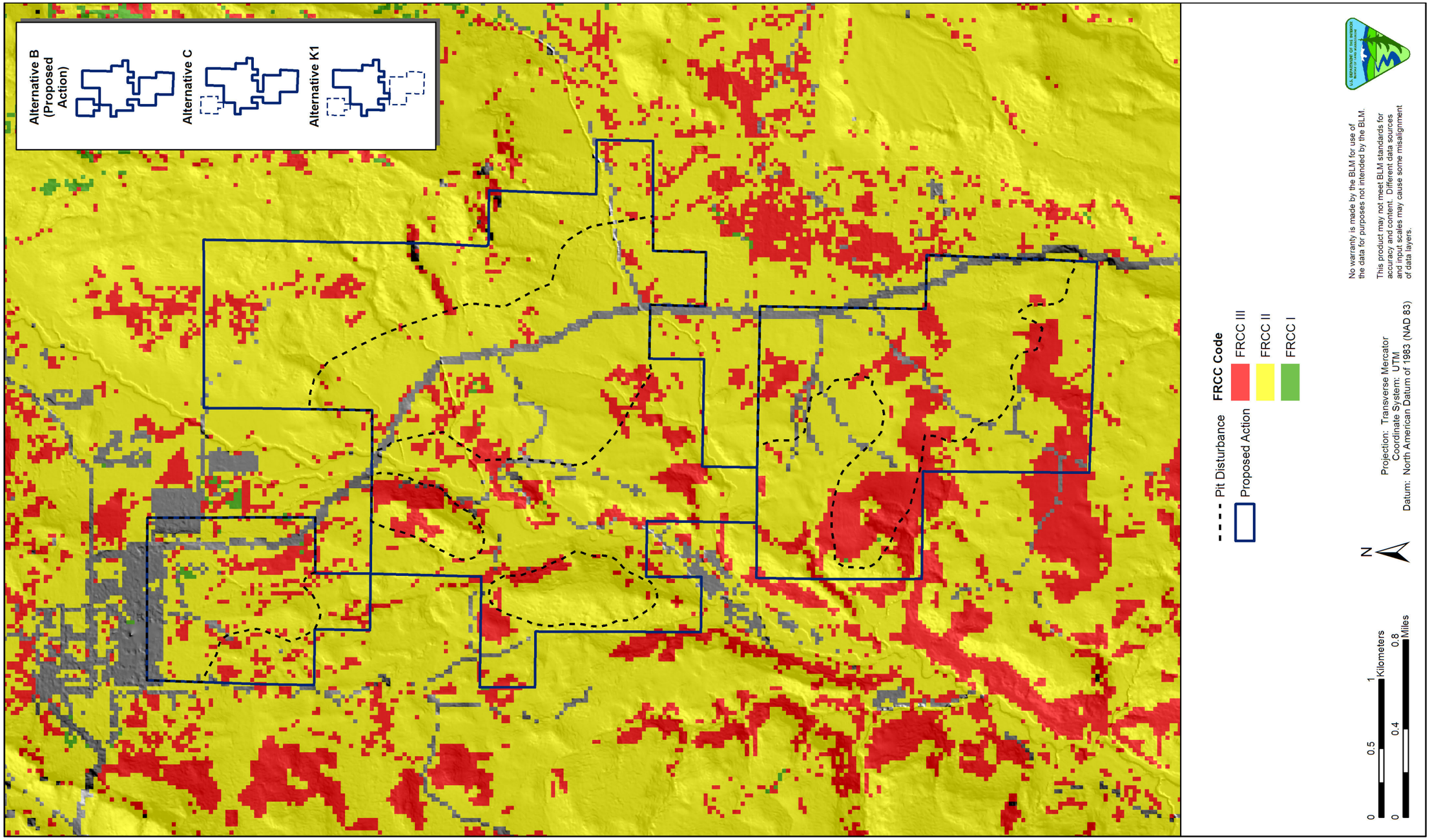
Map 3.6. Air quality monitoring stations in Utah.



Map 3.7. Panguitch historic district boundaries and coal haul transportation route.

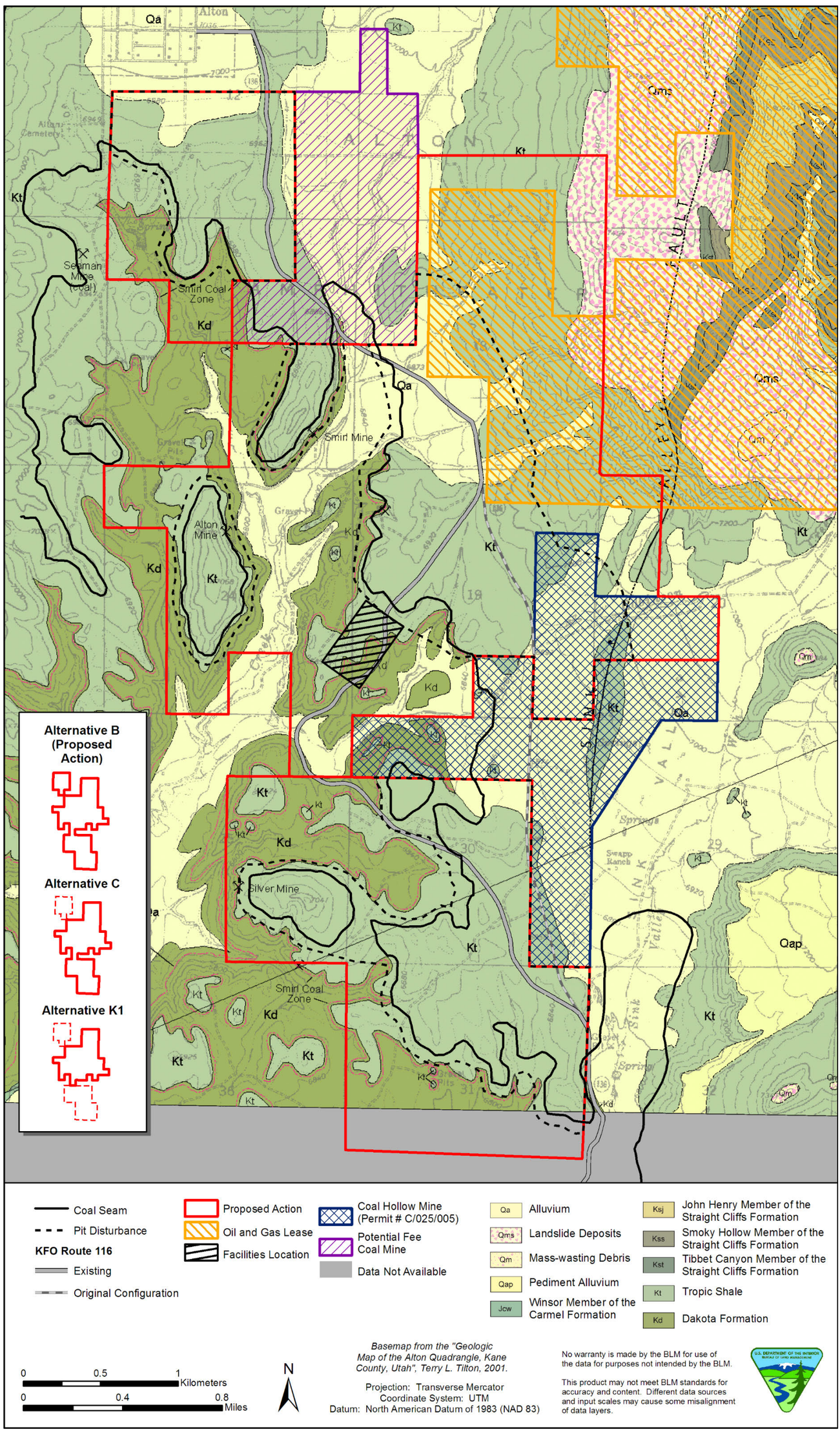
Map 3.8. Glendale Bench Fire Management Unit in relation to the Alton Coal Tract.



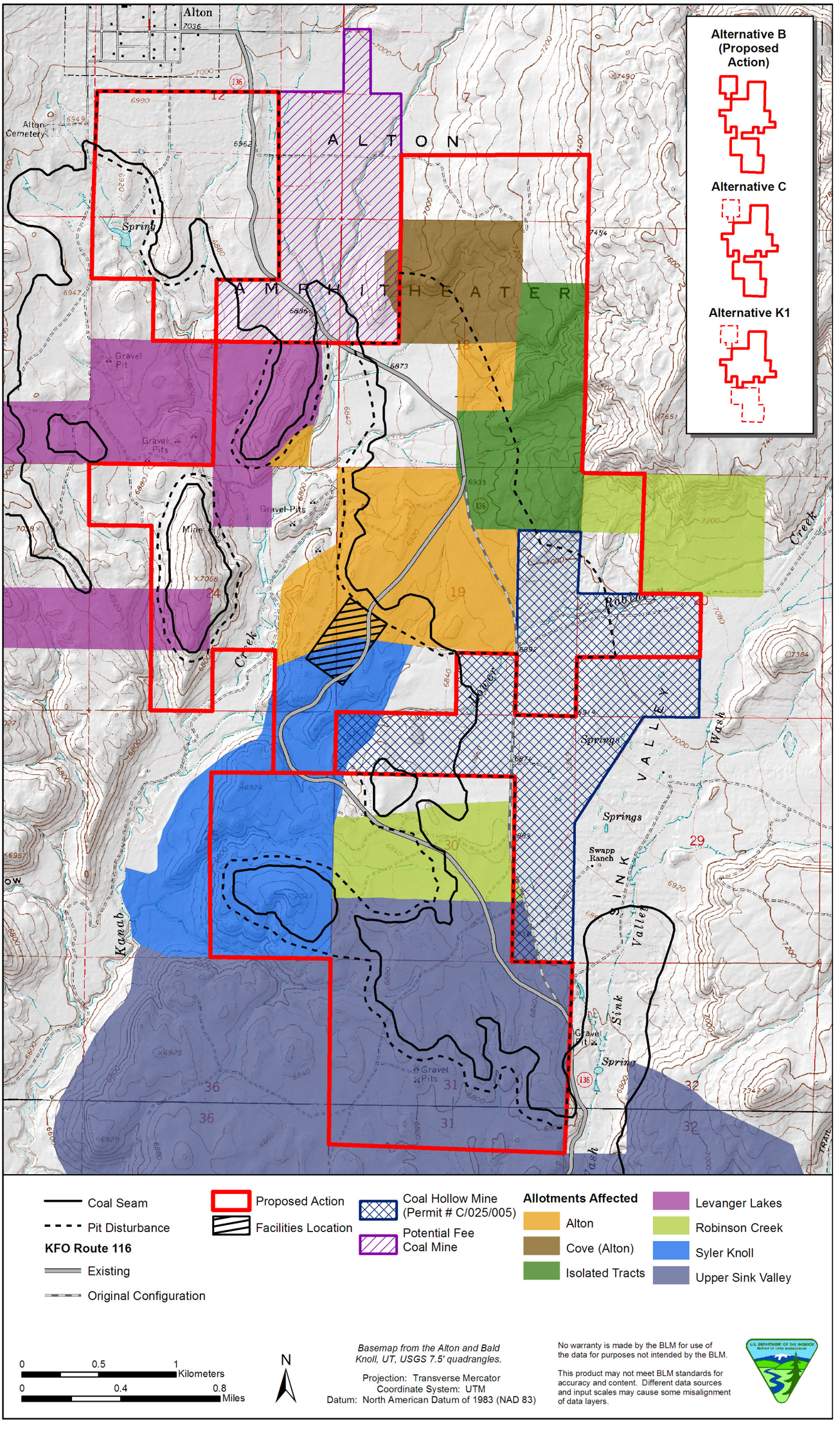


Map 3.9. Fire regime conditions class acreage in the Alton Coal Tract under Alternative B (Proposed Action) and Alternative C.

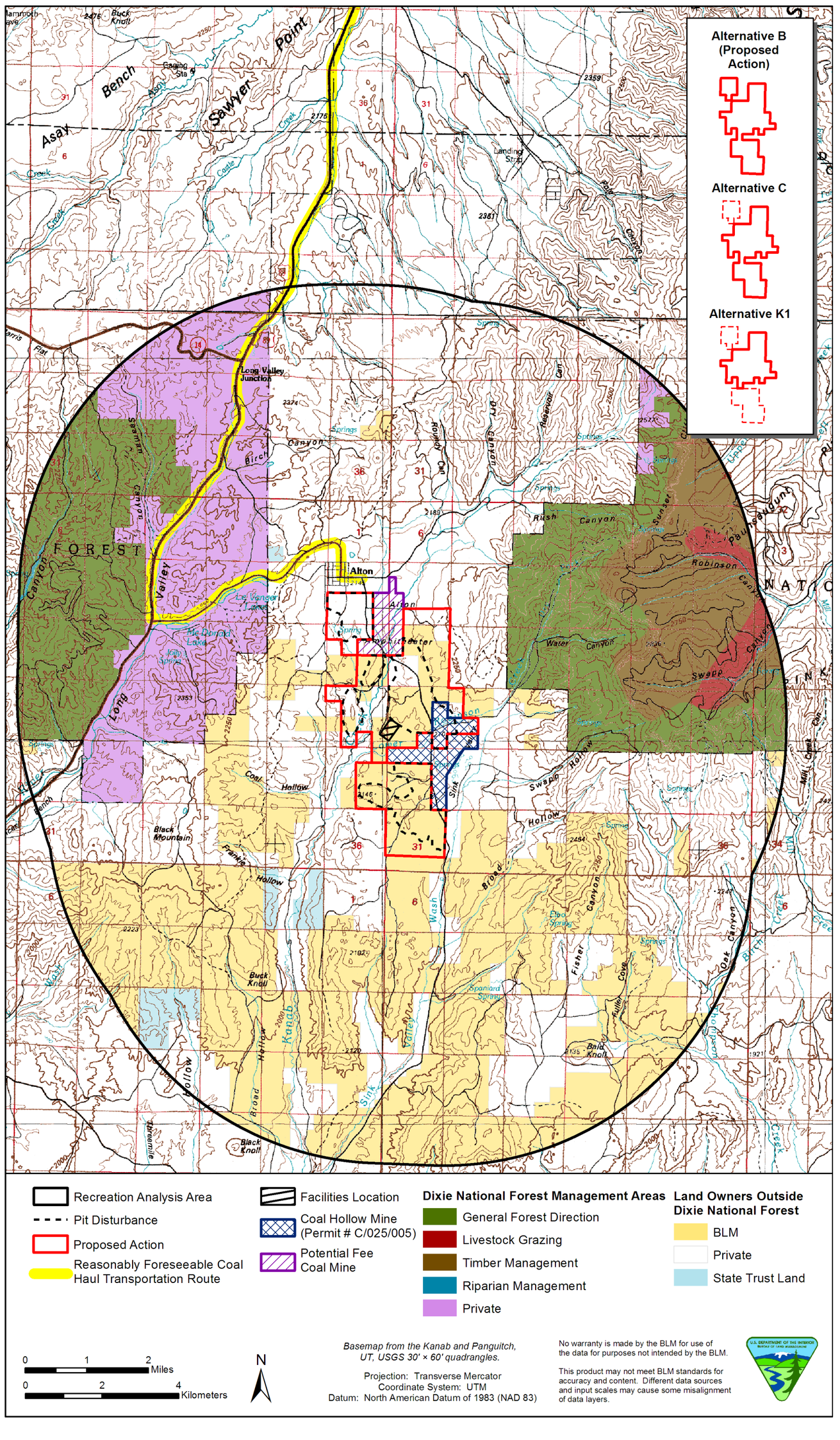
Map 3.10. Geological processes for the Alton Coal Tract.

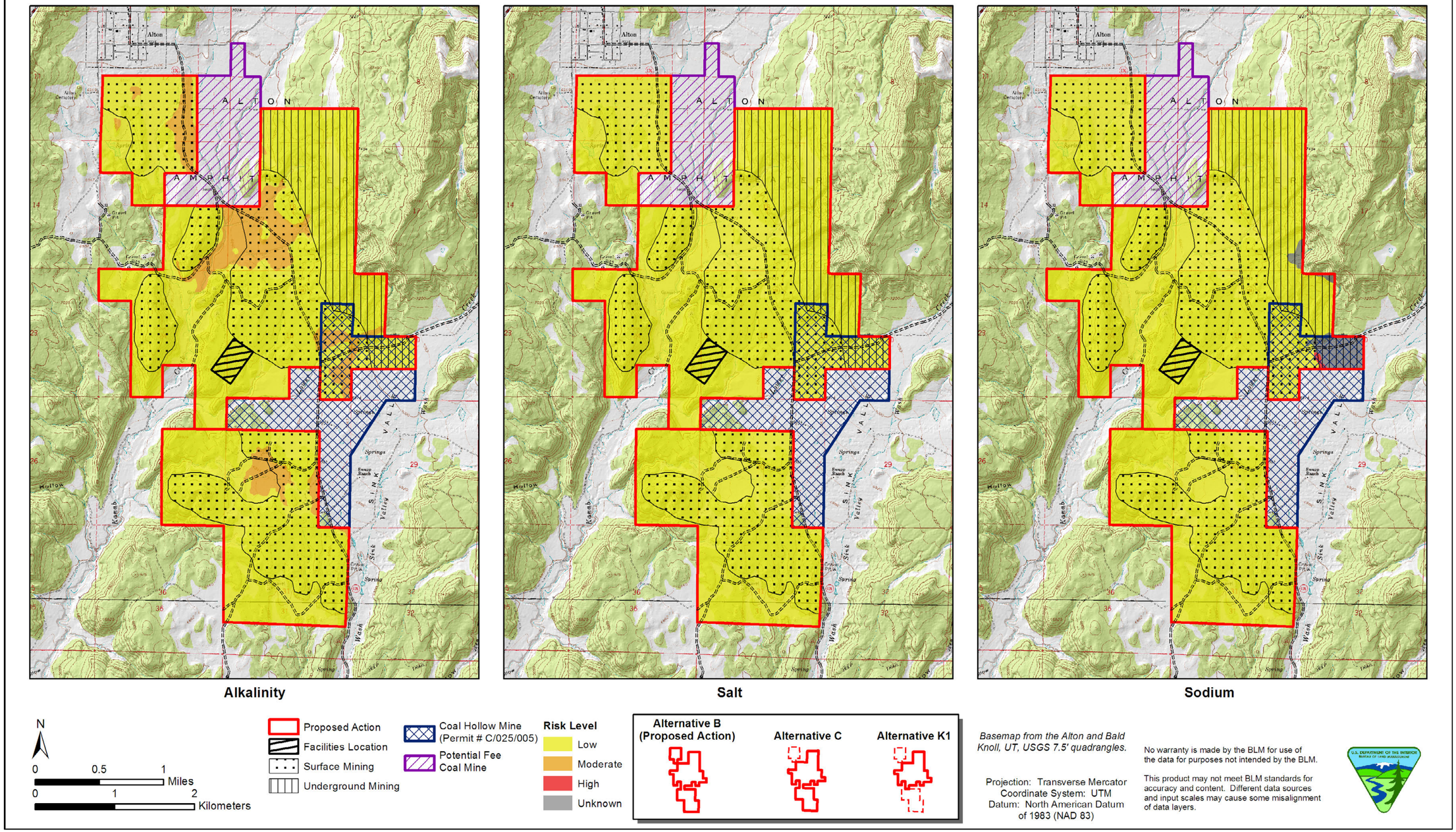


Map 3.11. Grazing allotments on the Alton Coal Tract.

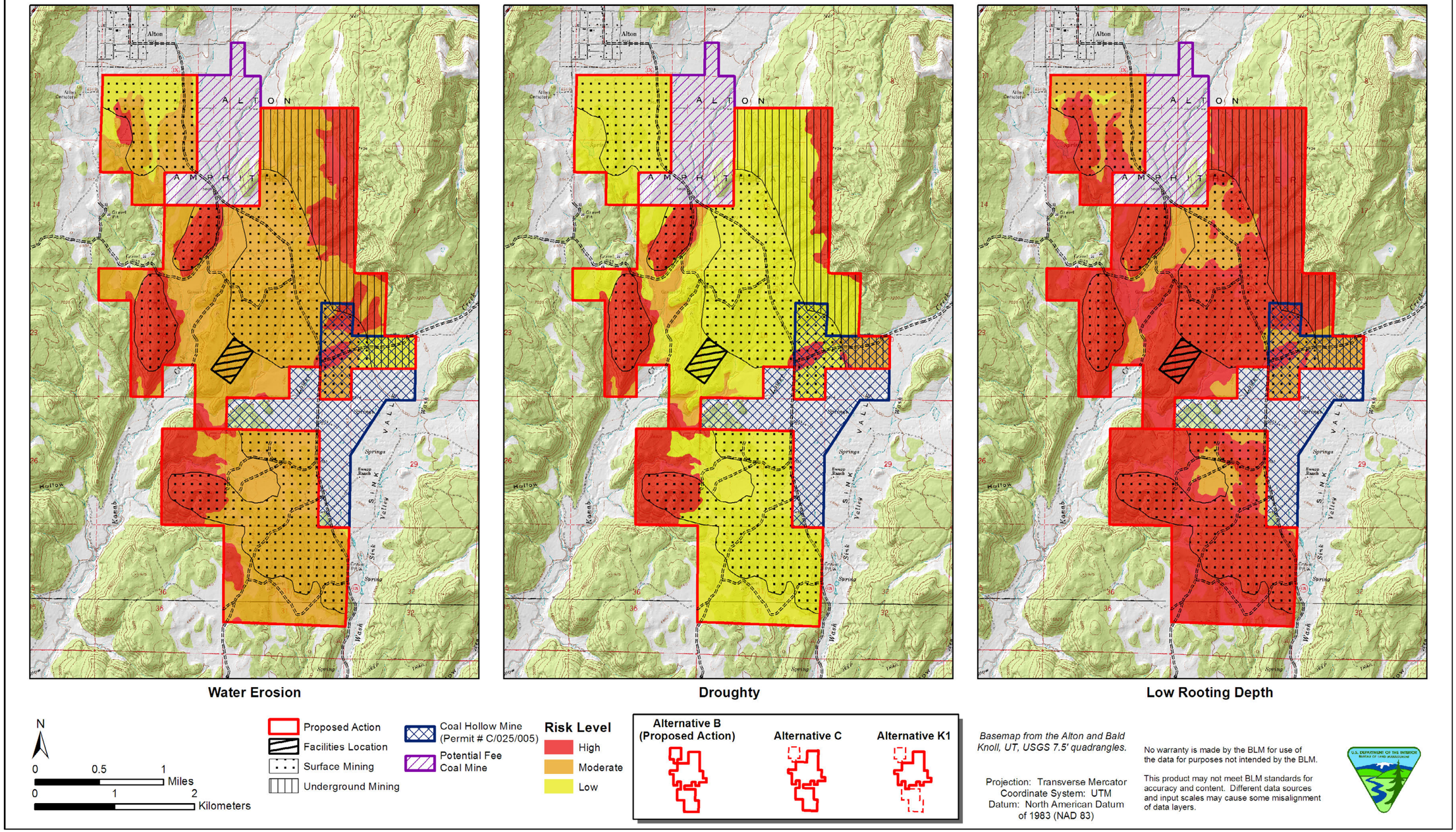


Map 3.12. Recreation resources analysis area for the Alton Coal Tract.

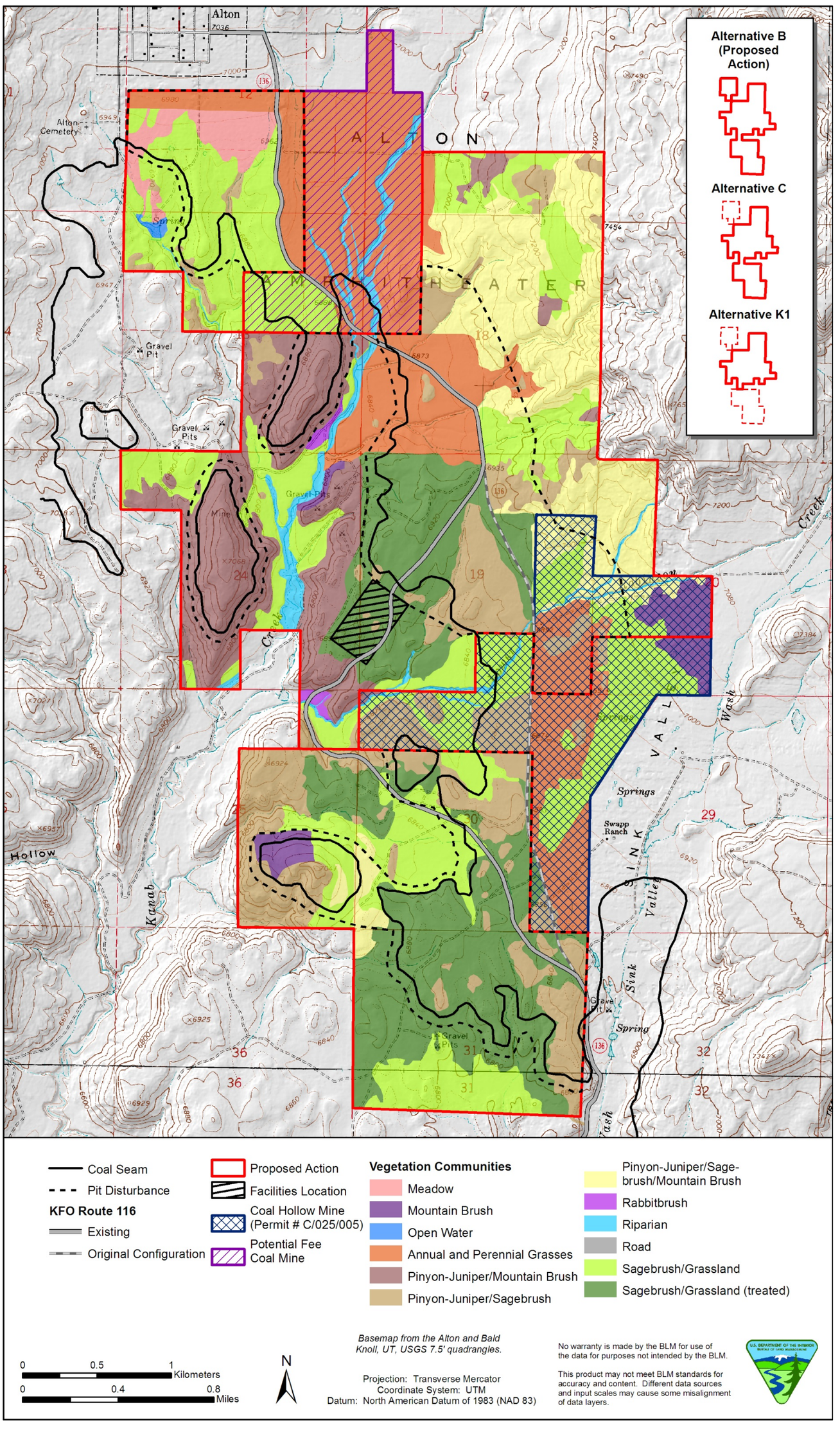




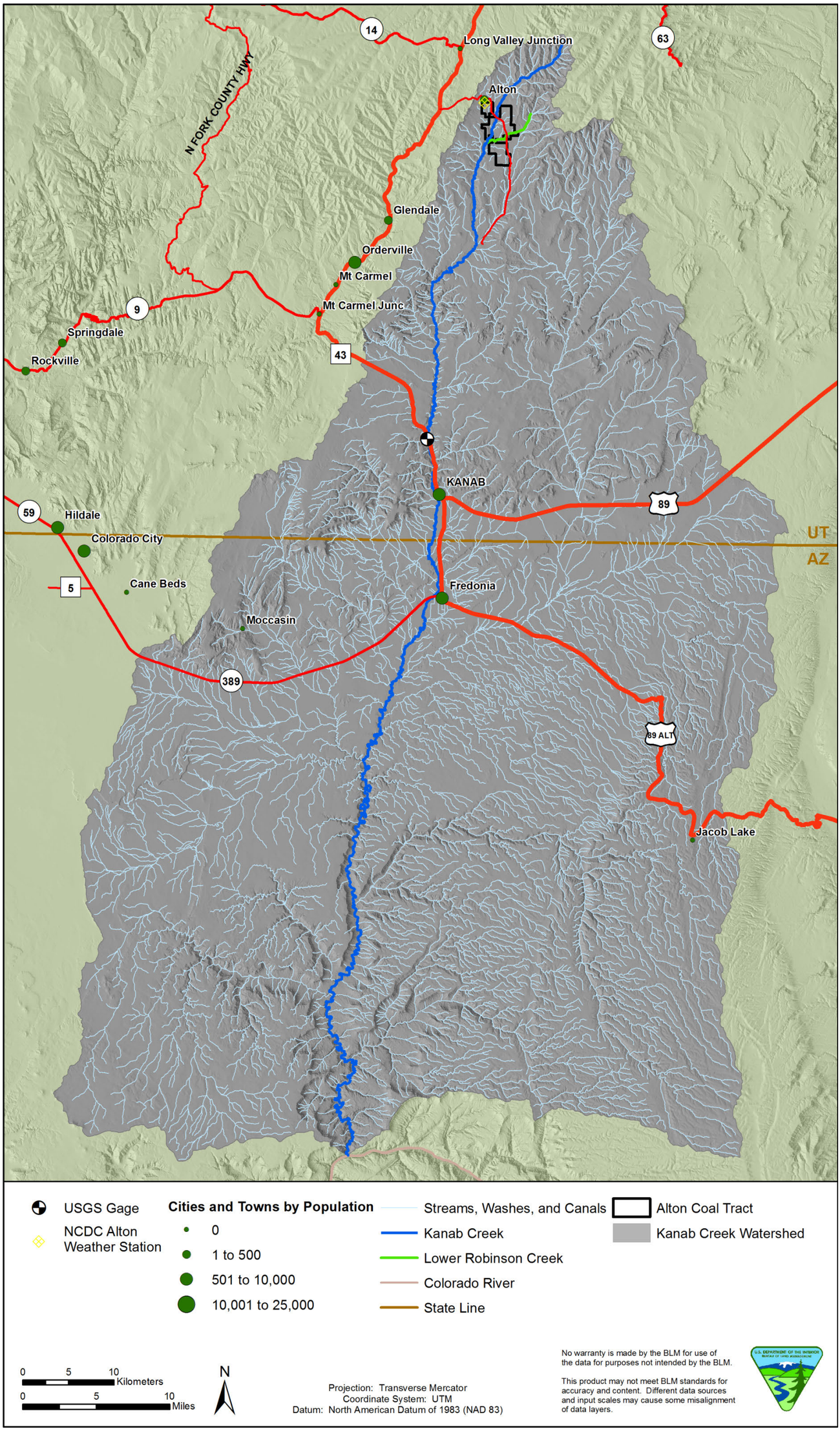
Map 3.13. Alkaline, saline, and sodic soils in the Alton Coal Tract.



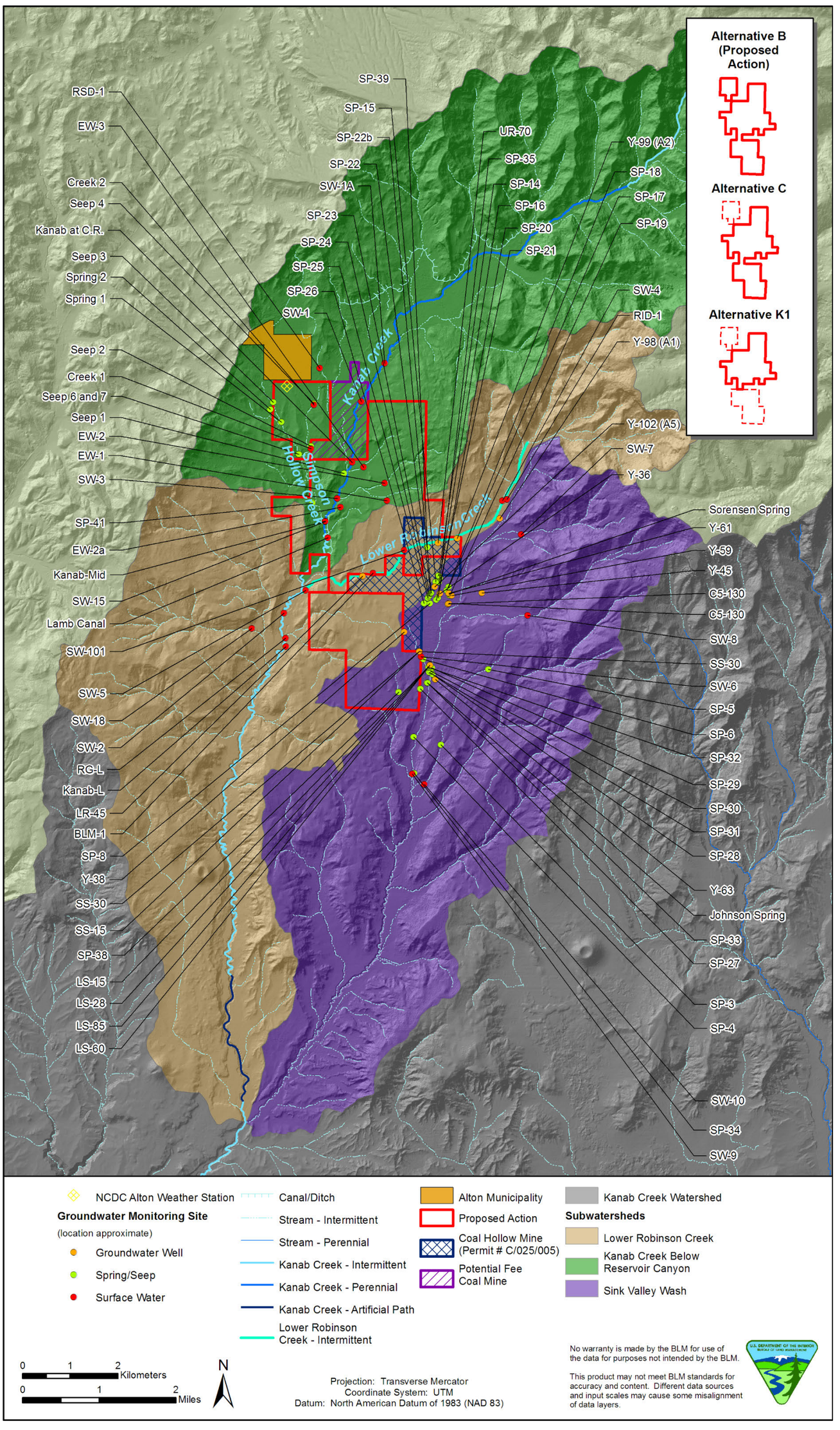
Map 3.14. Highly erodible, drought intolerant, and shallow soils in the Alton Coal Tract.



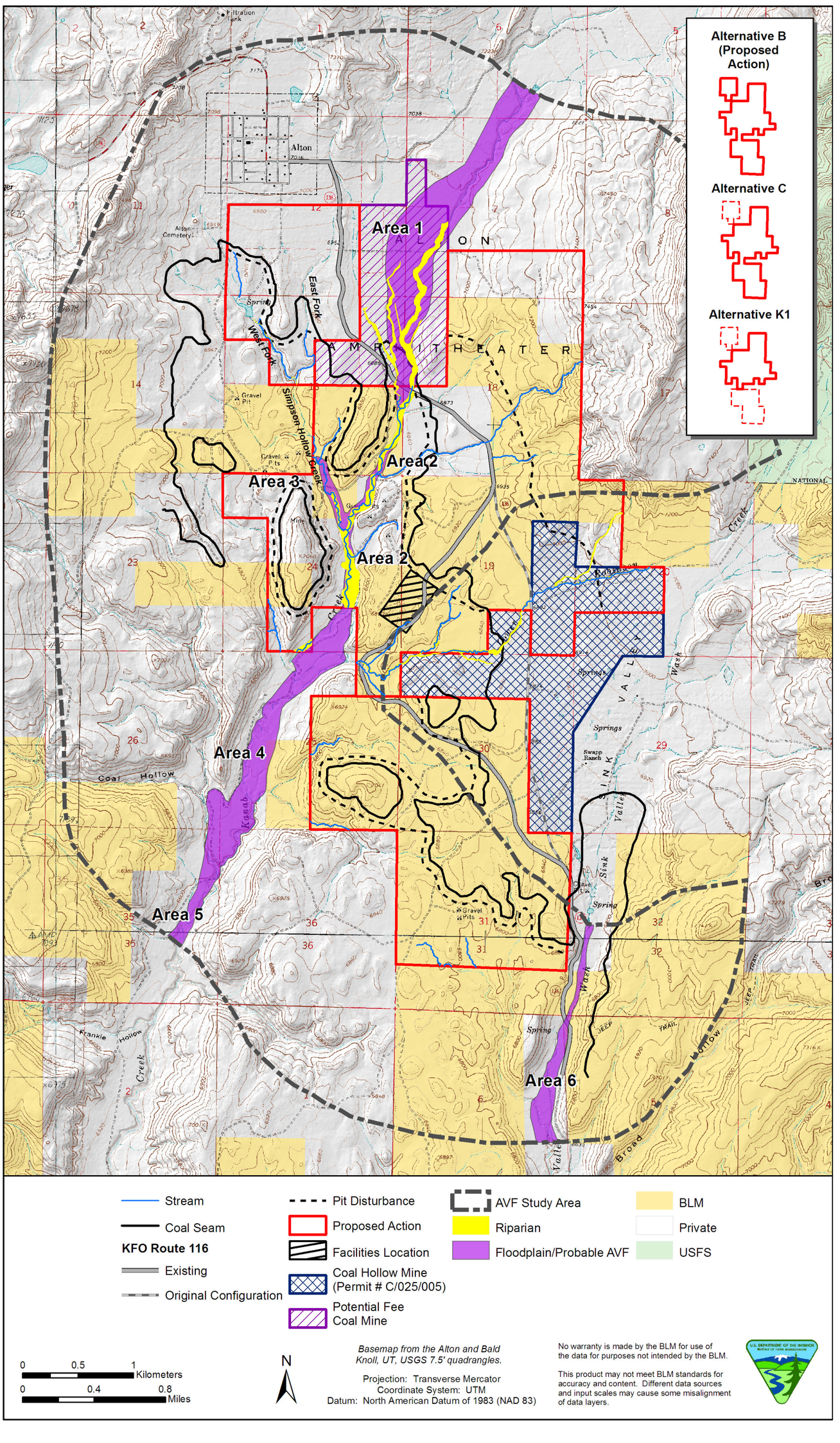
Map 3.15. Vegetation communities on the Alton Coal Tract.



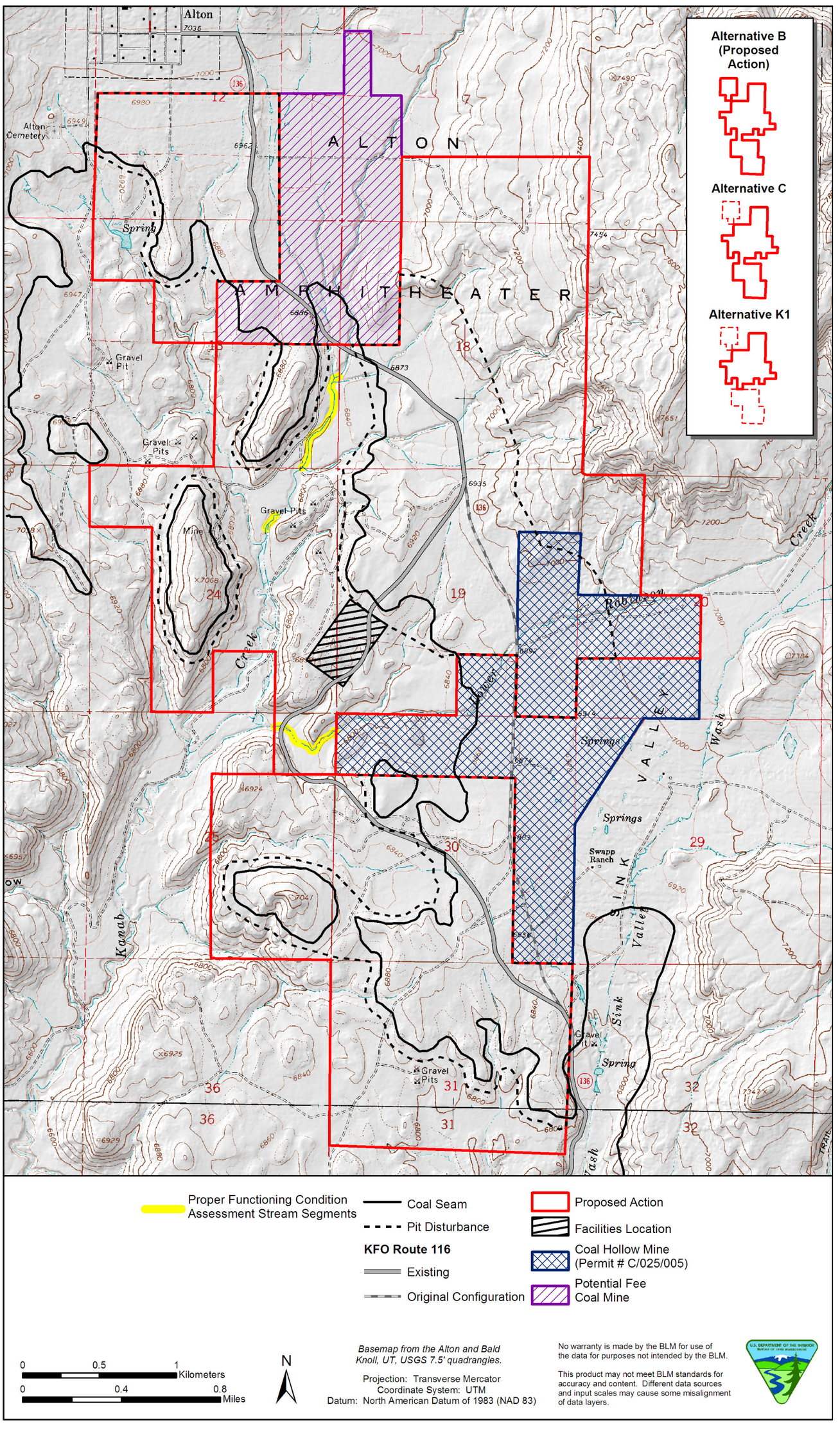
Map 3.16. Entire watershed, National Climatic Data Center station, and U.S. Geological Survey gage downstream on Kanab Creek.



Map 3.17. Watershed map showing subwatersheds and groundwater monitoring sites.

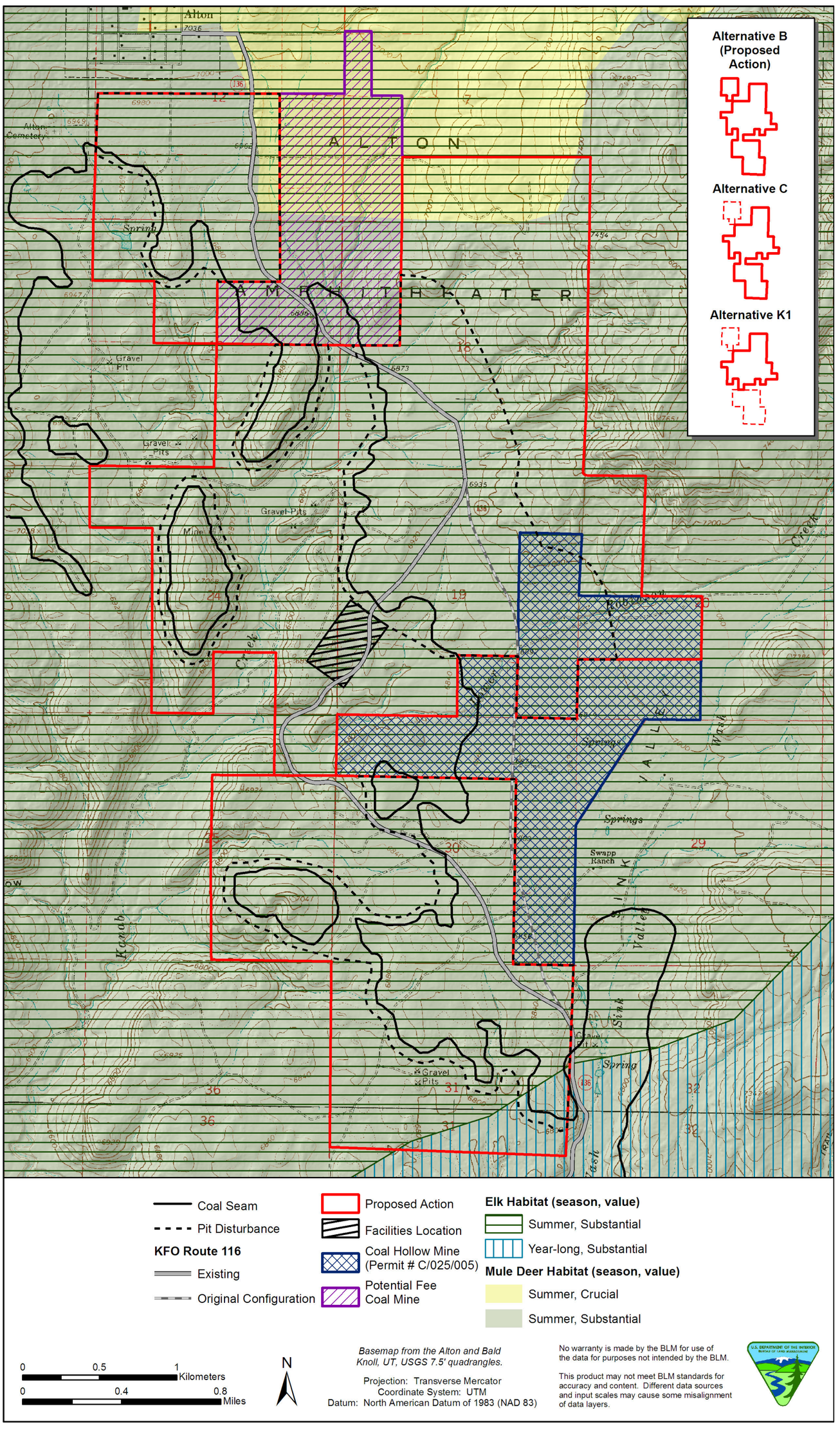


Map 3.18. Floodplains and probable alluvial valley floors on the tract and in the alluvial valley floor study area.

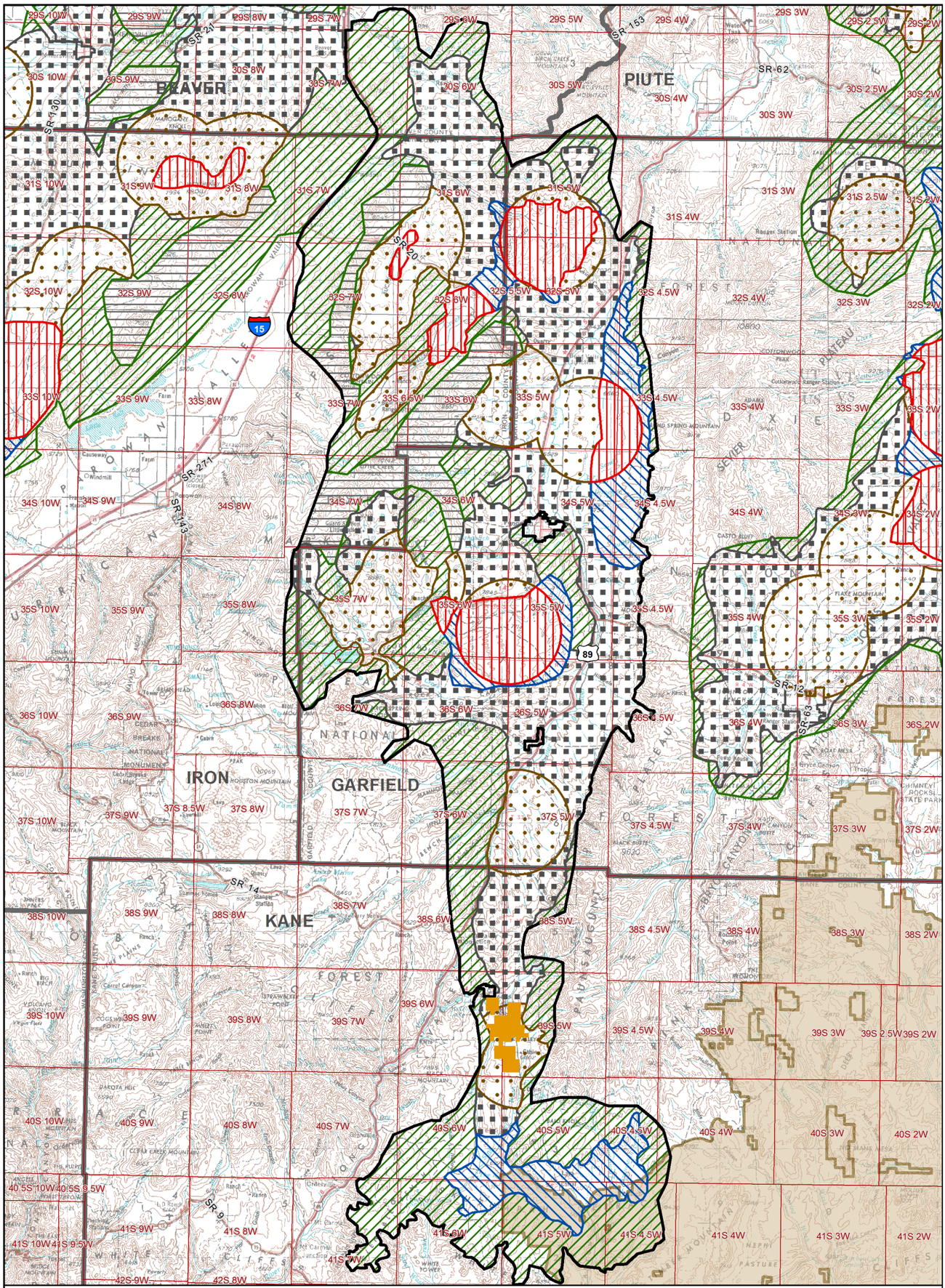


Map 3.19. Proper functioning condition assessment stream segments in the Alton Coal Tract.

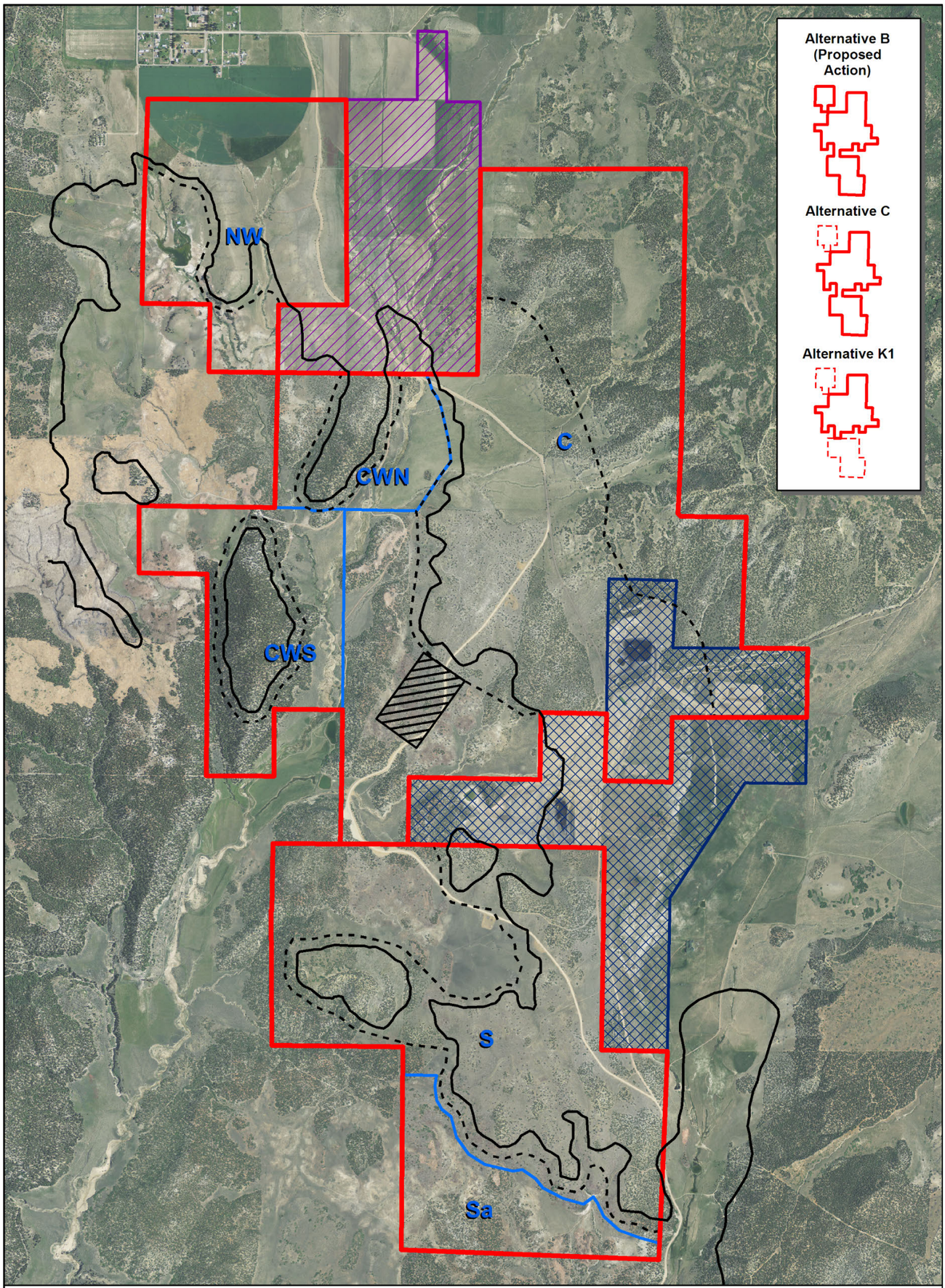
Map 3.20. Big game habitat in and near the Alton Coal Tract.



Map 3.21. Greater Sage-Grouse analysis area and UDWR sage-grouse habitat.



Map 3.22. Alton Coal Tract with NAIP imagery.



Coal Seam
Pit Disturbance
Proposed Action
Facilities Location
Coal Block Boundary
Coal Hollow Mine (Permit # C/025/005)
Potential Fee Coal Mine

0 0.5 1 Kilometers
0 0.4 0.8 Miles

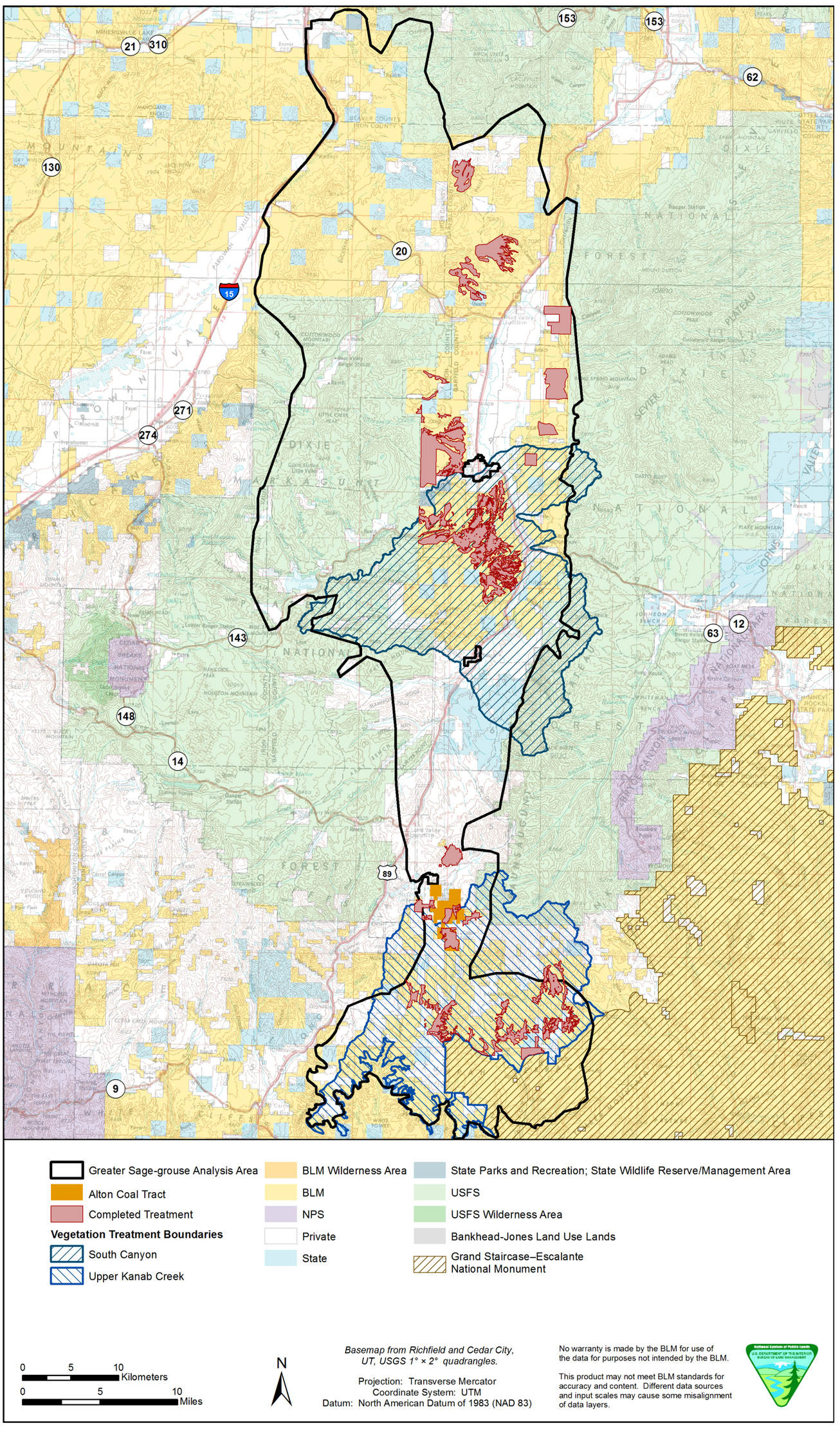
N

Imagery from NAIP: 2011.

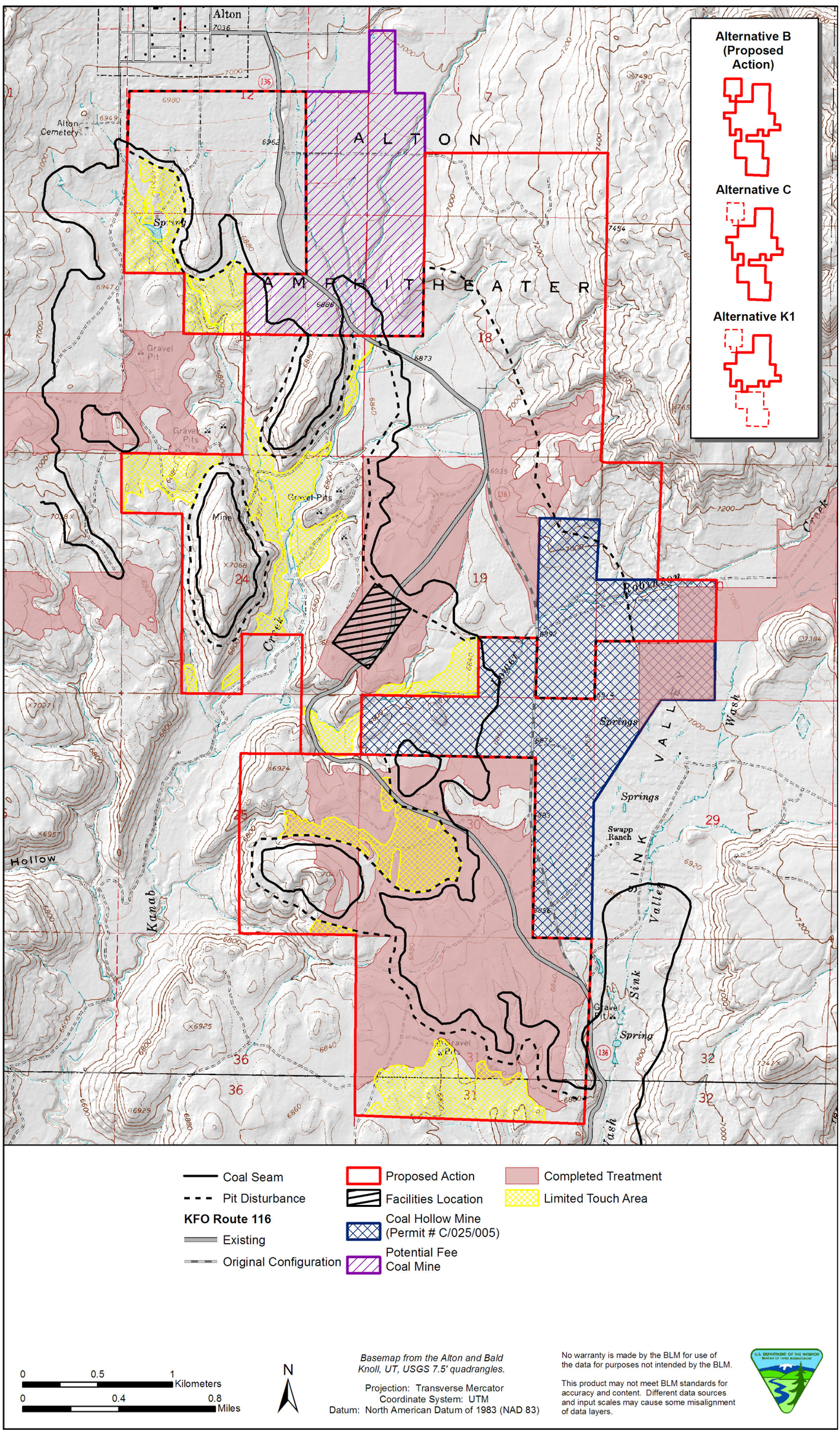
Projection: Transverse Mercator
Coordinate System: UTM
Datum: North American Datum of 1983 (NAD 83)

No warranty is made by the BLM for use of the data for purposes not intended by the BLM.

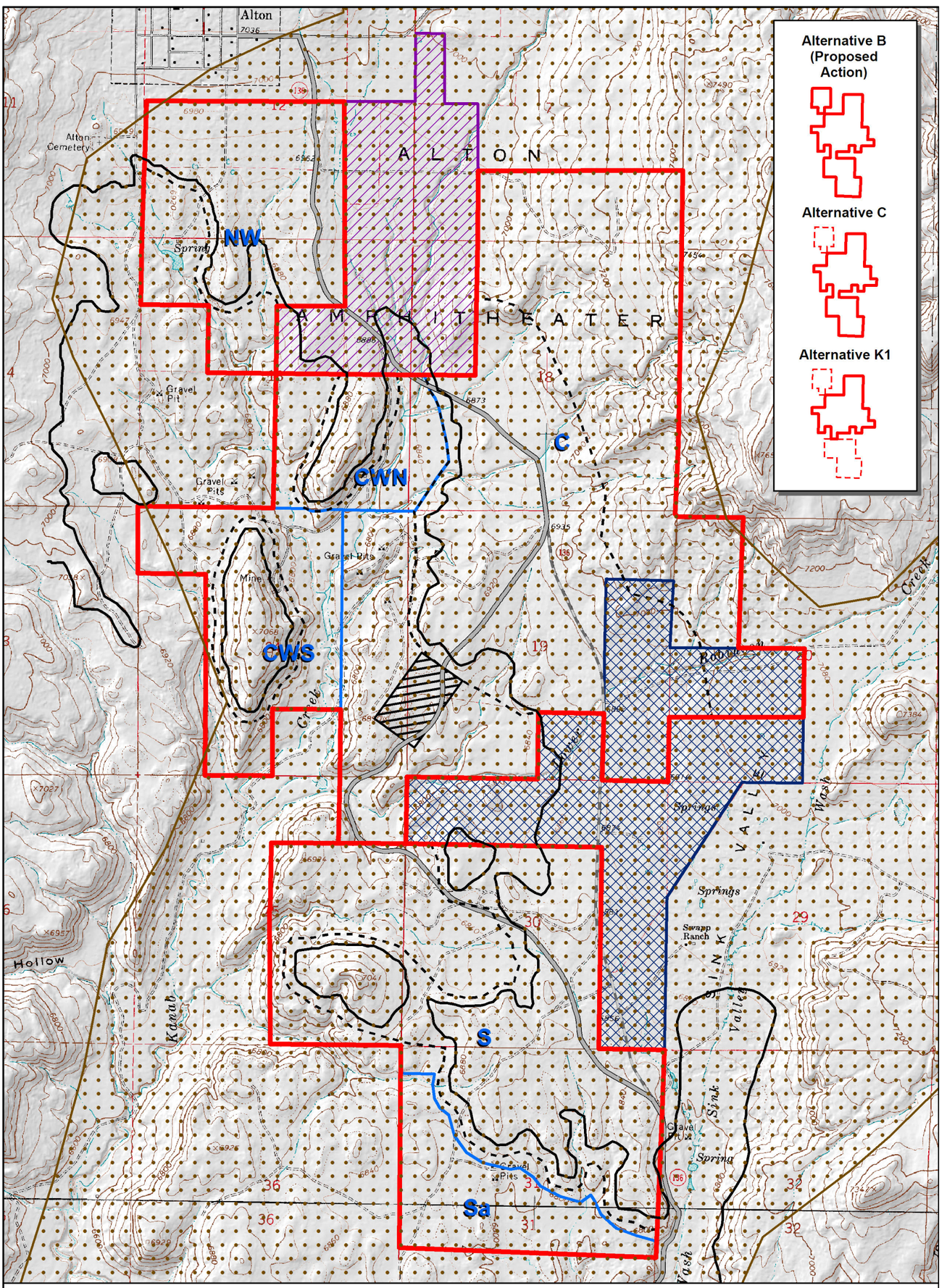
This product may not meet BLM standards for accuracy and content. Different data sources and input scales may cause some misalignment of data layers.



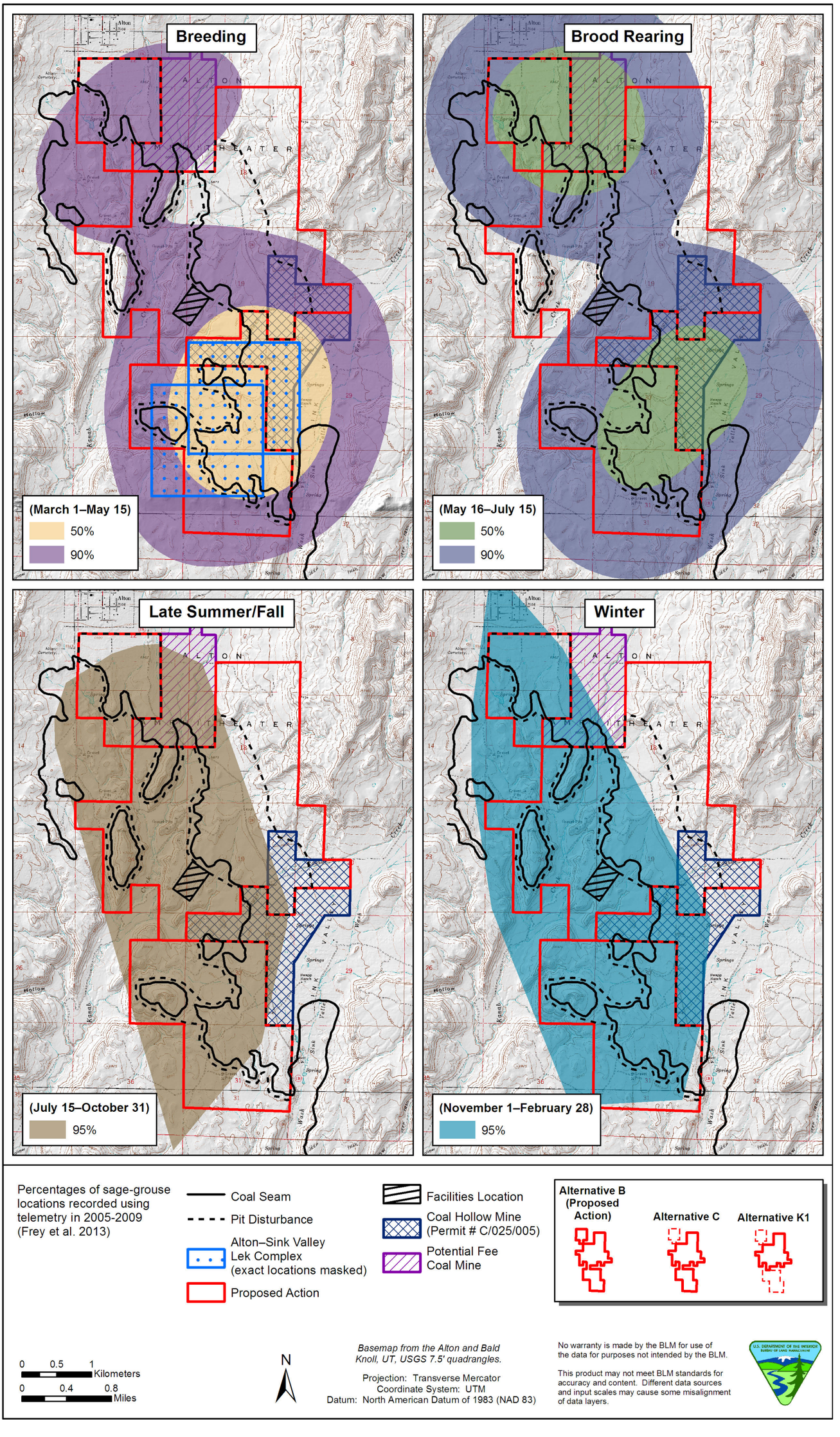
Map 3.23. South Canyon and Upper Kanab Creek completed vegetation treatment boundaries in relation to the Alton Coal Tract.



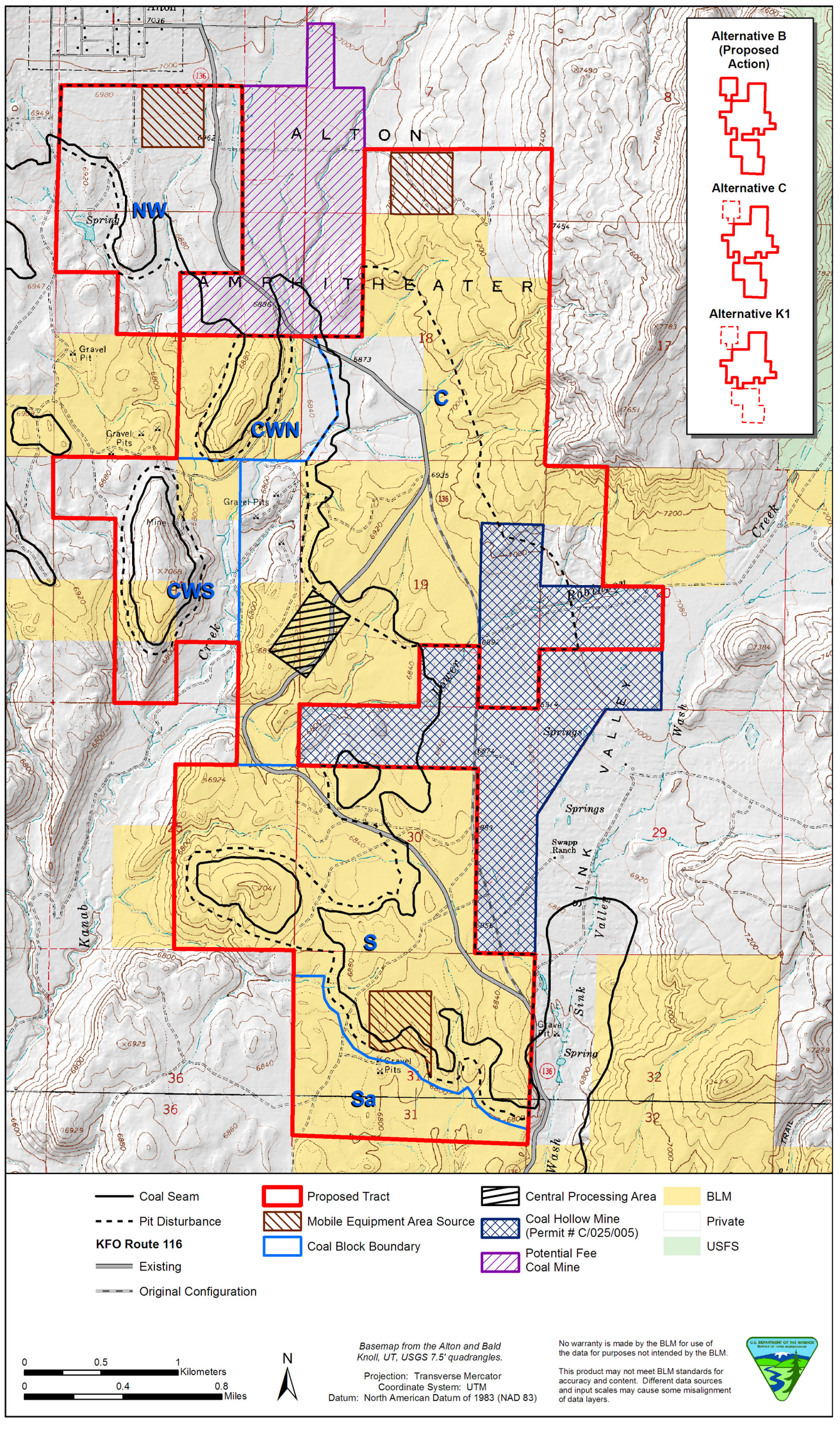
Map 3.24. Completed vegetation treatments and limited-touch areas in and near the Alton Coal Tract.



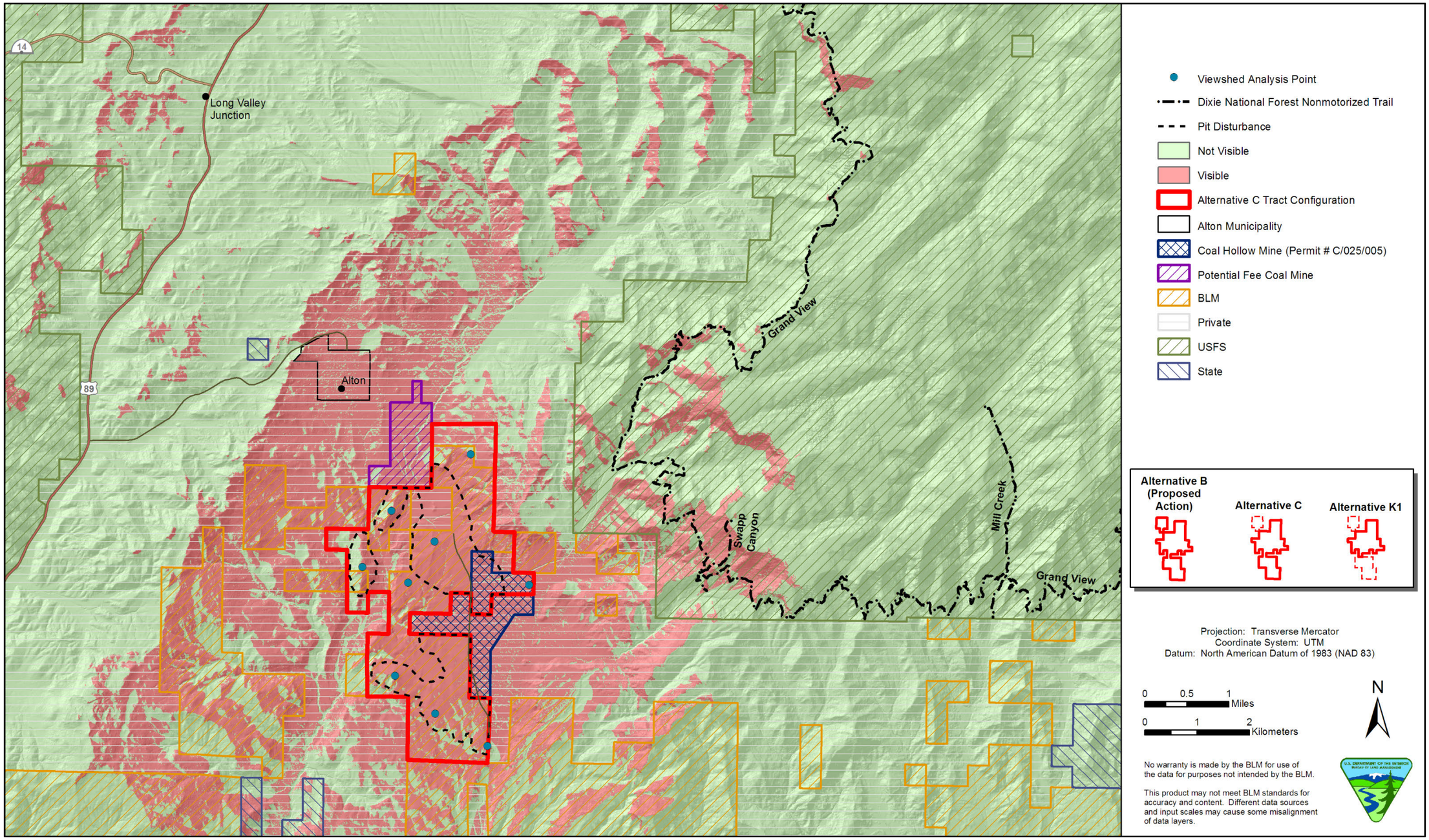
Map 3.25. Greater Sage-Grouse occupied habitat in and near the Alton Coal Tract.



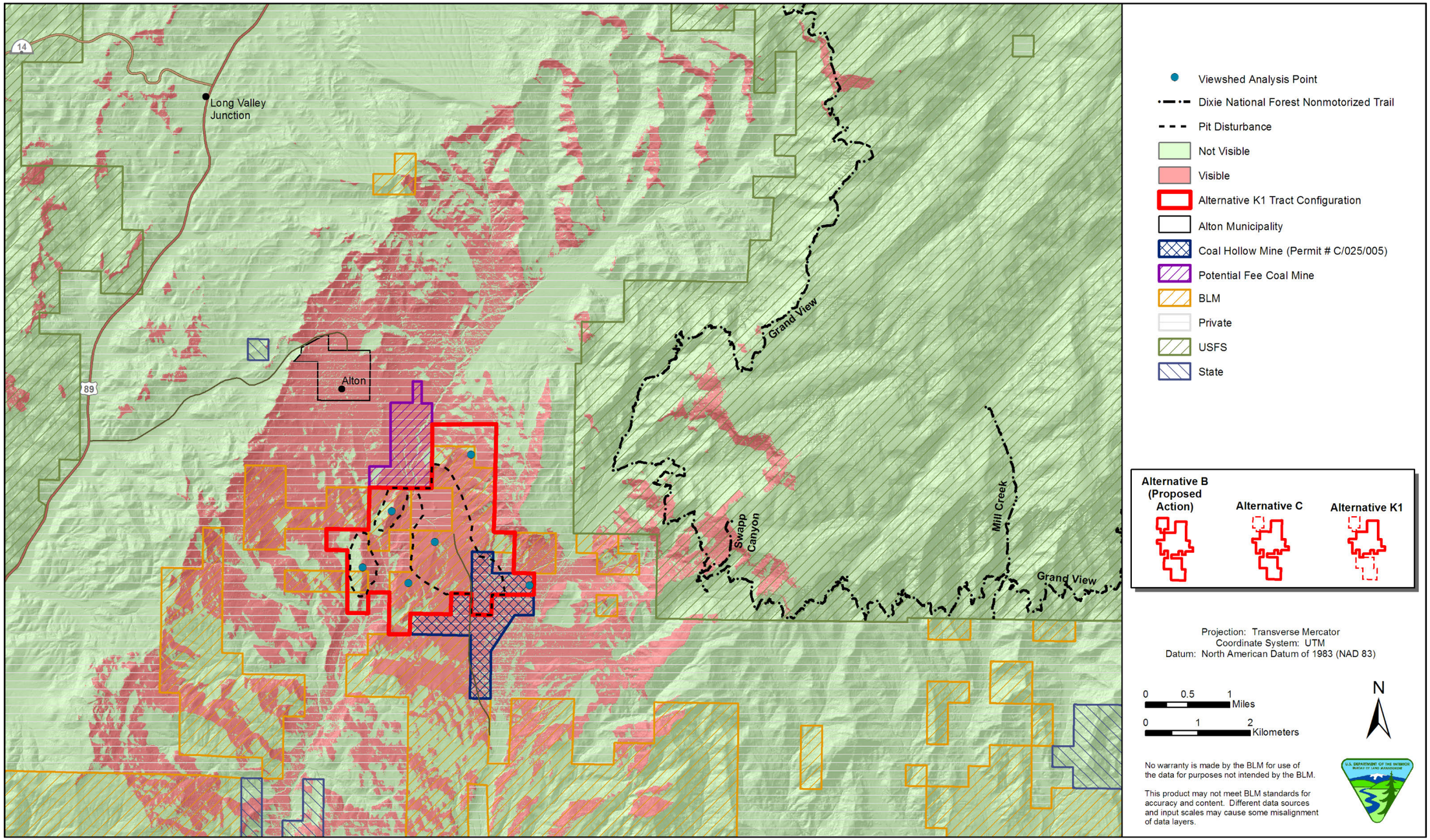
Map 3.26. Greater Sage-Grouse breeding, brood-rearing, late summer/fall, and winter habitat in relation to the Alton Coal Tract.



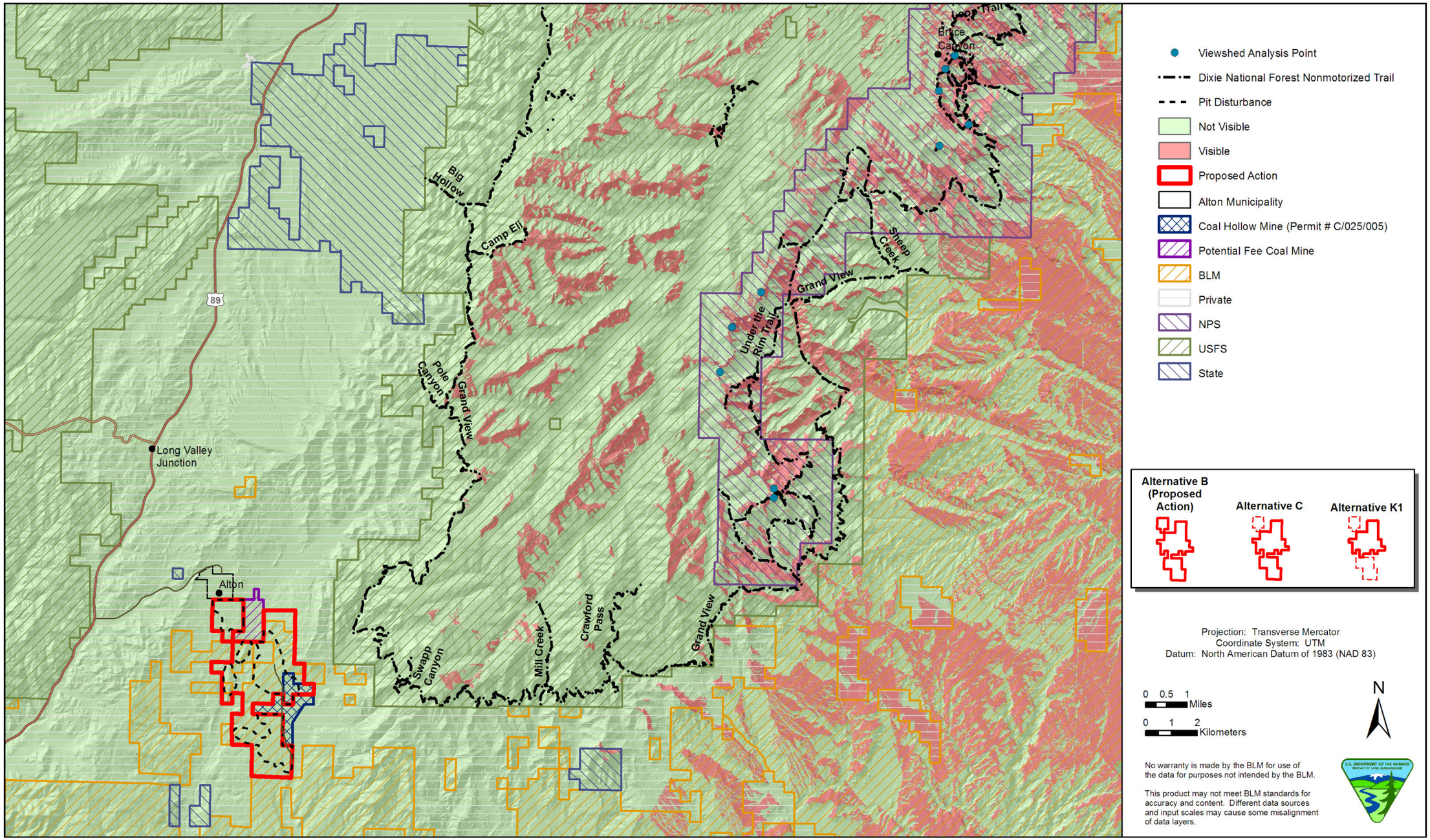
Map 4.1. Mobile equipment area source and central processing areas on the Alton Coal Tract.



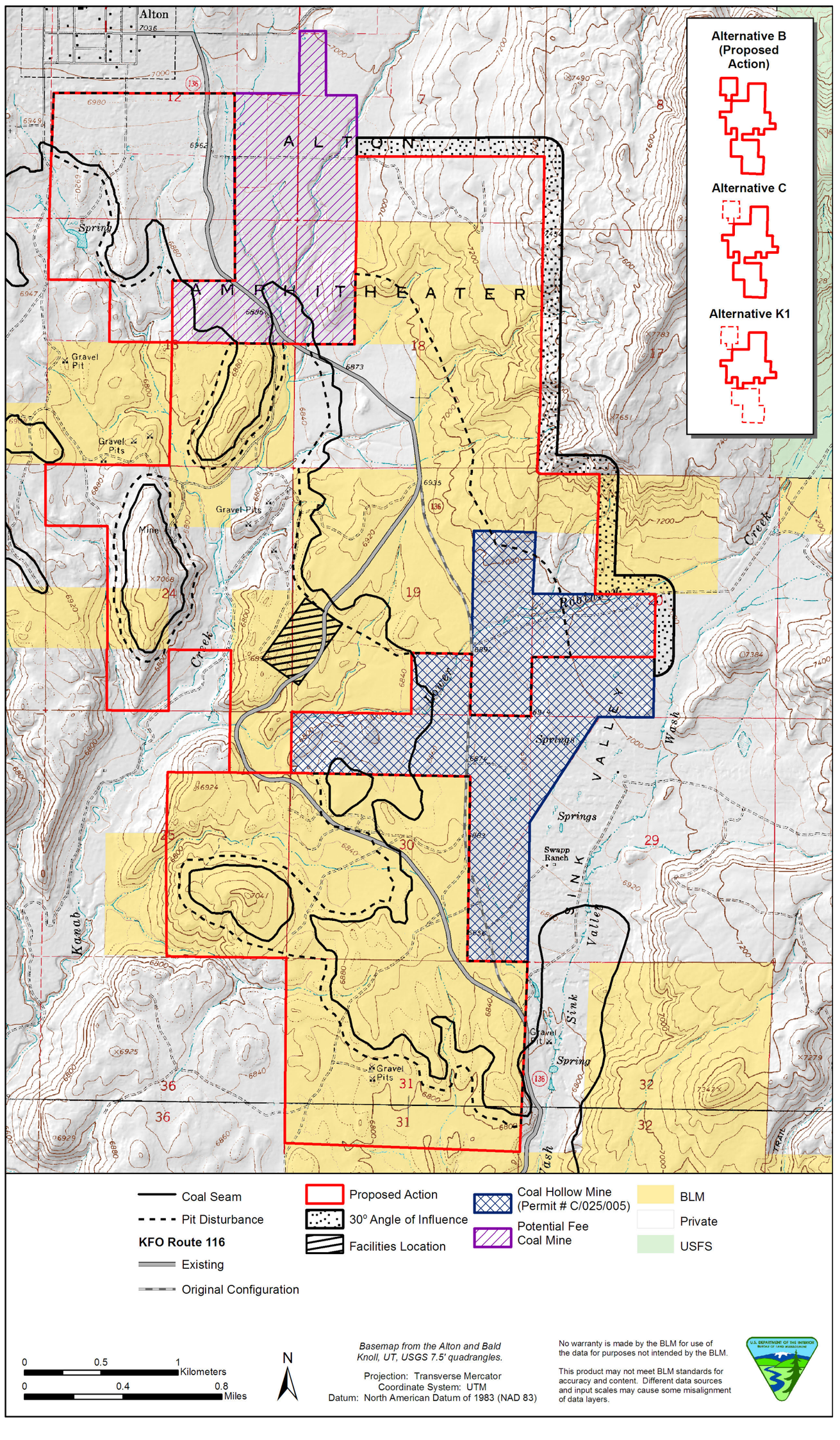
Map 4.2. Alternative C viewshed with viewshed analysis points.



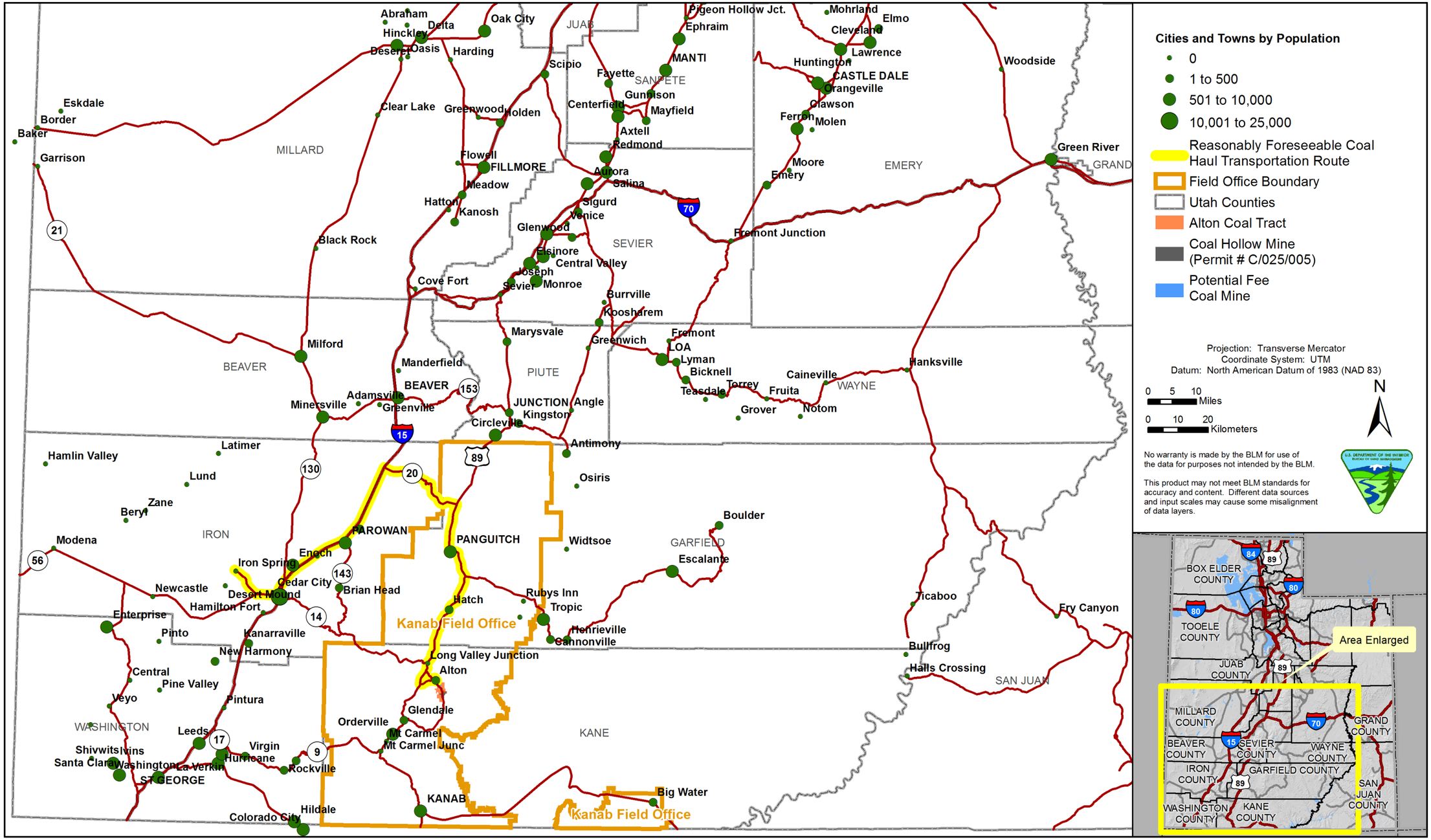
Map 4.3. Alternative K1 viewshed with viewshed analysis points.



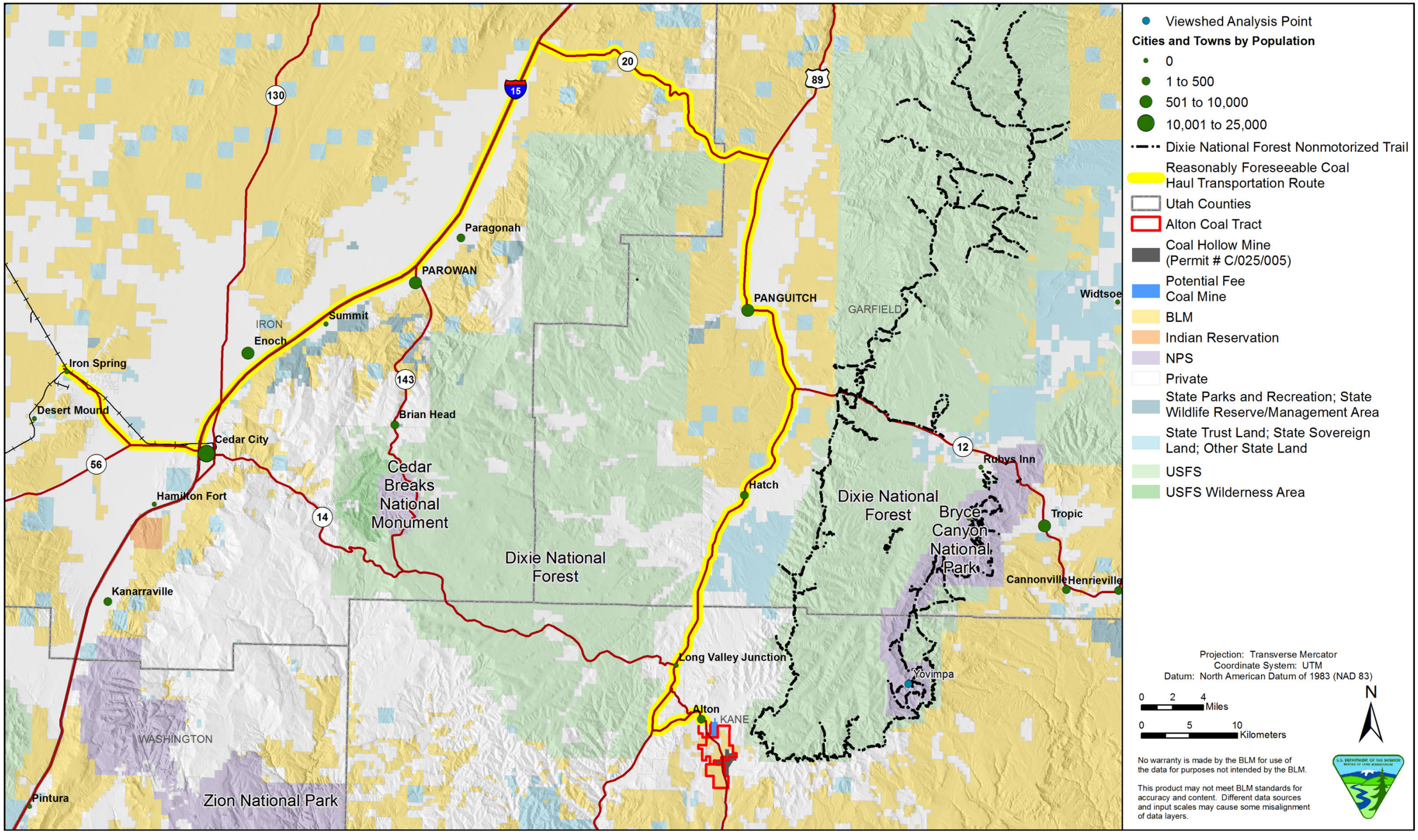
Map 4.4. Bryce Canyon National Park viewshed with viewshed analysis points.



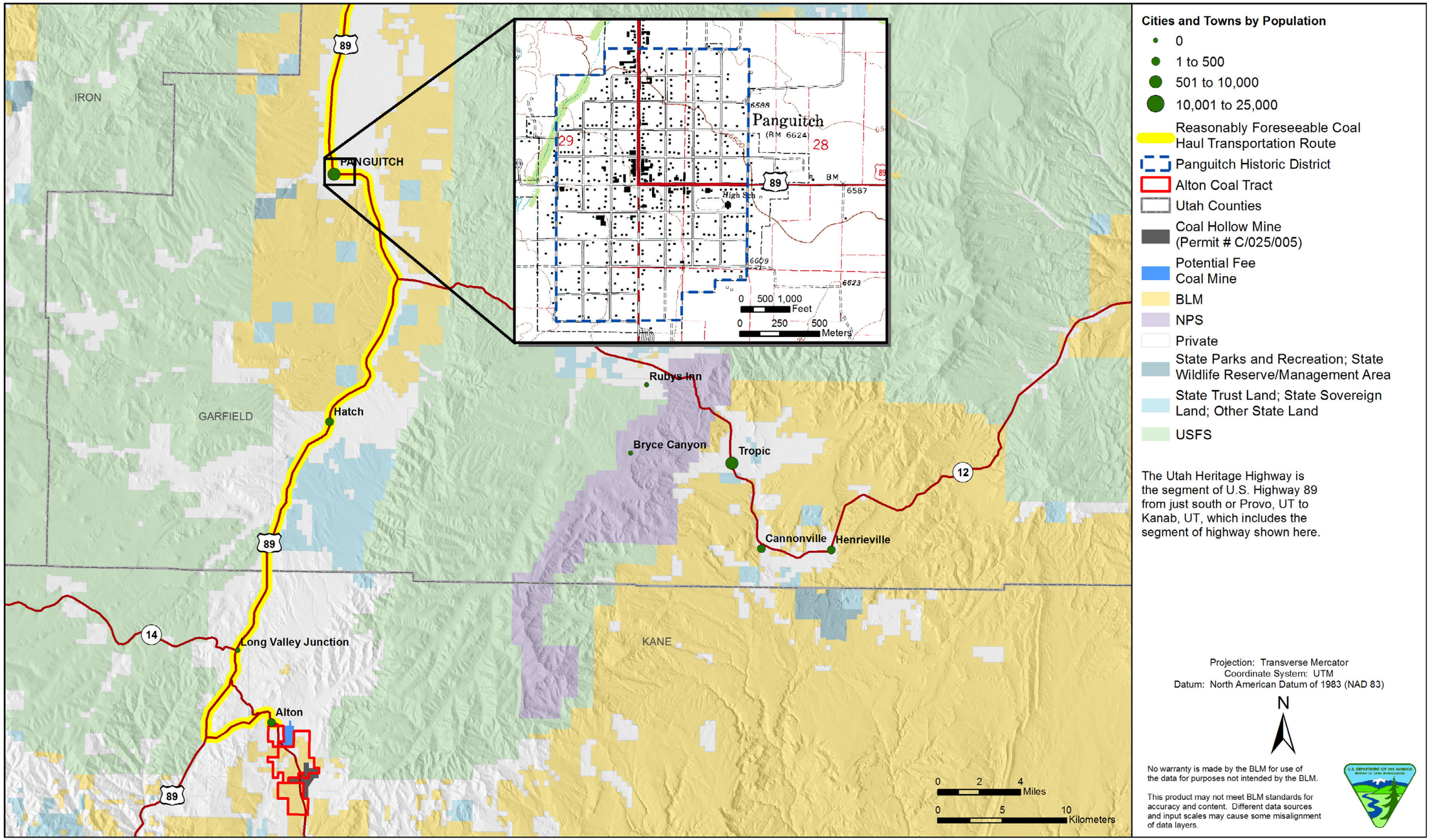
Map 4.5. Assessment area for gas and minerals, including the 30° angle of influence.



Map 4.6. Cumulative impacts assessment area for cultural resources, fire management, and geology and minerals, hazardous materials and hazardous and solid waste, land use and access, livestock grazing, paleontology, recreation, socioeconomics, soils, vegetation, water resources, wildlife, and special status species.



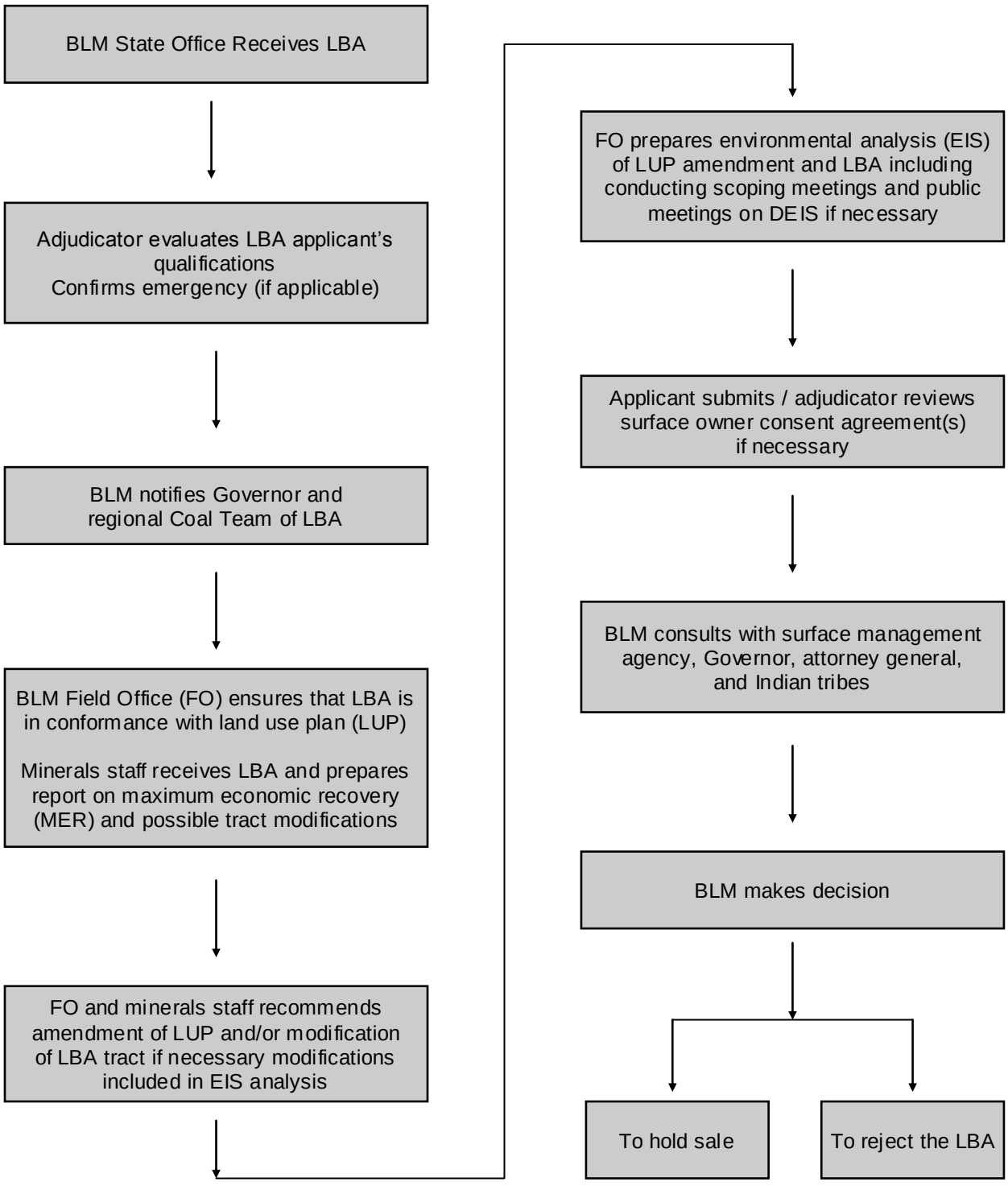
Map 4.7. Cumulative impacts assessment area for aesthetic resources and transportation.



Map 4.8. Cumulative impacts assessment area for cultural resources.

APPENDIX B.
THE COAL LBA PROCESS

The Coal LBA Process



APPENDIX C.
UNDERGROUND (SUBSURFACE) MINING METHODS

UNDERGROUND (SUBSURFACE) MINING METHODS

SURFACE-RELATED: AUGER MINING AND HIGHWALL MINING

For coal seams that are too deep for surface mining and also too small to warrant extensive underground mining, auger mining and highwall mining methods can be used. The coal seams must be exposed or easily accessible by the highwall of a surface mine or other excavation.

AUGER MINING

Generally, auger mining is used for recovering coal beyond that which is accessible by contour strip-mining (Figure A1). This method is limited to coal seams that are horizontal or slightly pitched. Auger mining can create pits up to 500 feet into the highwall (Crowell 2001) depending on the conditions of the site and the type of auger used. This mining method is generally inexpensive; however, coal recovery rates are low.

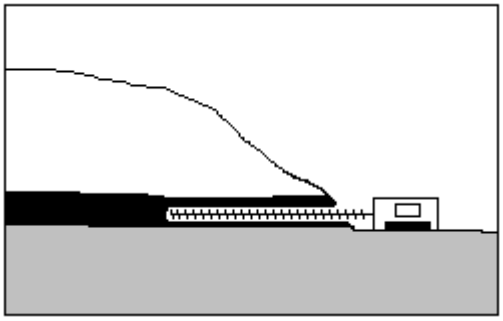


Figure A1. Auger mining into a coal seam.

HIGHWALL MINING

Highwall mining is another method used when an otherwise inaccessible coal seam is exposed by contour strip mining. In this method, a continuous mining machine operated remotely is driven into the exposed seam. The haulage system on the machine brings the coal out of the tunnel to be collected and stockpiled. In this method, drives into the seam are separated by long, parallel coal pillars that support the overburden (Figure A2). The width of these support pillars must be based on the geologic conditions of the site. The maximum recovery rate of this method is higher than that of auger mining although continuous mining machines require more capital investment.

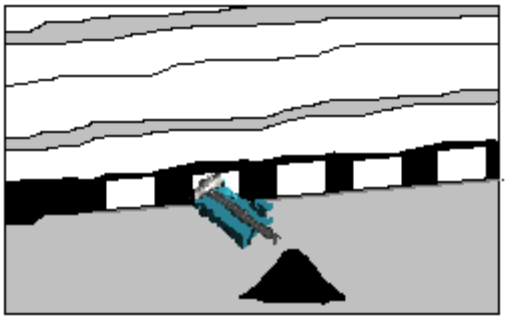


Figure A2. Highwall mining into a coal seam.

UNDERGROUND: ROOM-AND-PILLAR MINING AND LONGWALL MINING

Underground methods are used when the coal reserve is 300 feet or more below the surface of the earth. These methods, room-and-pillar mining and longwall mining, require heavy machinery and a greater degree of capital investment than the surface-related methods. Machinery used in underground mining includes continuous miners, shuttle cars, drills, cutting machines, and tractors. Underground mining also requires ventilation and airway systems, dust control, fire prevention, electrical power and communication systems (Given et al. 1973).

ROOM-AND-PILLAR MINING

In this form of underground mining, coal is removed from a seam in such a way that rectangular or square pillars remain in order to support the overburden (Figure A3). In most cases, coal seams must be relatively flat (maximum 5 to 6 degrees pitch), although steep pitch mining methods also exist. Seams must be large enough to allow heavy machinery such as shuttle cars and tractors through easily (Given et al. 1973).

With this method there is flexibility as to which areas of the seam are to be mined; areas with high quality materials can be extracted while areas of lower quality material can be left as overburden support. Discontinuing extraction in areas that are not economically convenient is relatively simple. It is also easy to adapt the shape of the mined area to fit the outline of the seam. Depending on the site conditions and the goals of the mining operation, the pillars can either be left in place or removed when mining is complete (Given et al. 1973).

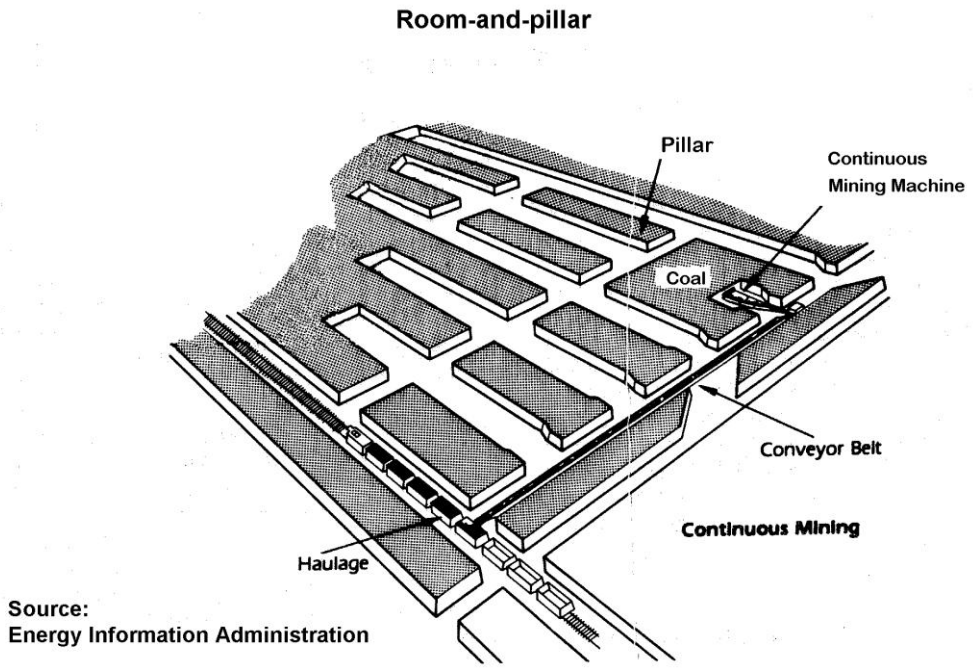


Figure A3. Room-and-Pillar mining method.

LONGWALL MINING

In areas where coal veins are relatively flat and expansive, longwall mining can be used in conjunction with room-and-pillar mining. In this method, large continuous blocks of coal are isolated within a seam (Figure A4), either by room-and-pillar areas or with the use of roadways. These blocks are usually 200 to 600 feet wide and up to several miles long. Conveyor systems are set up along the sides and faces of the blocks to carry coal to areas where it can be loaded and stockpiled (Given et al. 1973).

A machine called a shearer is drawn along the face of the block of coal that is opposite the mine entry (Figure A5). The roof behind the shearer is supported by hydraulic jacks that are around 5 ½ feet wide and up to about 20 feet tall placed in a long line. When the shearer has reached the end of the longwall face, these roof supports automatically move forward about 3 feet so the shearer can begin a new pass. Once the roof supports have advanced, the overburden behind them is allowed to collapse (called the "gob" or "goaf" area). The coal cut by the shearer falls onto a conveyor system that brings it to where it can be loaded into trucks and stockpiled (Given et al. 1973).

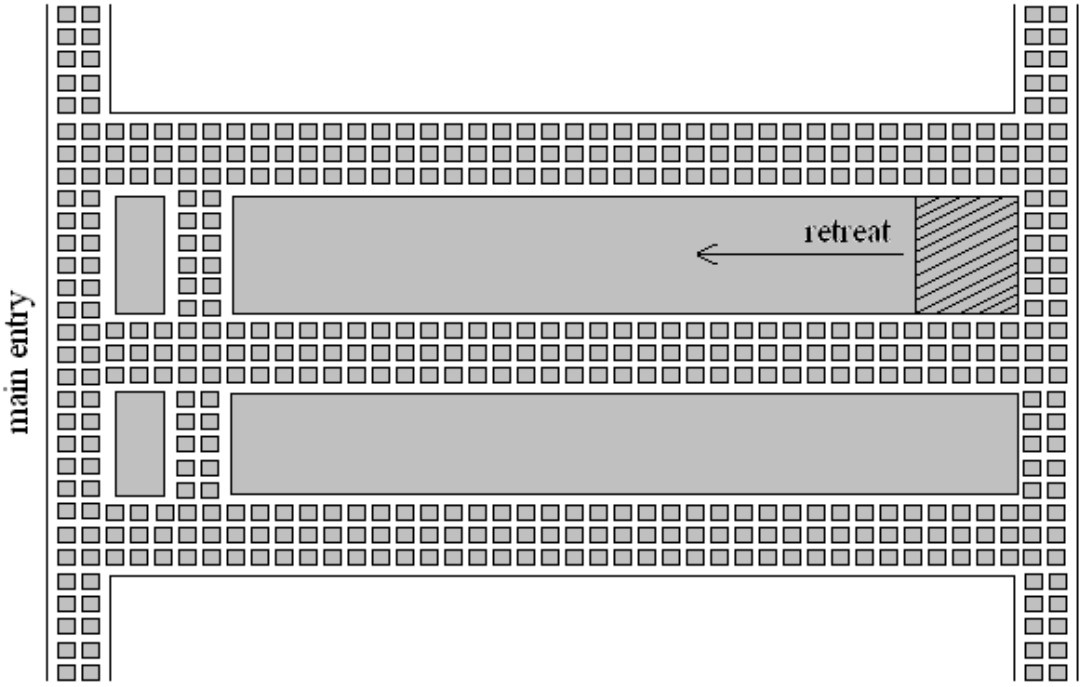


Figure A4. Longwall mining areas outlined with room-and-pillar areas. Longwall machinery is set up on the face of the block of coal opposite to the main entry to the mine. Coal is mined towards the mine entry. (Adapted from Given et. al 1973).

The benefits of longwall mining include a greater coal recovery rate than the room-and-pillar method and enhanced safety for mine workers due to the hydraulic roof supports. A detailed diagram of longwall mining is shown in Figure A5. A photo taken in a longwall mine is shown in Figure A6.

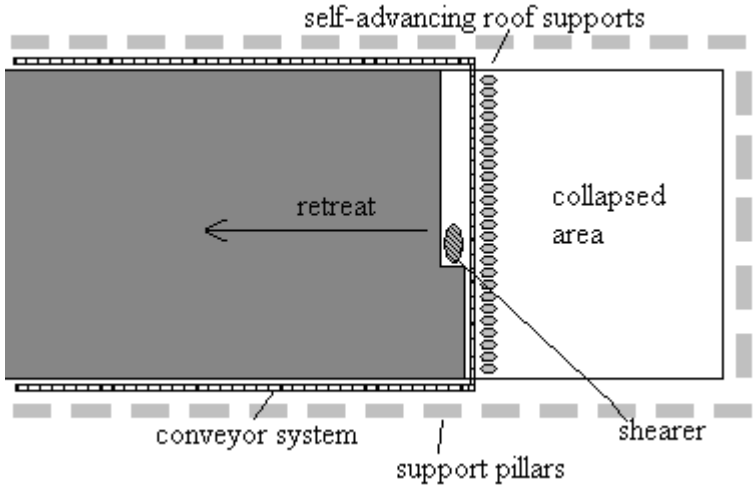


Figure A5. Detail of longwall mining.

Figure A6. Photo of longwall mining machinery including the shearer and the self-advancing roof supports (Hill-Douglas 2007).

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Given, I. A., W. Laird, J. W. Clark, S. F. Boshkov, F. D. Wright, R. L. Hafner, H. J.R., L. W. Casteel, A. Hoover, and C. Haycocks. 1973. Chapter 12- Underground Mining Systems and Equipment. Pages 12-45 - 12-95 in A. B. Cummins and I. A. Given, editors. SME Mining Engineering Handbook. Port City Press, Baltimore, MD.

Hill-Douglas, O. 2007. Mining: Mine Automation. CSIRO SOLVE:8-9.

APPENDIX D.
KANAB FIELD OFFICE: COAL UNSUITABILITY REPORT

APPENDIX 6—KANAB FIELD OFFICE: COAL UNSUITABILITY REPORT

INTRODUCTION

Bureau of Land Management (BLM) regulations regarding coal management on public lands are found in Title 43 of the Code of Federal Regulations (CFR), Part 3400. During land use planning, BLM is required to review federal lands and assess whether there are areas unsuitable for all coal mining or for certain stipulated methods of coal mining. This report addresses the 20 criteria of coal unsuitability as defined in 43 CFR 3461.5 and applies these criteria to the known recoverable coal resource areas (KRCRA) for the Alton, Kaiparowits, and Kolob coal fields. Unsuitability decisions were based on these criteria and applied to federally owned coal estates within the Kanab Field Office (KFO) Decision Area (KDA). Currently there are no active coal leases within the KDA, but one lease application is presently being processed/analyzed in the Alton Amphitheater.

GEOLOGIC SETTING

KPA coals are located within Late Cretaceous sedimentary strata of the Dakota and Straight Cliffs formations. The Alton and Kolob coal fields are in the Dakota Formation and the Kaiparowits coal field is in the John Henry Member of the Straight Cliffs Formation. The depositional environment for both the Dakota and Straight Cliffs coals was a coastal plain setting along the Western Interior Seaway. The Dakota coals were deposited approximately 95 million years ago during the onset (transgression) of the Western Interior Seaway. Kaiparowits coals were deposited approximately 85 million years ago as the Western Interior Seaway regressed from the area. Rivers originating along the Sevier Mountain belt and Mogollon highlands provided a steady supply of sediment for burial of the rich coastal mires.

LANDS CONSIDERED

The recoverable coal resources within the Kanab Planning Area (KPA) cross a number of surface ownership boundaries, including BLM, U.S. Forest Service (USFS), National Park Service (NPS), State of Utah, and private lands, and are located within Kane and Garfield counties. This report considers approximately 149,168 acres of federally owned coal within the KRCRA (Map 1) of the KDA.

COAL RESOURCES

The Kanab Field Office Mineral Potential Report (BLM/Utah Geological Survey 2006) identifies an in-ground coal resource for the KPA of approximately 10 billion tons. Approximately 200 million tons have been identified as surface minable in the Alton coal field. Generally, Dakota Formation coals range from a subbituminous B rank in the Alton coal field to subbituminous A rank in the Kolob coal field. The sulfur content varies, but averages about 1.2 percent. The in-place ash content generally ranges between 10 percent and 15 percent. Heat content for Dakota Formation coals varies from about 7,500 to 9,500 BTU/lb. In the Kaiparowits field, the coal rank decreases from high-volatile C bituminous to subbituminous from south to

north in the KPA. The ash and sulfur levels of the Straight Cliffs coals average about 10 percent and 0.7 percent, respectively. The heat content of Kaiparowits coal ranges from about 7,420 to 10,300 BTU/lb (BLM/UGS 2006).

Table A0-1 through Table A0-3 identify the coal resources based on the depth of cover and the mapped quadrangle. Shallower depths of cover, which have the potential for surface mining, are presented in Table A0-1.

Table A0-1. Alton Coal Field

Quadrangle	Depth of Cover				
	0 200 ft	200 1000 ft	1000 2000 ft	2000 3000 ft	TOTAL
Alton	95.3	212.1	114.3	98.9	520.6
Bald Knoll	52.7	152.9	48.8	42.3	296.7
Orderville NE-SE	38.3	96.9	0.0	0.0	135.2
Skutumpah Creek	16.9	183.4	107.4	17.8	325.5
TOTAL	203.2	645.3	270.5	159.0	1,278.0
PERCENT	15.9%	50.5%	21.2%	12.4%	100.0%

Identified coal resource for the Alton coal field within the KPA by depth of cover and quadrangle (in millions of tons; from BLM/UGS 2006)

Table A0-2. Kolob Coal Field

Quadrangle	Depth of Cover			
	0 1000 ft	1000 2000 ft	2000 3000 ft	TOTAL
Orderville Canyon NE	62.4	305.6	193.2	561.2
Orderville Canyon SE	258.7	143.0	0.0	401.7
Orderville SW	132.2	257.0	8.4	397.6
TOTAL	453.3	705.6	201.6	1,360.5
PERCENT	33.3%	51.9%	14.8%	100.0%

Identified coal resource for the Kolob coal field within the KPA by depth of cover and quadrangle (in millions of tons; from BLM/UGS 2006)

Table A0-3. Kaiparowits Coal Field

Township/ Range	Depth of Cover					
	Minable			Deep		TOTAL
	0 1000 ft	1000 2000 ft	2000 3000 ft	3000 6000 ft	> 6000 ft	
33S, 2W	0.0	0.0	0.0	0.0	0.0	0.0
33S, 1W	0.0	0.0	0.0	0.0	0.0	0.0
33S, 1E	0.0	94.9	655.4	1,046.6	0.0	1,796.9
33S, 2E	10.5	48.8	93.3	7.3	0.0	159.9
34S, 2W	7.5	121.2	113.1	74.4	0.0	316.2

Township/ Range	Depth of Cover					TOTAL
	Minable			Deep		
	0 1000 ft	1000 2000 ft	2000 3000 ft	3000 6000 ft	> 6000 ft	
34S, 1W	0.0	0.0	45.3	49.9	0.0	95.2
34S, 1E	33.2	589.7	284.5	278.9	0.0	1,186.3
34S, 2E	1.4	45.0	0.0	0.0	0.0	46.4
35S, 2W	111.3	150.2	165.6	249.0	0.0	676.1
35S, 1W	0.0	0.0	0.0	405.7	54.4	460.1
35S, 1E	20.0	190.5	188.9	356.4	6.9	762.7
36S, 2W (N½)	65.5	42.6	7.9	0.1	0.0	116.1
36S, 1W (N½)	9.7	22.5	101.8	151.8	7.4	293.2
36S, 1E	104.2	217.8	189.5	948.8	0.0	1,460.3
TOTAL	363.3	1,523.2	1,845.3	3,568.9	68.7	7,369.4
PERCENT	4.9%	20.7%	25.0%	48.4%	0.9%	100.0%

Identified coal resource for the Kaiparowits Plateau coal field within the KPA by depth of cover and township (in millions of tons; from BLM/UGS 2006)

EVALUATION OF THE COAL UNSUITABILITY CRITERIA

This report assesses KDA coal resources for unsuitability based on the 20 criteria outlined in 43 CFR 3461.5. Underground mining of coal deposits is exempt from the criteria, where there would be no surface coal mining operations as stated at 3461.1.1(a). Surface mining operations include surface operations and surface impacts incident to an underground mine as stated in 43 CFR 3400.0-5(mm). In addition, where underground mining would include surface operations and surface impacts on federal lands to which a criterion applies, the lands shall be assessed as unsuitable unless an exception or exemption applies (43 CFR 3461.1(b)). Each criterion is subject to exceptions and/or exemptions as prescribed in the regulations.

Criterion Number 1

All Federal lands included in the following land systems or categories shall be considered unsuitable: National Park System; National Wildlife Refuge System; National System of Trails; National Wilderness Preservation System; National Wild and Scenic Rivers System; National Recreation Areas; lands acquired with money derived from the Land and Water Conservation Fund; National Forests; and Federal lands in incorporated cities, towns, and villages.

- Exceptions. (i) A lease may be issued within the boundaries of any National Forest if the Secretary finds no significant recreational, timber, economic or other values which may be incompatible with the lease; and (A) surface operations and impacts are incident to an underground coal mine, or (B) where the Secretary of Agriculture determines, with respect to lands which do not have significant forest cover within those National Forests west of the 100th Meridian, that surface mining may be in compliance with the Multiple-

Use Sustained-Yield Act of 1960, the Federal Coal Leasing Amendments Act of 1976 and the Surface Mining Control and Reclamation Act of 1977. (ii) A lease may be issued within the Custer National Forest with the consent of the Department of Agriculture as long as no surface coal mining operations are permitted.

- Exemptions. The application of this criterion to lands within the listed land systems and categories is subject to valid existing rights, and does not apply to surface coal mining operations existing on August 3, 1977.

A number of land systems specified in Criterion 1 are applicable under the unsuitability criteria.

National Forests

All National Forest lands are considered unsuitable for surface coal mining operations. An exception to this criterion would allow surface operations based on the specific criteria outlined above. The Dixie National Forest prepared a Coal Unsuitability Study in 1983, and found that only 10 acres met the conditions of the exception. The study was based on areas identified as high- and moderate-potential coal lands that did not have significant forest cover. However, National Forest lands are outside of the KDA and are not included in the BLM unsuitability decision.

National Recreation Areas

There are about 2,120 acres of federal coal in the Kaiparowits coal field that underlie the Glen Canyon National Recreation Area. Under Criterion 1, this federal coal is unsuitable for surface coal mining, however, it is not included in the BLM unsuitability decision because the lands are outside of the KDA.

National Wild and Scenic Rivers System

There are about 230 acres of lands that are considered suitable for inclusion in the National Wild and Scenic Rivers System.

Incorporated Cities, Towns, and Villages

Approximately 3,000 acres of federal coal in the Alton and Kolob coal fields within the KRCRA underlie the towns of Alton, Orderville, and Glendale. Because of possible damage to private property caused by subsidence and surface mining, these areas are determined to be unsuitable and will not be further considered for future leasing. The breakdown of the number of acres within each town is as follows:

Alton	101 acres
Glendale	1,742 acres
Orderville	1,162 acres

Exemptions for valid existing rights do not apply.

Summary: Criterion 1—Approximately 3,237 acres are determined to be unsuitable based on the conditions set forth in this criterion.

Criterion Number 2

Federal lands that are within rights-of-way or easements or within surface leases for residential, commercial, industrial, or other public purposes, on federally owned surface shall be considered unsuitable.

- Exceptions. A lease may be issued, and mining operations approved, in such areas if the surface management agency determines that: (i) All or certain types of coal development (e.g., underground mining) will not interfere with the purpose of the right-of-way or easement; or (ii) The right-of-way or easement was granted for mining purposes; or (iii) The right-of-way or easement was issued for a purpose for which it is not being used; (iv) The parties involved in the right-of-way or easement agree, in writing, to leasing; or (v) It is impractical to exclude such areas due to the location of coal and method of mining and such areas or uses can be protected through appropriate stipulations.
- Exemptions. This criterion does not apply to lands: To which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

There are only 17 recorded rights-of-way (ROW), totaling approximately 30 acres of land, within the KRCRA. The exception (parts (i), (iv), and (v)) of this criterion offers protection for the ROWs and their improvements from the potential adverse effects of mining or associated surface facilities and, therefore, will not be considered unsuitable.

There are a large number of roads that will be evaluated in the future for Revised Statute (RS) 2477 standing. This could greatly affect the number of ROWs within the KRCRA. It is likely that the criterion exception would also apply in these cases.

Summary: Criterion 2—No acres are determined to be unsuitable based on the conditions set forth in this criterion.

Criterion Number 3

The terms used in this criterion have the meaning set out in the Office of Surface Mining Reclamation and Enforcement regulations at Chapter VII of Title 30 of the Code of Federal Regulations. Federal lands affected by section 522(e) (4) and (5) of the Surface Mining Control and Reclamation Act of 1977 shall be considered unsuitable. This includes lands within 100 feet of the outside line of the right-of-way of a public road or within 100 feet of a cemetery, or within 300 feet of any public building, school, church, community or institutional building or public park or within 300 feet of an occupied dwelling.

- Exceptions. A lease may be issued for lands: (i) Used as mine access roads or haulage roads that join the right-of-way for a public road; (ii) For which the Office of Surface Mining Reclamation and Enforcement has issued a permit to have public roads relocated; (iii) If after public notice and opportunity for public hearing in the locality, a written finding is made by the authorized

officer that the interests of the public and the landowners affected by mining within 100 feet of a public road will be protected; (iv) For which owners of occupied dwellings have given written permission to mine within 300 feet of their buildings.

- Exemptions. The application of this criterion is subject to valid existing rights, and does not apply to surface coal mining operations existing on August 3, 1977.

Criterion 3 identifies approximately 3,200 acres of land within the KRCRA that have been found to be unsuitable. Data was not available to ascertain the location of all public buildings, community or institutional buildings, or occupied dwellings. Therefore, municipality boundaries were used to identify the areas of unsuitability. There are still a number of homes and summer cabins on private lands outside of these boundaries that are underlain by federal coal in the Alton and Kolob fields. A survey of the exact locations was not conducted. Because many of these structures are located in areas that would be mined primarily by underground methods, the underground exemption could possibly be applied. If the exemption could not be applied, mining would not be allowed within 300 feet of any such dwelling. A survey of existing dwellings would be made if leasing of federal coal is considered. The owners of the dwellings would be given the opportunity to give written permission for mining. If permission is not obtained, the area would then be designated unsuitable and the exact acreage calculated. Until that time, the area will be considered suitable.

The Alton Cemetery is underlain by surface minable coal. This area is unsuitable because surface mining is prohibited within 100 feet of a cemetery. This involves only about 1 acre.

As mentioned above in Criterion 2, the total acreage determined to be unsuitable could increase significantly in the future based on administrative determinations regarding RS 2477 road assertions.

The exemptions for valid existing rights do not apply because there are presently no authorized coal leases within the KRCRA.

Summary: Criterion 3—Approximately 3,200 acres are determined to be unsuitable for surface coal mining and surface impacts incident to underground mining based on the conditions set forth in this criterion.

Criterion Number 4

Federal lands designated as wilderness study areas shall be considered unsuitable while under review by the Administration and the Congress for possible wilderness designation. For any Federal land which is to be leased or mined prior to completion of the wilderness inventory by the surface management agency, the environmental assessment or impact statement on the lease sale or mine plan shall consider whether the land possesses the characteristics of a wilderness study area. If the finding is affirmative, the land shall be considered unsuitable, unless issuance of noncompetitive coal leases and mining on leases is authorized under the Wilderness Act and the Federal Land Policy and Management Act of 1976.

- Exemptions. The application of this criterion to lands for which the Bureau of Land Management is the surface management agency and lands in designated wilderness areas in National Forests is subject to valid existing rights.

There is one Wilderness Study Area (WSA) that partially overlies the KRCRA. Therefore, approximately 45 acres within the Parunuweap Canyon WSA are considered unsuitable.

The exemptions for valid existing rights do not apply because there are presently no authorized coal leases within the KRCRA.

Summary: Criterion 4—Approximately 45 acres are determined to be unsuitable for surface coal mining and surface impacts incident to underground mining based on the conditions set forth in this criterion.

Criterion Number 5

Scenic Federal lands designated by visual resource management analysis as Class I (areas of outstanding scenic quality or high visual sensitivity) but not currently on the National Register of Natural Landmarks shall be considered unsuitable.

- Exceptions. A lease may be issued if the surface management agency determines that surface coal mining operations will not significantly diminish or adversely affect the scenic quality of the designated area.
- Exemptions. This criterion does not apply to lands: to which the operator has made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977, or which include operations on which a permit has been issued.

There are presently no Visual Resource Management (VRM) Class I lands within the KRCRA. This will change in the future with the new KFO Resource Management Plan (RMP) based on BLM policy set forth in the Washington Office Instruction Memorandum 2000-096, which directs BLM to assign VRM Class I designations to all WSA lands. Therefore, after authorization of the new RMP, 45 acres in the Parunuweap Canyon WSA that fall within the KRCRA (Criterion 4) will become unsuitable for surface mining.

Summary: Criterion 5—No acres are determined to be unsuitable at this time.

Criterion Number 6

Federal lands under permit by the surface management agency, and being used for scientific studies involving food or fiber production, natural resources, or technology demonstrations and experiments shall be considered unsuitable for the duration of the study, demonstration or experiment, except where mining could be conducted in such a way as to enhance or not jeopardize the purposes of the study, as determined by the surface management agency, or where the principal scientific user or agency gives written concurrence to all or certain methods of mining.

- Exemptions. This criterion does not apply to lands: To which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

Southern Utah University in conjunction with the Utah Division of Wildlife Resources (UDWR) and the KFO BLM are studying Greater sage-grouse in the Alton area. The study incorporates

approximately 5,800 acres within the Alton Amphitheater. The purpose of the study is to determine locations and suitability for sage-grouse brooding and winter habitats. This study is scheduled to be complete in 2008. The schedule would not conflict with future mining/leasing and, therefore, the project area is considered suitable under this criterion.

Summary: Criterion 6—No acres are determined to be unsuitable.

Criterion Number 7

All publicly or privately owned places which are included in the National Register of Historic Places shall be considered unsuitable. This shall include any areas that the surface management agency determines, after consultation with the Advisory Council on Historic Preservation and the State Historic Preservation Officer, are necessary to protect the inherent values of the property that made it eligible for listing in the National Register.

- Exceptions. All or certain stipulated methods of coal mining may be allowed if, after consultation with the Advisory Council on Historic Preservation and the State Historic Preservation Officer, they are approved by the surface management agency, and, where appropriate, the State or local agency with jurisdiction over the historic site.
- Exemptions. This criterion does not apply to lands: to which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

This criterion applies to districts, sites, objects, and other items of historical, architectural, archaeological, or cultural significance in or eligible for inclusion in the National Register of Historic Places. Although no sites within the KRCRA have been included in the National Register, there are a large number of known and documented archaeological sites that have been determined eligible. The exception for stipulated coal mining methods that will not result in adverse impacts is applicable; however, mitigation may be required for eligible sites where adverse impacts cannot be avoided. The State Historic Preservation Officer has identified possible subsidence problems associated with underground mining. Stipulations would be necessary in any future leases to mitigate the adverse effects of subsidence.

Summary: Criterion 7—No acres are determined to be unsuitable at this time.

Criterion Number 8

Federal lands designated as natural areas or as National Natural Landmarks shall be considered unsuitable.

- Exceptions. A lease may be issued and mining operation approved in an area or site if the surface management agency determines that: (i) The use of appropriate stipulated mining technology will result in no significant adverse impact to the area or site; or (ii) The mining of the coal resource under appropriate stipulations will enhance information recovery (e.g., paleontological sites).
- Exemptions. This criterion does not apply to lands: To which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which includes operations on which a permit has been issued.

There are no designated natural areas or National Natural Landmarks designated under 43 CFR 2070 within the KRCRA.

Summary: Criterion 8—No acres are determined to be unsuitable.

Criterion Number 9

Federally designated critical habitat for listed threatened or endangered plant and animal species, and habitat proposed to be designated as critical for listed threatened or endangered plant and animal species or species proposed for listing, and habitat for Federal threatened or endangered species which is determined by the Fish and Wildlife Service and the surface management agency to be of essential value and where the presence of threatened or endangered species has been scientifically documented, shall be considered unsuitable.

- Exceptions. A lease may be issued and mining operations approved if, after consultation with the Fish and Wildlife Service, the Service determines that the proposed activity is not likely to jeopardize the continued existence of the listed species and/or its critical habitat.
- Exemptions. This criterion does not apply to lands: to which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

There are approximately 33,972 acres of federally designated critical habitat for the Mexican spotted owl (MSO) within the boundaries of the KRCRA. In informal consultation with the U.S. Fish and Wildlife Service (USFWS), BLM mapped areas that contain only the primary constituent elements for MSO habitat, as defined by the Mexican Spotted Owl Recovery Plan (USFWS 2001, FR 8530, vol. 66 no. 22). These areas were identified using professional judgment and by buffering the 2000 Willey MSO habitat model by ½ mile. The areas identified include approximately 4,380 acres of habitat that would be considered unsuitable for surface coal mining or surface facilities. In the event of future leasing, BLM would inventory coal areas for threatened and endangered (T&E) plant and animal species in conjunction with a site-specific environmental impact statement (EIS) analysis. Critical habitat designations for T&E plant or animal species will likely change in the future, at which time the determination of suitability would be revised.

Past surveys include a general reconnaissance for T&E plants in the entire southern Utah coal area by Dr. Stanley Welch in 1977. Moderately intensive surveys were conducted by Dr. Kent Ostler in 1979 on about 56,500 acres on the Utah Power and Light Company preference right lease application area, the El Paso Coal Company leases, and the Resources Company leases. A moderately intensive survey on about 26,800 acres in the Alton coal field was conducted by Dr. Robert Foster in 1979. UDWR inventoried the coal areas of southern Utah for T&E animals in 1977 and 1978. The process included a literature search and field inventories. In 1979 and 1980, BLM conducted an essential habitat inventory for the Utah prairie dog, peregrine falcon, and bald eagle in southern Utah. Several bald eagle sightings were made on the Alton and Kolob coal fields, and one concentration area was located (Criterion 12). No peregrine falcons or Utah prairie dogs were identified closer than 10 miles from the KRCRA (Escalante and Zion Unit Resource Analyses; Johnson 1979; UDWR 1977; USFWS 1978, 44 FR 7096, December 10, 1979).

The exception in this criterion could allow for surface mining and surface facilities within these areas only after the USFWS determined that the proposed activity is not likely to jeopardize the continued existence of the MSO or other listed species in the future and/or their critical habitats.

The exemption for substantial legal and financial commitments and ongoing mining operations does not apply because there are no active leases or operations within the planning area.

Summary: Criterion 9—Approximately 4,380 acres are determined to be unsuitable for surface coal mining and surface impacts incident to underground mining in the KDA. Exception(s) to this criterion may be applicable subject to site-specific analysis and consultation with USFWS.

Criterion Number 10

Federal lands containing habitat determined to be critical or essential for plant or animal species listed by a state pursuant to state law as endangered or threatened shall be considered unsuitable.

- Exceptions. A lease may be issued and mining operations approved if, after consultation with the state, the surface management agency determines that the species will not be adversely affected by all or certain stipulated methods of coal mining.
- Exemptions. This criterion does not apply to lands: To which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

The State of Utah does not maintain an official state T&E species list; therefore, no state-listed T&E plant or animal species or critical habitat exists for this criterion.

Summary: Criterion 10—No acres are determined to be unsuitable.

Criterion Number 11

A bald or golden eagle nest or site on Federal lands that is determined to be active and an appropriate buffer zone of land around the nest site shall be considered unsuitable. Consideration of availability of habitat for prey species and of terrain shall be included in the determination of buffer zones. Buffer zones shall be determined in consultation with the Fish and Wildlife Service.

- Exceptions. A lease may be issued if: (i) It can be conditioned in such a way, either in manner or period of operation, that eagles will not be disturbed during breeding season; or (ii) The surface management agency, with the concurrence of the Fish and Wildlife Service, determines that the golden eagle nest(s) will be moved. (iii) Buffer zones may be decreased if the surface management agency determines that the active eagle nests will not be adversely affected.
- Exemptions. This criterion does not apply to lands: to which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

In 2003, UDWR identified an active bald eagle nest within the KPA adjacent to the KRCRA. When including a 1-mile buffer zone, a portion of the KRCRA is intersected. Nests are considered active for a period of 7 years after discovery of a nest in use. Exercising (iii) of the exception above, the buffer has been modified because the natural topography provides adequate protection for the nest site. Approximately 20 acres of land remain unsuitable after the readjustment. Leasing may be feasible within the area determined to be unsuitable if the condition of exceptions (i and ii) are met. The underground exemption could also be applied on possible future leasing. Future leases would stipulate that no surface facilities could be built within a 1-mile radius of an active nest site and that surface operations could be conducted only between September 1 and December 31 of each year (Utah Field Office Guidelines for Raptor Protection From Human and Land Use Disturbances [USFWS 1999]). Future inventories by UDWR and BLM may identify additional eagle nests within the coal areas that would render the nest and buffer areas unsuitable.

The exemption for substantial legal and financial commitments and ongoing mining operations does not apply because there are no active leases or operations within the planning area.

Summary: Criterion 11—Approximately 20 acres are determined to be unsuitable for surface coal mining and surface impacts incident to underground mining. The exception in this criterion may be applicable subject to site-specific analysis and consultation with USFWS.

Criterion Number 12

Bald and golden eagle roost and concentration areas on Federal lands used during migration and wintering shall be considered unsuitable.

- Exceptions. A lease may be issued if the surface management agency determines that all or certain stipulated methods of coal mining can be conducted in such a way, and during such periods of time, to ensure that eagles shall not be adversely disturbed.
- Exemptions. This criterion does not apply to lands: to which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

BLM and UDWR inventories have identified a bald eagle winter concentration area of approximately 1,160 acres on Table Bench along the North Fork of the Virgin River. The wintering area is used from about November 1 to March 15 each year. The rough surface topography and the deep coals have led to the determination that only underground methods would be used to mine this area. The exception and underground exemption could be applied to possible future leases and surface facilities to restrict activities that could adversely disturb the eagles during the winter concentration period. Future inventories by BLM and UDWR may identify other bald eagle concentration areas within the coal areas, which could affect suitability (BLM 1978 and 1979, Zion Unit Analysis; UDWR 1977; Johnson 1979).

The exemption for substantial legal and financial commitments and ongoing mining operations does not apply because there are no active leases or operations within the planning area.

Summary: Criterion 12—Approximately 1,160 acres are determined to be unsuitable for surface coal mining and surface impacts incident to underground mining. The exception in this criterion may be applicable subject to site-specific analysis.

Criterion Number 13

Federal lands containing a falcon (excluding kestrel) cliff nesting site with an active nest and a buffer zone of Federal land around the nest site shall be considered unsuitable. Consideration of availability of habitat for prey species and of terrain shall be included in the determination of buffer zones. Buffer zones shall be determined in consultation with the Fish and Wildlife Service.

- Exceptions. A lease may be issued where the surface management agency, after consultation with the Fish and Wildlife Service, determines that all or certain stipulated methods of coal mining will not adversely affect the falcon habitat during the periods when such habitat is used by the falcons.
- Exemptions. This criterion does not apply to lands: to which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

BLM and UDWR inventories conducted in the late 1970s and early 1980s identified several prairie falcon nesting sites within the KPA, two of which were located within the KRCRA (BLM 1978, 1979 Zion and Escalante Unit Resource Analyses; UDWR 1977, 1978; Hoffman 1978; Johnson 1979; BLM field inventories 1976, 1977, 1978, and 1980). No recent surveys have been conducted to verify this data. Because of the amount of time that has passed since the data was collected and the likelihood of a change of status, no lands are designated as unsuitable under this criterion. A more thorough analysis would be required at the time of coal leasing to adequately address this criterion. Future inventories by UDWR and BLM or site-specific lease analysis may identify new falcon nests within coal areas. At that time the lands would be designated unsuitable unless the exception could be applied.

Summary: Criterion 13—No acres are determined to be unsuitable.

Criterion Number 14

Federal lands which are high priority habitat for migratory bird species of high Federal interest on a regional or national basis, as determined jointly by the surface management agency and the Fish and Wildlife Service, shall be considered unsuitable.

- Exceptions. A lease may be issued where the surface management agency, after consultation with the Fish and Wildlife Service, determines that all or certain stipulated methods of coal mining will not adversely affect the migratory bird habitat during the periods when such habitat is used by the species.
- Exemptions. This criterion does not apply to lands: to which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

Several Bird Habitat Conservation Areas have been identified by the Intermountain West Joint Venture (IWJV) along the East Fork of the Virgin River, East Fork of the Sevier River (Parker Mountain), and Escalante River in and adjacent to the KRCRA. In consultation with USFWS, BLM determined that high-priority habitats for migratory birds exist along these corridors, defined as a ½-mile buffer zone from the outer edge of the bank. Approximately 8,376 acres of the KRCRA would be affected and considered unsuitable. Future leasing within these areas could occur if site-specific consultation with USFWS determined that such operations would not adversely affect the migratory bird habitat during the periods of use.

The underground exemption does not apply in this criterion because of the potential to affect hydrologic systems and riparian habitat.

The exemption for substantial legal and financial commitments and ongoing mining operations does not apply because there are no active leases or operations within the planning area.

Summary: Criterion 14—Approximately 8,120 acres are determined to be unsuitable for surface coal mining and surface impacts incident to underground mining. The exception in this criterion may be applicable subject to site-specific analysis and consultation with USFWS.

Criterion Number 15

Federal lands which the surface management agency and the state jointly agree are habitat for resident species of fish, wildlife and plants of high interest to the state and which are essential for maintaining these priority wildlife and plant species shall be considered unsuitable. Examples of such lands which serve a critical function for the species involved include: (i) Active dancing and strutting grounds for Greater sage-grouse, sharp-tailed grouse, and prairie chicken; (ii) Winter ranges crucial for deer, antelope, and elk; (iii) Migration corridor for elk; and (iv) Extremes of range for plant species.

- Exceptions. A lease may be issued if, after consultation with the state, the surface management agency determines that all or certain stipulated methods of coal mining will not have a significant long-term impact on the species being protected.
- Exemptions. This criterion does not apply to lands: To which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

There are approximately 18,330 acres of crucial elk winter range; 12,780 acres of crucial mule deer winter range; 8,735 acres of Greater sage-grouse breeding, nesting, and brood-rearing habitat; and 12 acres classified as leks on federal coal lands within the KRCRA. The State of Utah and BLM agree that elk, mule deer, and sage-grouse habitats should remain suitable because site-specific analyses would occur before coal field leasing. Presently there is an EIS underway as part of a coal leasing application in the Alton Amphitheater. High-interest habitat issues will be addressed in this EIS.

Table A0-4. State Sensitive Species Habitat

State Sensitive Species Habitat (acres of habitat by ownership)	USFS	BLM	State Surface	Private Surface
Elk	17,015	1,235		80
Mule Deer	8,445	2,530	680	1,125
Sage-Grouse Breeding, Nesting, and Brood-Rearing	5,735	1,940		1,060
Sage-Grouse Lek		12		

Neither the BLM nor the State of Utah has high-interest plant species of concern within the KRCRA.

The first exception and underground exemption in this criterion would apply.

The exemption for substantial legal and financial commitments and ongoing mining operations does not apply because there are no active leases or operations within the planning area.

Summary: Criterion 15—No acres are determined to be unsuitable.

Criterion Number 16

Federal lands in riverine, coastal and special floodplains (100-year recurrence interval) on which the surface management agency determines that mining could not be undertaken without substantial threat of loss of life or property shall be considered unsuitable for all or certain stipulated methods of coal mining.

- Exemptions. This criterion does not apply to lands: To which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

Data for this criterion is not presently available to adequately delineate riverine and special floodplains. Limited 100-year flood hazard maps are available from the U.S. Department of Housing and Urban Development, but the data is not adequate to determine the threat assessment. A more thorough analysis will be required at the time of coal leasing to adequately address this criterion.

Summary: Criterion 16—No acres are determined to be unsuitable.

Criterion Number 17

Federal lands which have been committed by the surface management agency to use as municipal watersheds shall be considered unsuitable.

- Exceptions. A lease may be issued where the surface management agency in consultation with the municipality (incorporated entity) or the responsible governmental unit

determines, as a result of studies, that all or certain stipulated methods of coal mining will not adversely affect the watershed to any significant degree.
- Exemptions. This criterion does not apply to lands: To which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

No lands within the KRCRA have been committed for use as municipal watersheds.

Summary: Criterion 17—No acres are determined to be unsuitable.

Criterion Number 18

Federal lands with National Resource Waters, as identified by states in their water quality management plans, and a buffer zone of Federal lands ¼ mile from the outer edge of the far banks of the water, shall be unsuitable.

- Exceptions. The buffer zone may be eliminated or reduced in size where the surface management agency determines that it is not necessary to protect the National Resource Waters.
- Exemptions. This criterion does not apply to lands: To which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

In the State of Utah, the designation "High Quality Waters" is the equivalent of National Resource Waters, and therefore waters with this designation receive additional regulatory protection.

Within the KPA, the State of Utah has designated Category 1 High Quality Waters in the following drainages:

1. North Fork of the Virgin River and tributaries, from the confluence with the East Fork of the Virgin River to its headwaters
2. East Fork of the Virgin River and tributaries, from the confluence with the North Fork of the Virgin River to its headwaters
3. East Fork of the Sevier River and tributaries, from the Kingston diversion to its headwaters
4. Kanab Creek and tributaries, from the irrigation diversion at the confluence with Reservoir Canyon to its headwaters (Utah Administrative Code R317-2-12).

Consistent with Criterion 18 and state rules, BLM has determined that protection of High Quality Waters can be achieved through the use of the unsuitability designation, best management practices (BMP), and the state permitting process. Buffers were established for springs and perennial and intermittent streams, as follows:

- Perennial streams: ¼ mile (1,320 feet; 402 meters) slope distance from the outer edge of the bank

- Intermittent streams: 330 feet (100 meters) slope distance from the outer edge of the bank
- Springs: 330 feet (100 meters) slope distance from the edge of the saturated area.

The locations of springs and perennial and intermittent stream reaches were determined based on interviews with employees of the BLM KFO and NPS (Sharrow, personal communication) as well as with a local landowner who has extensive knowledge of the area (Esplin, personal communication). Their input was used to edit the U.S. Geological Survey (USGS) digital line graphs dataset that covers the KPA. Stream segments that would be perennial or intermittent if it were not for irrigation diversions were classified according to their potential condition rather than their altered condition.

Approximately 13,760 acres are determined to be unsuitable because of proximity to National Resource Waters. It is likely that additional perennial/intermittent streams and springs are present that were not mapped. If such waterways are determined to exist after the publication of this report, they would be buffered and protected as described above.

The exemption for substantial legal and financial commitments and ongoing mining operations does not apply because there are no active leases or operations within the planning area.

Summary: Criterion 18—Approximately 12,988 acres are determined to be unsuitable for surface coal mining and surface impacts incident to underground mining.

Criterion Number 19

Federal lands identified by the surface management agency, in consultation with the state in which they are located, as alluvial valley floors according to the definition in §3400.0—5(a) of this title, the standards in 30 CFR Part 822, the final alluvial valley floor guidelines of the Office of Surface Mining Reclamation and Enforcement when published, and approved state programs under the Surface Mining Control and Reclamation Act of 1977, where mining would interrupt, discontinue, or preclude farming, shall be considered unsuitable. Additionally, when mining Federal land outside an alluvial valley floor would materially damage the quantity or quality of water in surface or underground water systems that would supply alluvial valley floors, the land shall be considered unsuitable.

- Exemptions. This criterion does not apply to surface coal mining operations which produced coal in commercial quantities in the year preceding August 3, 1977, or which had obtained a permit to conduct surface coal mining operations.

There is insufficient data at this time to determine either suitability or unsuitability of any area for coal development under this criterion. Identification of alluvial valley floors (AVF) is accomplished by the surface management agency in consultation with the state according to the definition in the Surface Mining Control and Reclamation Act of 1977 (SMCRA) (PL 95-87), the standards in 30 CFR 822, the Office of Surface Mining (OSM) AVF guidelines, and approved state programs under SMCRA.

The AVF guidelines provide a sequential procedure for identifying AVFs. The first phase is a reconnaissance investigation that identifies probable AVFs using available regional or generalized data. The second phase is more detailed, and involves test drilling and mapping of

geologic, vegetation, and soils data, leading to a determination that an area meets the criteria outlined in the regulations (30 CFR 78 19(c)(2)). The third phase requires more detailed descriptions of the AVFs identified in phase two, and involves water monitoring for a sufficient period of time to be able to describe seasonal fluctuations.

In response to a petition to designate certain lands in the study area as unsuitable for surface coal mining, OSM completed the first phase of an AVF investigation in the Alton coal field area (OSM 1983). The following list represents areas identified as possible AVFs within the KRCRA, but additional analysis would be required before leasing:

1. Kanab Creek, upper and lower
2. Sink Valley Wash
3. Unnamed tributary north of Alton and west of Kanab Creek
4. Thompson Creek
5. Mill, Tenny, and Skutumpah Creeks
6. Lower Johnson Wash
7. Yellow Creek
8. Upper Paria drainage
9. East Fork of the Sevier River.

AVFs may exist within the decision area, but initial mapping of AVFs has occurred only within the Alton area and at a reconnaissance level. Approximately 3,850 acres were identified as possible AVFs using data obtained from an investigation conducted by Jack Schmidt (1980) and BLM geographic information system (GIS) data layers. No lands within the planning area are designated as unsuitable under this criterion. A more detailed investigation would be required at the time of lease analysis.

The exemption for ongoing mining operations does not apply because there are no active leases or operations within the planning area.

Summary: Criterion 19—No acres are determined to be unsuitable.

Criterion Number 20

Federal lands in a state to which is applicable a criterion (i) proposed by the state or Indian tribe located in the planning area, and (ii) adopted by rulemaking by the Secretary, shall be considered unsuitable.

- Exceptions. A lease may be issued when: (i) Such criterion is adopted by the Secretary less than 6 months prior to the publication of the draft comprehensive land use plan or land use analysis, plan, or supplement to a comprehensive land use plan, for the area in which such land is included, or (ii) After consultation with the state or affected Indian tribe, the surface management agency determines that all or certain stipulated methods of coal mining will not adversely affect the value which the criterion would protect.
- Exemptions. This criterion does not apply to lands: To which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

Neither the State of Utah nor Indian tribes have proposed any criteria that would affect the coal lands under review, although in 1980 Secretary of Interior Andrus signed a decision designating certain areas in the viewshed of Bryce Canyon National Park unsuitable for surface coal mining and surface impacts incident to underground mining. Approximately 31,620 acres fall within the KRCRA, and these are determined to be unsuitable.

The exemption for substantial legal and financial commitments and ongoing mining operations does not apply because there are no active leases or operations within the planning area.

Summary: Criterion 20—Approximately 10,614 acres are determined to be unsuitable for surface coal mining and surface impacts incident to underground mining.

SUMMARY OF THE UNSUITABILITY EVALUATION

The coal resources with development potential within the KPA have been evaluated based on the 20 criteria of unsuitability. Based on the criteria, the coal resources that are considered unsuitable for surface coal mining or surface operations and impacts incident to underground mining are shown on Map 2. These resources have been determined to be unsuitable based on Criteria 1, 3, 4, 9, 11, 12, 14, 15, 18, and 20. As a result of this analysis, there are approximately 35,538 acres within the KDA that are determined to be unsuitable for surface coal mining or operations and surface impacts incident to underground mining.

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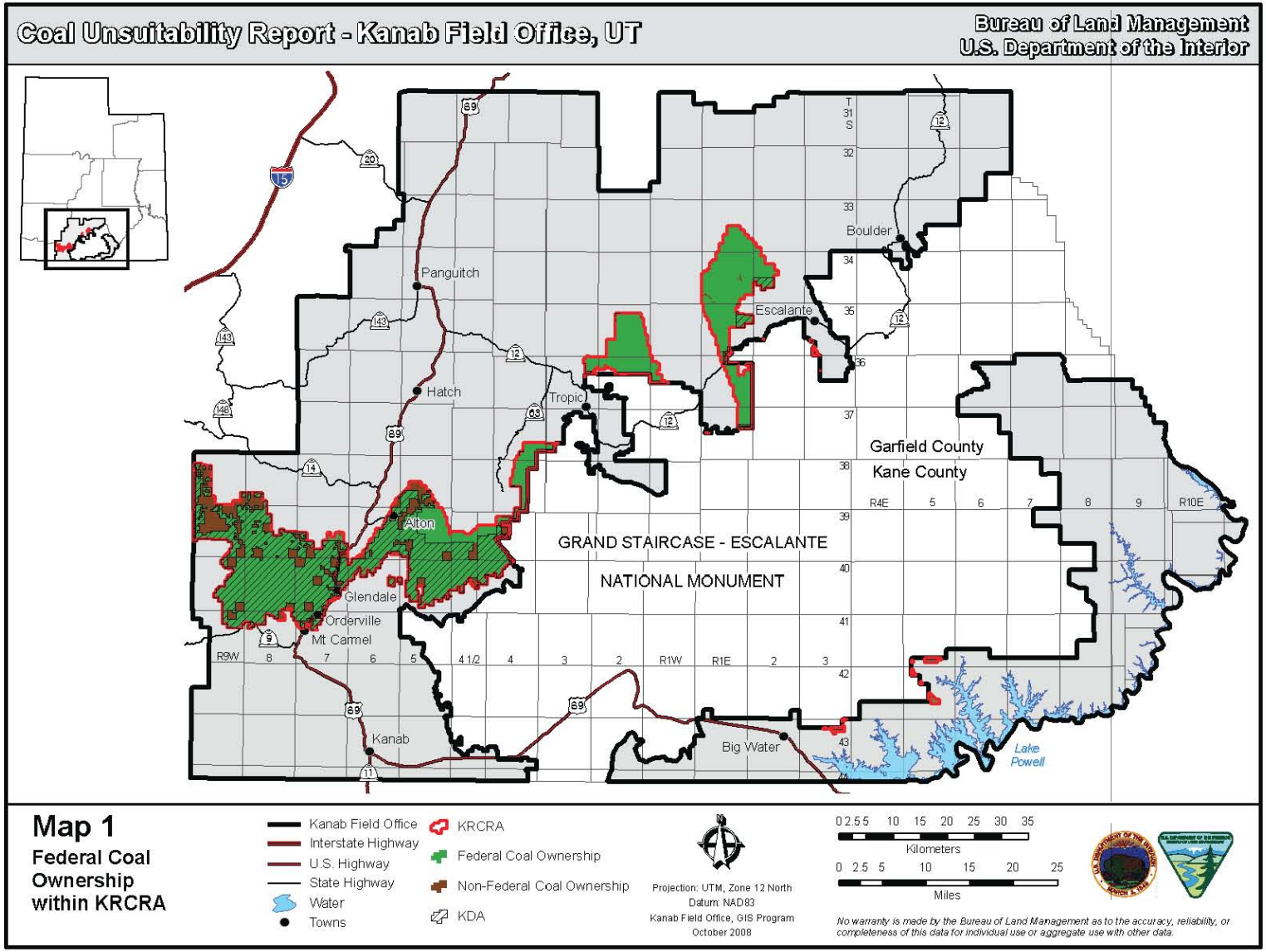
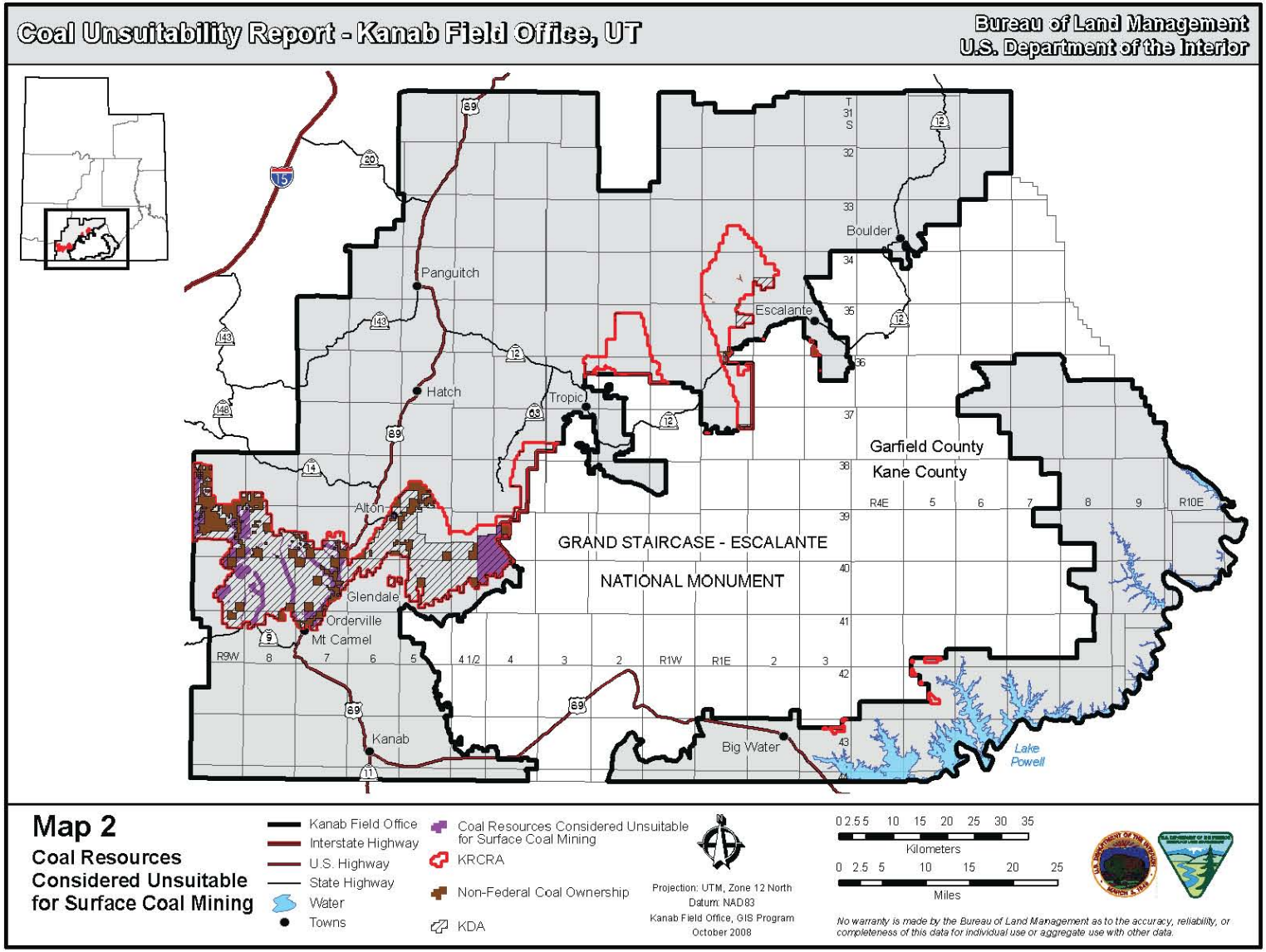
MAP 1. FEDERAL COAL OWNERSHIP WITHIN KRCRA



MAP 2. COAL RESOURCES CONSIDERED UNSUITABLE FOR SURFACE MINING



APPENDIX E.
ALTON COAL TRACT LEASE BY APPLICATION GREATER SAGE-GROUSE MITIGATION PLAN DRAFT

ALTON COAL TRACT LEASE BY APPLICATION
GREATER SAGE-GROUSE MITIGATION PLAN

DRAFT

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March 2014

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ATTACHMENTS

Attachment A. Alton Coal Tract Lease by Application (LBA) Greater Sage-Grouse Mitigation Plan Effects on Non-wildlife Resources Analyzed in the SDEIS

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1. BACKGROUND

In November 2004, Alton Coal Development, LLC (ACD) filed a Lease by Application (LBA) to mine federal coal near the town of Alton, Utah (Case Number UTU 081895). This application was filed under the regulations of 43 Code of Federal Regulations (CFR) 3425, Leasing on Application. The original application included nearly 2,723 surface acres and approximately 38 million tons of recoverable coal. The Bureau of Land Management (BLM) reconfigured the tract to exclude approximately 40 acres and to include approximately 898 additional acres. Acreage added to the tract during tract reconfiguration was based on the identification of additional recoverable coal reserves not included in the original LBA and on additional surface acreage deemed necessary for mine operations. The Alton Coal Tract LBA (hereafter the Alton Coal Tract or tract), as reconfigured, contains approximately 3,577 surface acres and approximately 49 million tons of recoverable coal reserves (Figure 1). The reconfigured tract is the tract under consideration in the Proposed Action of the Alton Coal Tract LBA environmental impact statement (EIS) process.

Public scoping on the LBA tract was conducted in 2006 and 2007 and is detailed in the *Alton Coal Tract LBA EIS Public Scoping Report* (SWCA Environmental Consultants [SWCA] 2007). The BLM issued a draft EIS (DEIS) in November 2011 that considered one action alternative (Alternative C) in addition to the Proposed Action (BLM 2011a). A supplemental DEIS (SDEIS) has been completed (BLM 2014). The BLM decided to prepare an SDEIS based on, among other things, the need to analyze in detail Alternative K1, which had been dismissed from detailed analysis in the DEIS. This alternative is now being considered in detail largely to address public and agency concerns regarding impacts to the Greater Sage-Grouse (*Centrocercus urophasianus*) population, noise and visual impacts to the town of Alton, and issues related to conflicting land uses (agriculture versus surface mining).

ACD was issued a permit by the State of Utah on October 19, 2009, and began mining on the Coal Hollow Tract, located on private lands adjacent to the Alton Coal Tract, in late 2010. As the permitting agency, the Utah Division of Oil, Gas, and Mining (DOGM) required mitigation actions that focus on minimizing impacts to Greater Sage-Grouse (hereafter *sage-grouse*) and enhancing habitat. These actions are detailed in Volume 3 of the *Coal Hollow Mining and Reclamation Plan* (ACD 2009, Appendix 3-5), and have been ongoing since mining began.

To date, the following have been accomplished or are on-going as mitigation projects in the Alton–Sink Valley under the Coal Hollow permit:

- Vegetation treatments consisting of conifer removal and sagebrush restoration (including the establishment of a core conservation area, connectivity between habitat patches, and restoration of a lekking area)
- Activities to shift mating activities away from the historic lek
- Predator control
- Employee wildlife awareness education

The status and use by sage-grouse of completed vegetation treatments projects are described in Section 3.18.3.4.2 of the SDEIS.

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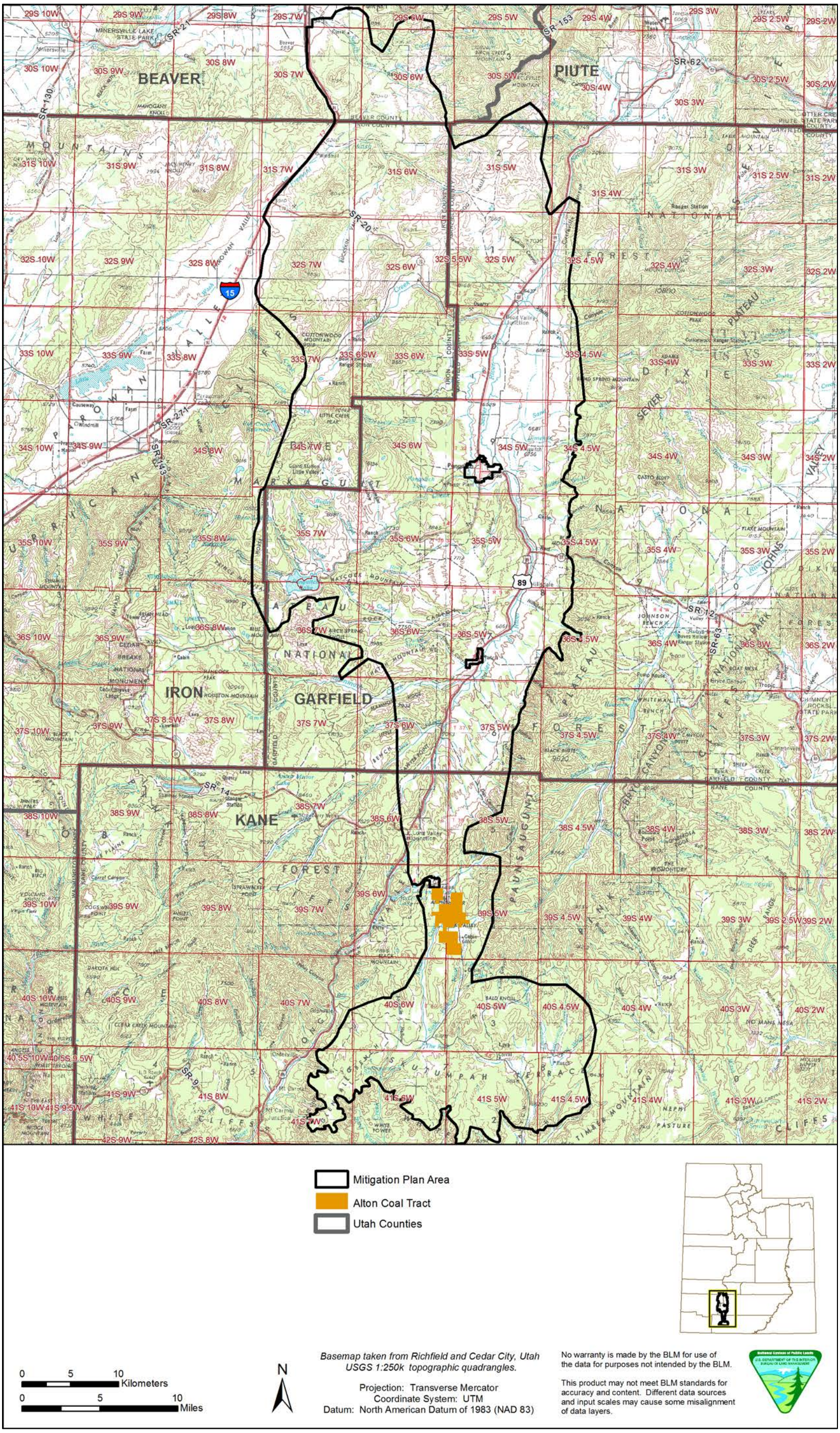

Figure 1. Alton Coal Tract location .

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2. PURPOSE

This plan will remain in draft form throughout the leasing decision process associated with the Alton Coal EIS. It will be finalized during the permitting stage, with ongoing input from U.S. Fish and Wildlife Service (USFWS), Utah Division of Wildlife Resources (UDWR), and DOGM.

The purpose of this plan is to describe the strategy for avoiding and reducing impacts, where possible, to the sage-grouse populations potentially affected by leasing and mining the Alton Coal Tract, in accordance with the guiding regulations summarized below. The requirements of this plan are applicable to all action alternatives except where the configuration of the action alternative makes certain requirements of this plan unnecessary. If the BLM's decision following the EIS process is to offer the tract for competitive leasing, the requirements of this mitigation plan would be incorporated as design features appropriate to the alternative selected. These design features would be reflected in lease stipulations as part of a lease contract after a record of decision (ROD) is issued.

This mitigation plan describes the following:

- Plan goals
- Guiding regulations specific to this plan
- Potential impacts on the sage-grouse population from implementation of mining activities on the tract
- Lands on which impact reduction activities and mitigation would be conducted
- Potential mitigation project types, including success criteria and maintenance requirements
- Options for monitoring sage-grouse use in the Alton–Sink Valley area

References to appropriate sections in the SDEIS are provided for a summary of the existing conditions and impacts resulting from the Proposed Action. Sage-grouse use of the tract is based on the most recently available data.

All off-site mitigation activities would be conducted in the mitigation plan area (see Figures 1 and 3), which includes public, state, and private land, and which corresponds to the sage-grouse analysis area in the Alton Coal LBA EIS. The sage-grouse analysis area corresponds to the boundaries of the Panguitch Sage-Grouse Management Area (SGMA) in the *Conservation Plan for Greater Sage-grouse in Utah* (sage-grouse conservation plan) (UDWR 2013), and the Panguitch Priority Area for Conservation in the *Sage-grouse Conservation Objectives Draft Report* (Sage-grouse Conservation Objectives Team 2012).

Although this mitigation plan is centered on mitigating impacts to sage-grouse, conservation of sagebrush ecosystems would likely also benefit a variety of wildlife species such as Sage Sparrow (*Amphispiza belli*), Brewer's Sparrow (*Spizella breweri*), Sage Thrasher (*Oreoscoptes montanus*), pronghorn (*Antilocapra americana*), mule deer (*Odocoileus hemionus*), elk (*Cervus canadensis*), and the UDWR species of concern pygmy rabbit (*Brachylagus idahoensis*) (UDWR 2009). Also, cattle grazing would benefit from an increase in forbs and bunchgrasses; however, cattle would be excluded from the mitigation areas until the vegetation has established successfully. Non-wildlife resources that are analyzed in the SDEIS that would be affected by the sage-grouse mitigation plan include vegetation, livestock grazing, fire management, cultural resources, visual resources, and soils. The impacts that the sage-grouse mitigation plan would have on these resources are discussed in Attachment A of this plan.

2.1. Terminology

The terminology used in this plan to describe short- and long-term impacts is consistent with the terminology used throughout the Alton Coal Tract EIS process. That is, *short term* refers to the period when the development of the mine and the mining of coal would occur. *Long term* refers to impacts that occur or remain after the cessation of coal mining and during, or continuing into, the period following the reclamation and monitoring period.

Throughout the document, the term *refugia*, or *refuges*, is used to describe an area of suitable habitat to which sage-grouse individuals can retreat when other habitats have been disturbed. Refugia would be most effective when the refuge locations are currently occupied by sage-grouse. Because sage-grouse are highly mobile, it is expected that they will seek out areas with less disturbance and higher quality habitat when traditional habitat patches are no longer available. If deemed appropriate and necessary, the BLM, in cooperation with USFWS, UDWR, and DOGM, may choose to relocate sage-grouse individuals to refugia. Such relocation would be an example of other management actions that could be considered if birds are not found to be using the refugia areas created.

The term *limited-touch area* is used in this plan to describe no-coal areas within the tract that have intact or restored sagebrush habitats that are required to provide adequate refugia throughout the life of the mine. Surface-disturbing activities in these limited-touch areas are to be avoided if possible. However, these areas can be used to access mining blocks that would otherwise be inaccessible. See Figure 2 for the locations of limited-touch areas.

The mitigation plan area, as shown on Figure 1, not only roughly corresponds to the Panguitch Core Area (Governor's Working Group on Sage-grouse 2012) as described above, but is also UDWR's determination of *occupied sage-grouse habitat*. The tract habitat is designated by UDWR as brood-rearing habitat, but based on site-specific information available to date (i.e., Frey et al. 2013; Frey 2013; Curtis and Frey 2007; Petersen 2007, 2010, 2012, 2013a), it is evident that the species does not use the tract habitat solely for brood-rearing. For the purpose of this document, the habitat polygon defined by UDWR is hereafter referred to as *occupied habitat*.

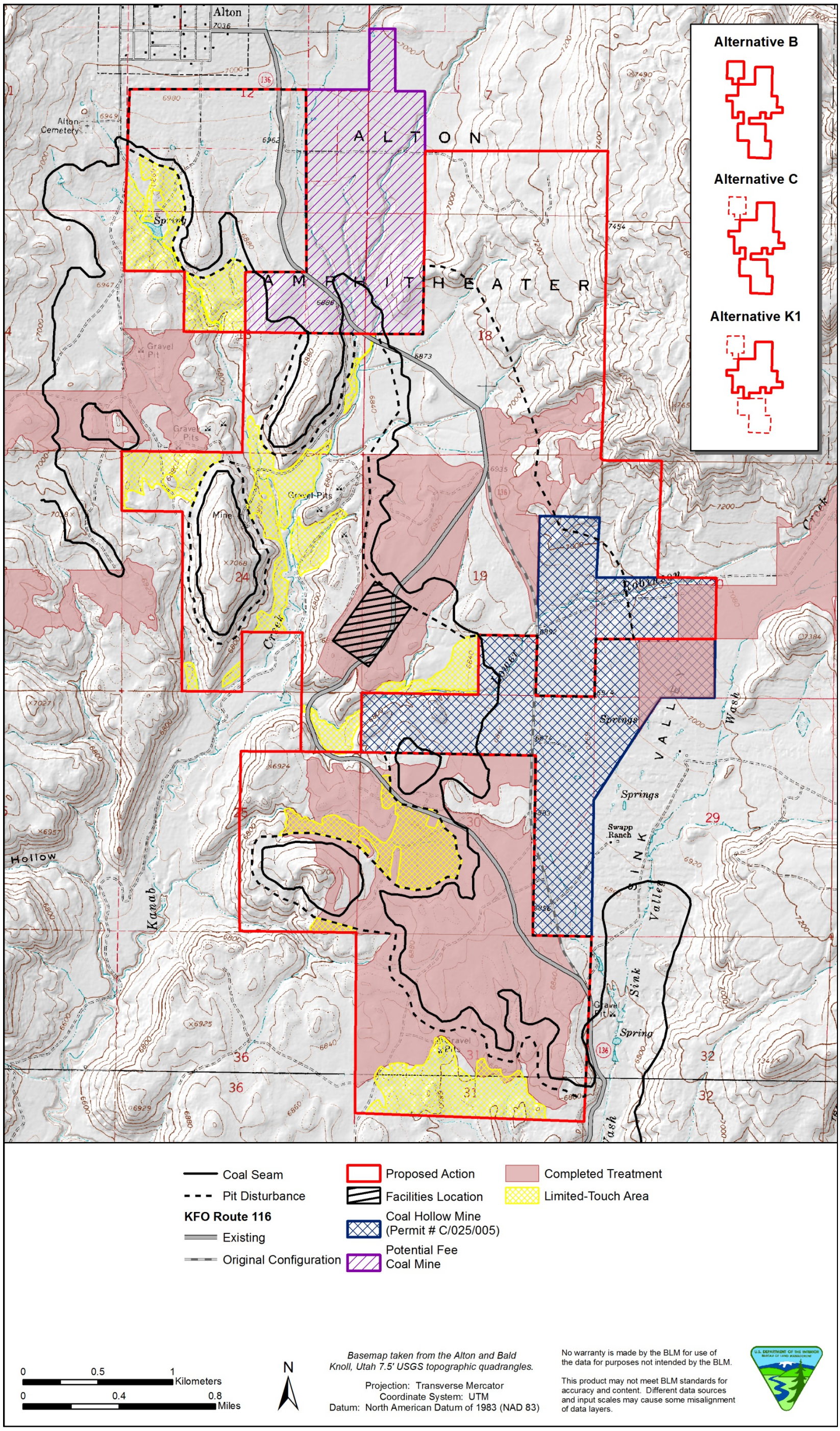

Figure 2. Tract configuration showing limited-touch areas and completed vegetation treatments.

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3. GUIDING REGULATION

Many of the public and agency comments received on the DEIS concern impacts to the local sage-grouse population. The SDEIS considers this mitigation plan as a design feature in the analysis of impacts. Mitigation actions are needed in response to public and agency comments on the DEIS, but also as a result of the regulations listed in Section 4.18.2.1.1 of the SDEIS with the following clarifications and additions:

- The Washington Office Instruction Memorandum (IM) 2012-043 identifies the need to "cumulatively maintain or enhance sage-grouse habitat" (BLM 2011b). The Washington Office IM also provides interim conservation policies and procedures to BLM field officials to be applied to ongoing and proposed authorizations and activities that affect the sage-grouse and its habitat. Under this IM, the BLM has the authority to condition the lease with a requirement for off-site mitigation (refer to Washington Office IM 2008-204, Off-Site Mitigation; BLM 2008a). This sage-grouse mitigation plan is intended to address the procedural requirements of this IM with respect to the Alton Coal Tract LBA EIS process. This sage-grouse mitigation plan complies with the IM 2012-043 requirements listed for leasable minerals (energy and non-energy) and fences on preliminary priority habitat. It complies with the requirement to "cumulatively maintain and enhance Greater Sage-grouse habitat" by instituting the following requirements:
    - Habitat avoidance through the designation of limited-touch areas in sagebrush habitats in the tract
    - Enhancing Block Sa (comprising 186.3 acres) and the portions of Block S that have not yet been enhanced prior to the commencement of mining activities
    - Requiring that Blocks S and NW not be mined simultaneously, allowing one to provide a refuge while the other is experiencing disturbances due to mining
    - Reclaiming in-tract sagebrush habitats to vegetation standards that would provide sage-grouse habitat in the long term
    - 4:1 ratio of mitigation acres to disturbance acres to increase available habitat in the analysis area in the short term

  The mitigation plan also complies with BLM IM 2008-204, which allows for off-site mitigation.
- Four decisions in the *Kanab Field Office Record of Decision and Approved Resource Management Plan* (KFO RMP; BLM 2008b) pertain to sage-grouse management (SSS-54, SSS-55, SSS-56, and SSS-57) and detail temporal and spatial buffers for leks and winter habitat within which no surface-disturbing activity may occur. SSS-57 states that an exemption, waiver, or modification may be granted on a case-by-case basis. This sage-grouse mitigation plan is intended to fulfill the requirement for an exception to these RMP decisions that states that the operator must submit a plan that demonstrates that impacts resulting from habitat loss from the Proposed Action can be adequately mitigated.

The BLM initiated a stakeholder process to develop this mitigation plan. The Color Country Adaptive Resource Management Local Working Group (CoCARM)—the local sage-grouse working group— was identified as a representative stakeholder group for initial discussions because it comprises the appropriate agency and government officials with knowledge of the current land uses and quality of habitat in the local area needed to develop an effective and appropriate mitigation plan. This group includes members that represent the UDWR, BLM, U.S. Forest Service (USFS), USFWS, DOGM, affected private landowners, and local public officials. CoCARM met on April 19, June 13 (which was the first meeting attended by USFWS), and August 27, 2012, to initiate discussions about the Alton Coal Tract mitigation planning process.

Outside of the CoCARM meetings, a conference call between BLM, USFWS, and SWCA representatives took place on September 11, 2012, to address the concerns of USFWS. An additional conference call was

held on November 19, 2012, to specifically discuss the mitigation ratio, and was attended by representatives from the BLM, USFWS, Kane County, ACD, UDWR, DOGM, CoCARM, and SWCA. As the applicant for the lease tract, ACD plays an appropriate role in the stakeholder process because they, or the successful bidder for the lease if it is not ACD, would need to implement the mitigation actions.

In Utah, sage-grouse populations are currently managed by UDWR under the sage-grouse conservation plan (UDWR 2013). The sage-grouse conservation plan reflects sage-grouse recommendations that were provided to the Governor of Utah by a multi-disciplinary group of stakeholders in early 2012. The BLM is currently evaluating an amendment to multiple land use plans under which the sage-grouse conservation plan is one of the action alternatives under consideration. See Section 1.7.1.1 of the SDEIS for a more detailed description of this process. Pursuant to Section 7.3.2 of the sage-grouse conservation plan, the BLM may continue the pending evaluation of the Alton LBA without recourse to the provisions of the plan.

Given the dynamic nature of the current regulatory environment for sage-grouse, the BLM expects that there may continue to be changes in sage-grouse policies and guidance between completion of the mitigation plan and final implementation of mitigation actions. The BLM will consider new information as it becomes available and revise the mitigation plan if appropriate.

3.1. Compliance with the National Environmental Policy Act

The mitigation actions described in this document will be incorporated into the Alton Coal Tract SDEIS as required design features. To maintain compliance with the National Environmental Policy Act (NEPA), the successful lessee must follow the mitigation practices set forth by this plan.

Mitigation projects would be fully compliant with NEPA by the completion of site-specific analyses on all projects prior to any mitigation-related disturbance. Site-specific documents would tier off the Alton Coal Tract LBA EIS to the extent possible. Site-specific analyses would address impacts on other resources and areas from individual mitigation projects. Separating the site-specific documentation for mitigation actions from the Alton Coal Tract LBA EIS is necessary to maintain the flexibility of choosing appropriate mitigation areas after the tract is leased and nearer to the timeframe when mining would begin. It is not appropriate to select specific mitigation projects and specific mitigation areas at this time given the currently shifting nature of sage-grouse management policies and guidelines as described above. If the BLM decides in its ROD to offer the Alton Coal Tract for competitive leasing following completion of the EIS process, the successful bidder would need to complete several other permitting steps (e.g., compliance with the Surface Mining Control and Reclamation Act of 1977) before conducting mining activities on the tract. These permitting steps typically involve detailed field studies and months to years to complete.

Site-specific NEPA analyses have already been completed for vegetation treatment projects near the tract in Kane and Garfield counties. The vegetation treatments conducted as mitigation measures for the tract would likely be similar to those analyzed in the *Upper Kanab Creek Watershed Vegetation Management Project Environmental Assessment* (BLM 2011c) and the *South Canyon Vegetation Enhancement Environmental Assessment* (BLM 2010). Both of these projects involve removal of pinyon-juniper that has in-filled and encroached into all other vegetation types, including ponderosa pine areas, sagebrush/grasslands, and mountain brush communities. The purpose of these projects is to create diverse, healthy age classes of sagebrush, with an understory of desired grasses and forbs. Such sagebrush communities provide quality habitat necessary to maintain sustainable populations of sage-grouse, mule deer, and sagebrush-obligate species. Many of these projects have been completed and are currently used by grouse, as shown in Figure 2 and Figure 3 and as described in Section 3.18.3.4.2 of the SDEIS.

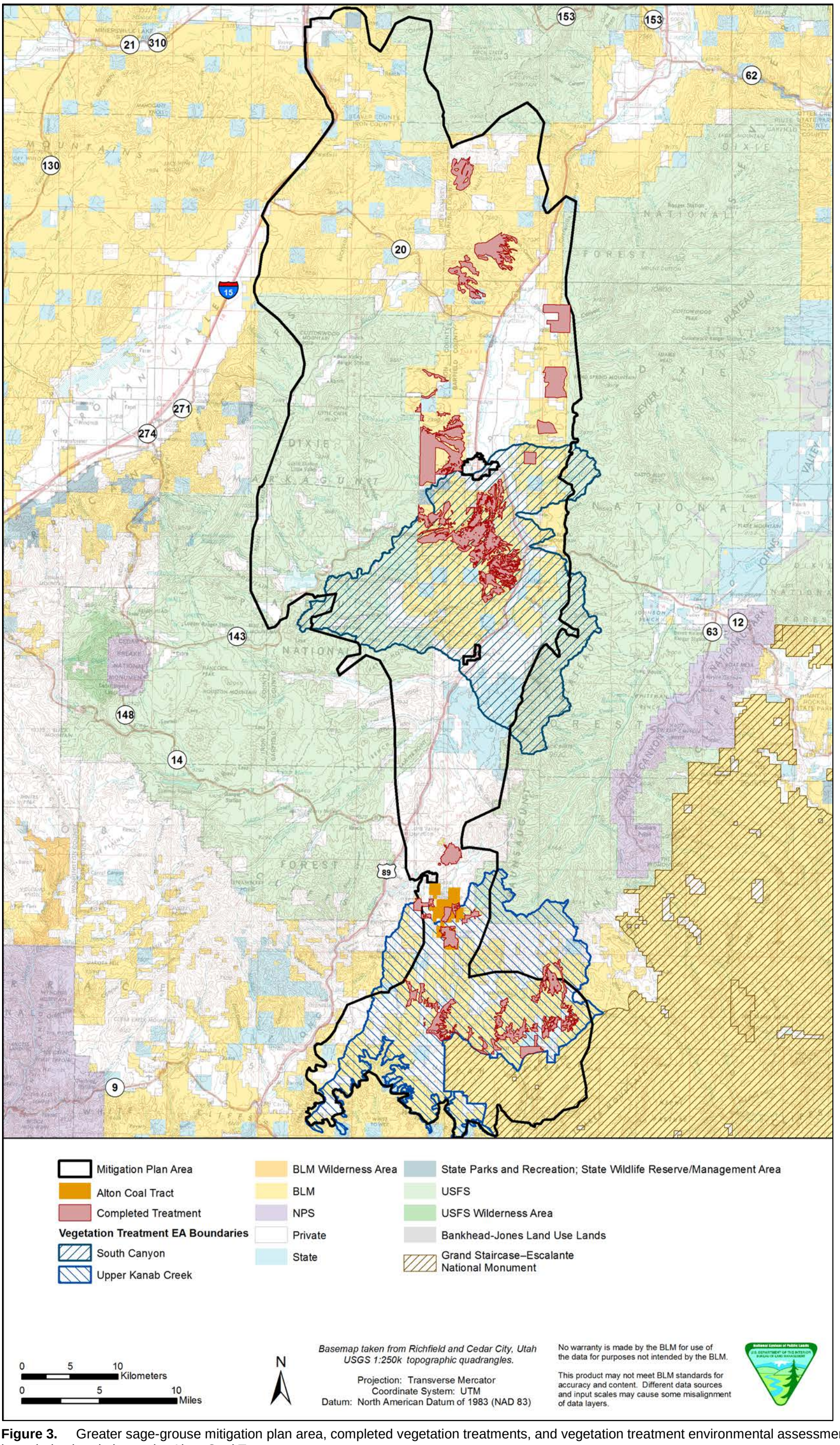

Figure 3. Greater sage-grouse mitigation plan area, completed vegetation treatments, and vegetation treatment environmental assessment boundaries in relation to the Alton Coal Tract.

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However, due to inadequate funding, all potential vegetation treatment projects in these areas would likely be completed over the course of decades. With funding from the selected lessee, projects in these areas could be conducted within a short timeframe and make a large amount of habitat available to local sage-grouse within the timeframe of the life of the mine (which varies under each alternative). Areas covered by these environmental assessments could undergo vegetation treatments immediately, without having to delay the mitigation process for additional analysis and/or permitting.

4. GOALS

The goals of this mitigation plan are as follows:

- Offset habitat impacts of mining the tract, as identified through the EIS process, by implementing habitat management and vegetation treatment projects in the mitigation plan area.
- Identify mitigation opportunities that reduce or remove threats under the five listing factors used by the USFWS to assess the status of ESA-listed and candidate species. A detailed discussion of these factors can be found in *Endangered and Threatened Wildlife and Plants; 12-month Findings for Petitions to List the Greater Sage-grouse (*Centrocercus urophasianus*) as Threatened or Endangered; Proposed Rule* (50 CFR 17, *Federal Register* 75:13910–14014). These factors are as follows:
    - The presence of threatened destruction, modification, or curtailment of habitat or range, including urbanization, energy development, mining, fences, fire, invasive plants, pinyon-juniper encroachment, climate change, and habitat fragmentation
    - Overuse for commercial, recreational, scientific, or educational purposes, including hunting, bird watching, Native American religious use, and scientific studies
    - Disease and predation, including the potential for West Nile virus outbreaks, and increased predation
    - Inadequacy of existing regulatory mechanisms at the local, state, federal, and international levels[1]
    - Other natural or human-made factors affecting the species' continued existence, including pesticides, contaminants, recreational activities, life history traits that may affect viability, and drought.

      The key threats to sage-grouse in the mitigation plan area are increased predator populations, vegetation management (conflicting uses or lack of management), energy development, conifer encroachment, and residential/commercial development (Frey et al. 2006; USFWS 2013), as described in Section 5 of this document.
- Establish potential mitigation project types and locations based on the availability of existing site-specific sage-grouse population information (e.g., lek counts) and ecological condition information (e.g., habitat location and size, opportunity locations, completed vegetation treatment locations). This site-specific information includes data gathered for the adjacent Coal Hollow Mine, which has been in operation since 2010. Monitoring data regarding sage-grouse population and activity have been gathered, and continue to be gathered, in association with this mine. The existing site-specific population information may not be conclusive, but it can be used to help inform project planning.

[1] The findings were published on March 5, 2010. Since that time, regulatory mechanisms have been created to address threats to Greater Sage-Grouse, such as the sage-grouse conservation plan (UDWR 2013); a resolution passed by Kane County, Utah, on April 22, 2013, with the goal to protect, maintain, improve, and enhance Greater Sage-Grouse habitat in Kane County; and BLM's IM No. 2012-043, which was published on December 22, 2011, and ensures that interim conservation policies and procedures are implemented when field offices authorize or carry out activities on public land while the BLM develops and decides how to best incorporate long-term conservation measures for Greater Sage-Grouse into applicable land use plans.

- Ensure the short- and long-term persistence of
    - the current southern-most population of Greater Sage-Grouse across the range of the species, and
    - suitable habitat to support that population.

The mitigation plan area corresponds to the boundaries defined for the sage-grouse analysis area, as described in Section 3.18.3.4 of the SDEIS. The key threats to sage-grouse in the mitigation plan area are increased predator populations, vegetation management (conflicting uses or lack of management), energy development, conifer encroachment, and residential/commercial development (Frey et al. 2006; USFWS 2013).

5. THREATS TO GREATER SAGE-GROUSE

Rangewide, sage-grouse numbers have declined, and they now occupy approximately 56% of their historic range, though the actual decline in sage-grouse numbers since pre-settlement times is unclear because estimates were largely anecdotal before the implementation of systematic surveys in the 1950s (USFWS 2013). In general, population declines are primarily due to the following:

- Habitat loss
- Habitat fragmentation
- Reduced habitat quality from urban expansion
- Habitat loss and fragmentation associated with energy development
- Conversion of habitats to agriculture
- Alteration of habitats by invasive species that reduce habitat quality by reducing herbaceous forage and/or by increasing the frequency and intensity of ground fires (Bosworth 2003; UDWR 2002; UDWR 2005).

The CoCARM local working group identified concentrated wildlife and/or livestock use as another threat in the mitigation plan area due to the high levels of both wildlife and livestock grazing in the mitigation plan area, the contentiousness of the issue, and because the exact extent of these impacts (both negative and beneficial) is not known (Frey et al. 2006). Additionally, conifer encroachment has played a large role in decreasing available sagebrush habitat in the mitigation plan area.

Mining activities on the tract would contribute to sage-grouse habitat loss, habitat fragmentation, and alteration of habitats by invasive species. The species' sagebrush steppe habitats and associated herbaceous understory have already been reduced by improper grazing, invasive plant species, altered fire regimes, pinyon-juniper encroachment, and oil and gas industry expansion (UDWR 2005). Pinyon-juniper woodland encroachment into sagebrush habitats has reduced the quality and quantity of sagebrush stands and contributed to a rangewide decline in sage-grouse abundance (Connelly et al. 2004)—a threat that is locally evident. High predation rates from non-native predators or un-naturally high native predator populations are another specific threat to sage-grouse in this area (Connelly et al. 2004; UDWR 2005). The Alton sage-grouse population has experienced high mortality from predation, with a relatively large number of sage-grouse known to have been killed by predators since 2005 (Curtis and Frey 2007). Increasing predation by non-native predators (domestic pets, red foxes, raccoons) and native ravens is of concern (Frey et al. 2006). In Utah, sage-grouse are present in scattered populations north and west of the Colorado River (UDWR 2002) on approximately 40% of their historic range (Beck et al. 2003).

6. SUMMARY OF FEDERAL ACTION UNDER CONSIDERATION

A detailed description of alternatives can be found in Chapter 2 of the DEIS (BLM 2011a) and the SDEIS (BLM 2014).

6.1. Design Features Incorporated into the Federal Action

The on-tract reclamation, pre-mining vegetation treatment, and mitigation (avoidance) measures incorporated into the federal action are detailed in Section 4.18.2.1.2.1 of the SDEIS.

Note that under Alternative K1, which is analyzed in detail in the SDEIS, Blocks S and NW are excluded from the tract, and therefore these avoidance-based mitigation conditions would not apply under this alternative (though these areas would be available for off-site mitigation actions as appropriate). Likewise, under Alternative C (analyzed in detail in the DEIS and the SDEIS), Block NW is excluded from the tract, and therefore, certain avoidance-based mitigation actions would not apply under this alternative.

7. GREATER SAGE-GROUSE USE OF MITIGATION PLAN AREA AND TRACT

Greater Sage-Grouse use of the mitigation plan area (analysis area) and tract is described in Section 3.18.3 of the SDEIS. Detailed information can be found in the following sections of the SDEIS:

- 3.18.3.1 Regulatory Status
- 3.18.3.2 General Habitat Needs
- 3.18.3.3 Distribution and Threats
- 3.18.3.4 Analysis Area Description (corresponds to mitigation plan area)
    - 3.18.3.4.1 Connectivity and Movement between Leks
    - 3.18.3.4.2 Completed Analysis Area (mitigation plan area) Vegetation Treatments
    - 3.18.3.4.3 Coal Hollow Mining Operation
- 3.18.3.5 Sage-grouse Use of the Tract
    - 3.18.3.5.1 Lek Description
    - 3.18.3.5.2 Counts and Estimate
    - 3.18.3.5.3 Tract and Transportation Route Habitat
        - 3.18.3.5.3.1 Breeding, Nesting, and Brood-rearing Habitat in the Tract
        - 3.18.3.5.3.2 Wintering Habitat in the Tract
        - 3.18.3.5.3.3 Transportation Route Habitat

Figure 4 displays the occupied sage-grouse habitat according to UDWR and the existing vegetation communities that comprise sage-grouse habitat in the tract.

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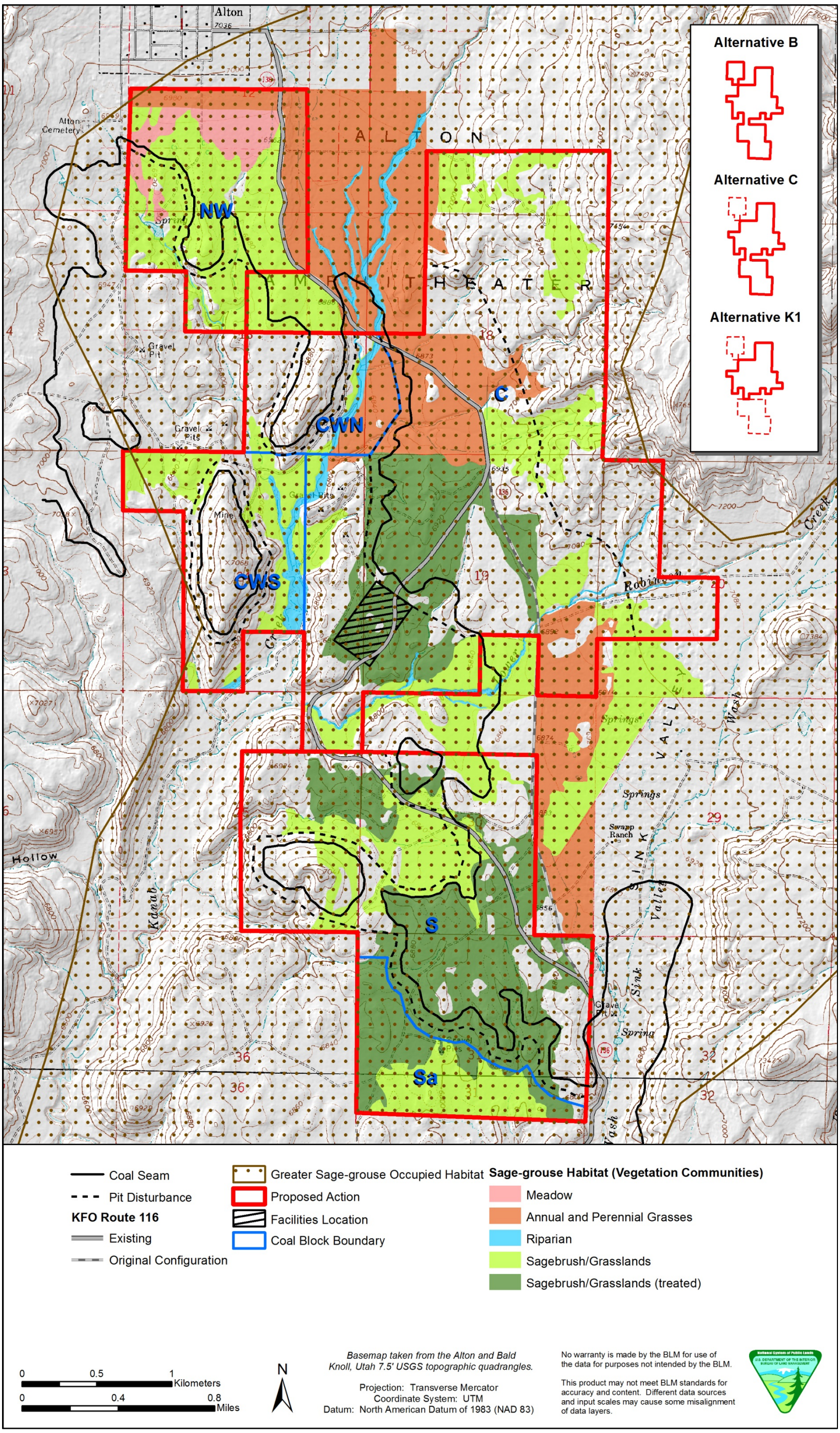

Figure 4. Sage-grouse occupied habitat and vegetation communities on the Alton Coal Tract.

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8. IMPACTS TO GREATER SAGE-GROUSE

Impacts to Greater Sage-Grouse from each alternative is described in Section 4.18.2 of the SDEIS. Detailed impacts analyses can be found in the following sections in the SDEIS:

- 4.18.2.2 Impact Indicators
- 4.18.2.3 Analysis Assumptions
- 4.18.2.4 Impacts Resulting from Mining the Tract
    - 4.18.2.4.1 Alternative A: No Action
    - 4.18.2.4.2 Alternative B: Proposed Action
        - 4.18.2.4.2.1 Habitat Loss and Displacement
        - 4.18.2.4.2.2 Infrastructure Impacts, Including Roads
        - 4.18.2.4.2.3 Noise and Nighttime Lighting Impacts
    - 4.18.2.4.3 Alternative C: Reduced Tract Acreage and Seasonal Restrictions
    - 4.18.2.4.4 Alternative K1: Reduced Tract Acreage
- 4.18.2.5.1 Impacts Resulting from Coal Hauling
    - 4.18.2.5.2 Alternative A: No Action
    - 4.18.2.5.2 Alternative B (Proposed Action), Alternative D (Reduced Tract Acreage and Seasonal Restrictions, and Alternative K1 (Reduced Tract Acreage)

9. PROPOSED MITIGATION PLAN LANDS

As introduced in Section 2 (Purpose), all mitigation actions would be conducted in appropriate habitat in the mitigation plan area (Figure 3). This area is also roughly the Panguitch Core Area in the *Utah Greater Sage-grouse Management Plan* (UDWR 2013), the impacts analysis area for sage-grouse in the SDEIS, and occupied habitat as defined by UDWR (UDWR 2012). The purpose of determining a mitigation plan area is to ensure that mitigation 1) is accomplished in the same area as potential impacts from leasing and mining the Alton Coal Tract and 2) would benefit the impacted sage-grouse population. Mitigation would occur both on and off the tract and could occur on state, federal, and/or private lands, with permission from the owner or manager of the lands where specific mitigation actions would take place.

Many options for habitat improvement projects exist in the tract and the mitigation plan area. Off-tract vegetation treatments to fulfill mitigation requirements would be prioritized in those areas analyzed in the BLM's *South Canyon Vegetation Enhancement Project Environmental Assessment* and *Upper Kanab Creek Watershed Improvement Project Environmental Assessment* (BLM 2010, 2011c).
Areas analyzed in these environmental assessments consist of places where conifer removal could be done from areas with an intact sagebrush understory immediately adjacent to habitat occupied by sage-grouse.

Prioritizing these areas would increase the potential for off-tract vegetation treatments to be successful and useful to the impacted sage-grouse because 1) these areas exhibit classic characteristics of habitat that, when treated, would quickly increase available sage-grouse habitat (Baruch-Mordo et al. 2013; Commons et al. 1999; Frey et al. 2013); and 2) the Panguitch sage-grouse population has been documented to quickly use habitat after juniper elimination, especially in areas adjacent to occupied

habitat, indicating intact sagebrush habitat is limited in the area (Frey et al. 2014). Prioritizing vegetation treatments in these areas would increase the potential for mitigation to benefit local sage-grouse in the short term. However, the best available and most site-specific information would be taken into consideration when choosing exact mitigation project locations to provide the maximum benefit to the impacted birds.

Several habitat improvement projects are already planned for the tract, but have not yet been completed. Several large vegetation treatments have occurred near the tract recently, such as those associated with the Upper Kanab Creek and South Canyon Vegetation Enhancement projects; activities to expedite the recovery of sagebrush into these habitats may benefit sage-grouse. Throughout the area most heavily used by the sage-grouse population, there are extensive stands of pinyon-juniper. Activities to reduce the spatial extent of these stands, especially along the interface between forested and sagebrush-dominated habitats, may benefit sage-grouse. Many areas, especially in habitats that have experienced fire relatively recently, are dominated by invasive annual grasses (e.g., cheatgrass), and a holistic approach to managing the spread and extent of these species may be critical for the long-term maintenance of sagebrush-dominated habitats vital to the sage-grouse population. There are also many locations with potential to enhance grass and forb availability as well as to control for common sage-grouse predators. Some locations for potential projects as well as previously treated areas are presented on Figure 5.

The success of these vegetation treatments would be determined through monitoring conducted by BLM personnel or contractors. Success would not be tied to a requirement that sage-grouse must use the treated habitat; reasons for such are detailed in Section 11.2 below (Success Criteria). Monitoring would consist of nested frequency or other BLM monitoring techniques and photo points. There would be regular monitoring (sage-grouse counts), with annual monitoring of actual use, and trend monitoring every three to five years as staffing and funding permit.

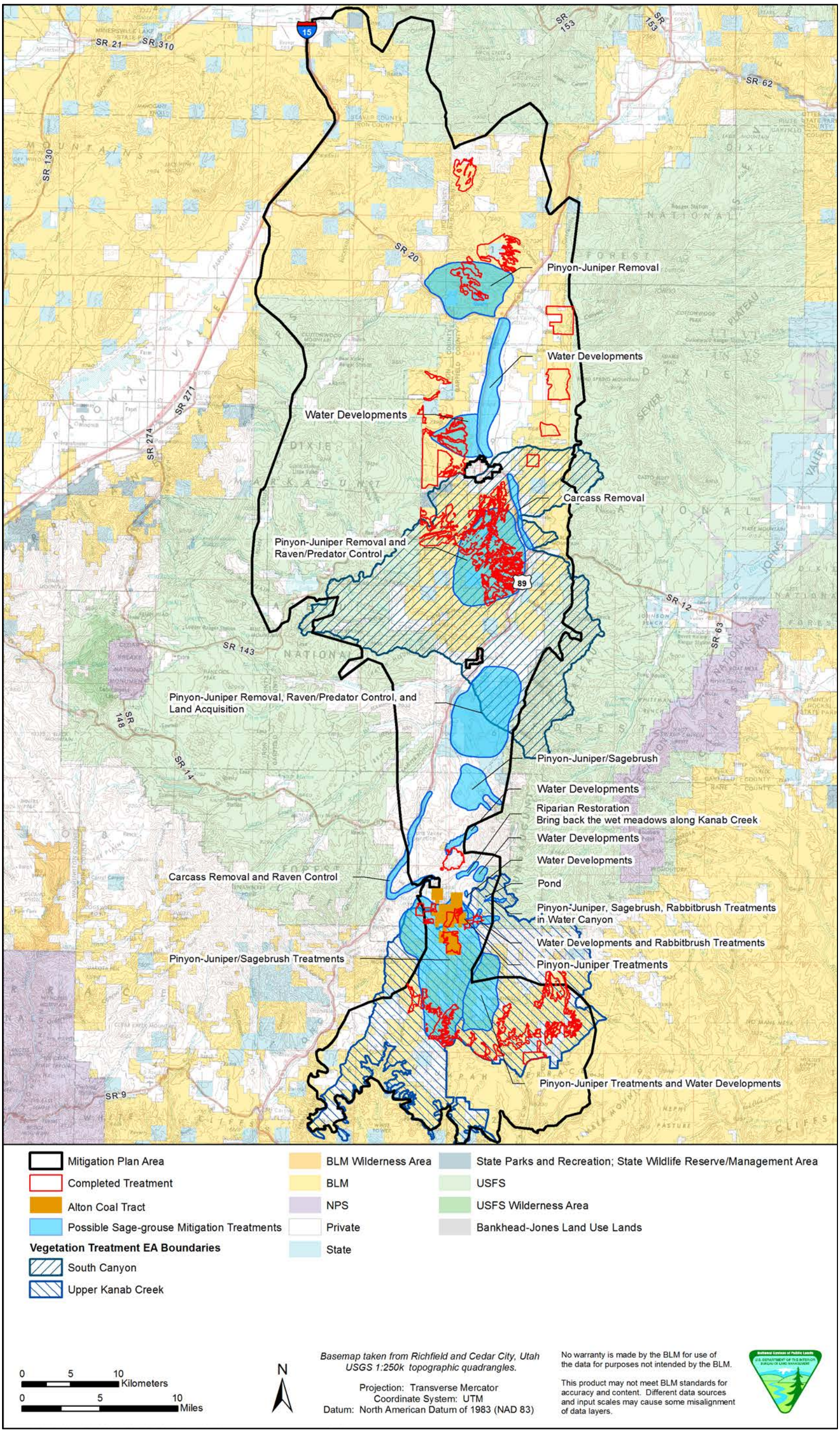

Figure 5. Possible sage-grouse mitigation treatments and previously treated areas in and near the Alton Coal Tract.

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Acres inside the potential mitigation areas (except those identified for carcass removal, raven control, and water developments and excluding the tract under Alternative B) that have not previously been treated are reported in Table 1 as areas that are available for treatment. These areas occur on lands owned/managed by the BLM, USFS, state, and private entities. Additional acres would be available for treatment under Alternatives C and K1 because the tract size would be decreased, and areas directly adjacent to the tract would not be mined at this time. The acreage that has been previously treated consists of the following types of treatments overseen by BLM: aerator/harrow/seed, bull hog, bull hog/seed, burn, crush, lop and scatter, mastication/mow, plow, seed, and thin. Note that the acres available for treatment reported in Table 1 may not all currently be habitat or locations appropriate for vegetation treatment. The acreage displayed in Table 1 is reported to provide context of how much of the mitigation plan area has been treated and whether the mitigation ratio proposed in this plan is feasible.

Table 1. Areas Identified as Having a High Potential for Mitigation, Areas Previously Treated (through 2013), and Total Acreage of Areas Available for Treatment, by Land Ownership

	Potential Mitigation Areas (acres)	Previously Treated (acres)*	Available for Treatment (acres)
BLM	104,538	26,996	77,542
USFS	23,721	2	23,719
State (Utah Department of Natural Resources and School and Institutional Trust Lands Administration)	19,346	1,300	18,046
Private	55,163	1,576	53,578
Total	202,768	29,874	172,885

* Data from BLM (2013).

10. COMPENSATORY MITIGATION PLANNING PROCESS

Under this plan, the avoidance actions listed in Section 4.18.2.1.2 (Design Features) of the SDEIS would be required throughout the life of the mine. The following mitigation planning process applies to compensatory (off-site mitigation) actions, which would be evaluated and implemented continually.

Wildlife populations, management objectives, and the factors affecting them are very dynamic. It is therefore impractical to identify specific compensatory mitigation locations, in advance, for the life of mining activities on the tract. Furthermore, deciding on exact mitigation project locations is not an appropriate action for this phase of the planning process. Exact locations, scopes, and other relevant details of mitigation projects would be chosen at the permitting phase, when more detail is known regarding mining sequences and annual disturbance amounts. This adaptive management component allows decisions to remain flexible as changes occur to the environment, as positive or negative impacts are identified to sage-grouse and habitats, and as relevant studies are published.

The BLM and DOGM (in consultation with UDWR and USFWS) would lead compensatory mitigation planning for the life of the mine to ensure interagency cooperation and coordination of mitigation actions and to ensure compliance with the mitigation plan. The scope of mitigation actions (locations, areas, and nature of vegetation treatments) would be developed based on biological considerations, and agreed to by the BLM, DOGM, and the successful lessee. Other entities that would be kept informed of the intentions and progress of the mitigation projects are local governments, CoCARM, and affected

private landowners where development or mitigation is proposed to occur. Projects would conform to the governing land use plan of the KFO and/or other managers/owners as applicable. Projects would also be consistent with the sage-grouse conservation plan (UDWR 2013), the purpose of which is to provide for the management of sage-grouse in Utah consistent with Utah Code Title 23, which declares wildlife as the property of the state, and with the UDWR goals of expanding wildlife populations and conserving sensitive species. The successful lessee would be responsible for carrying out the approved mitigation, as applicable, and working with the BLM, UDWR, DOGM, and the land manager or owner in implementing appropriate activities. The lessee could either carry out the mitigation using company resources, or provide funding to other entities that would then complete the mitigation actions. The selected lessee would be responsible to fund all aspects of the mitigation projects, including the required NEPA documentation and monitoring.

In addition to supporting development of this plan, BLM and DOGM would have five future plan implementation responsibilities. During the leasing process, BLM would be the lead agency implementing these responsibilities. During project implementation DOGM would become the lead agency implementing these responsibilities. The five future plan implementation responsibilities are as follows:

- Provide guidance to the successful lessee on minimizing, to the extent practicable, impacts associated with planned future mining activities on the tract and complying with lease stipulations.
- Provide potential project types and locations for consideration by the BLM, other entities as applicable, and selected lessee for habitat improvement projects.
- Conduct site-specific NEPA analysis once specific mitigation locations and actions have been chosen.
- Determine when a project is successfully completed and ensure that success is maintained for the specified time period.
- Enforce the mitigation requirements of the mitigation plan as design features, including the requirement that year-round, suitable habitats are continuously available to provide refugia for the sage-grouse population while removal and restoration of other habitat areas are taking place.

Mitigation projects would begin as soon as practicable, which could be before mining activities begin, and would be ongoing throughout the life of the mine until the total mitigation obligation is satisfied. The BLM desires that as many mitigation requirements are completed as early as possible so sage-grouse can benefit from the mitigation actions during mining activities. In this way, the lessee could mitigate for direct impacts before they have occurred. In subsequent years of development, an annual review of the development activities would be conducted, and an annual summary of project activities would be provided. Annual review meetings would be held with representatives from the lessee, BLM, DOGM, UDWR, and USFWS to discuss the success of completed mitigation and for outstanding requirements for mitigation projects to be conducted in the future.[2]

10.1. Mitigation Requirements

This section sets forth mitigation requirements to be carried out by the successful bidder. These requirements were designed to compensate for direct and indirect impacts (as described in Section 4.18.2 of the SDEIS) that may occur to local sage-grouse groups from mining the tract. Habitat impacted would be mitigated for with improvements to like habitat when possible, but such decisions are more

[2] The Office of Surface Mining Reclamation and Enforcement also has an oversight role over DOGM's regulation of coal mining within the state, under the Surface Mining Reclamation and Control Act (30 United States Code 1201 et seq).

appropriately made at the implementation stage through site-specific NEPA analyses. The following would be required as design features for the lessee:

- Vegetation treatments (as well as mesic and riparian habitat enhancement projects) at a ratio of 4:1 per acre of directly surface-disturbed sage-grouse habitat. Research pertaining to and concurrent with the vegetation treatments (e.g., monitoring bird habitat use, sagebrush canopy measurements) is necessary to ensure appropriate and successful treatments. Off-site vegetation treatments would be completed no more than one year after the corresponding on-tract surface disturbance occurs. The exact timing of mitigation projects would be determined at the permitting stage when more detailed knowledge of the mining sequence and level of disturbance is known.
- As a preventative measure, the removal of all fences that occur within 2 miles of the Alton–Sink Valley lek, where practicable.
- Because coal trucks comprise approximately 4% of the traffic on nearby roads, the proponent would be responsible for funding up to 4% of the Utah Department of Transportation's roadkill carcass removal on the coal transportation haul route in coordination with Utah Department of Transportation, DOGM, UDWR, and BLM. Enforcement would be based on a cooperative agreement between these entities.
- A nearby mine approximately half the size of the tract has contracted with U.S. Department of Agriculture (USDA) Wildlife Services to spend approximately $6,000 every five years for local predator control. Under this lease agreement, the selected lessee would provide $12,000[3] every five years to USDA Wildlife Services to fund predator control actions in the mitigation plan area, focusing on corvid species, red fox, and other potential predators.

Assigning ratios to acres of direct impacts to offset project impacts is a common approach used for determining appropriate levels of mitigation, with the understanding that sufficient data must exist to adequately compare the value of ecological services between habitat lost and habitat replaced. Mitigation ratios are applicable to acres of habitat directly impacted, and they are implemented to ensure that indirect impacts to sage-grouse (such as noise, fragmentation, habitat avoidance, and the time-lag before reclamation actions are successful) are appropriately compensated for. A 4:1 ratio was chosen for this project for the following reasons:

1. It is the ratio currently used for mitigation requirements by DOGM for the Coal Hollow permit.
2. It is the ratio that is recommended for mitigation in nesting areas by the sage-grouse conservation plan (UDWR 2013).
3. It is the lowest ratio that would be acceptable according to USFWS.
4. Required reclamation of surface disturbance would take place on the tract in such a way as to create sage-grouse habitat in the long term by decreasing current levels of conifer encroachment. Though reclamation is not considered to be mitigation for the purposes of this plan, reclamation would ultimately benefit sage-grouse.
5. Other actions as described above (e.g., fence marking) would be implemented to mitigate for impacts to sage-grouse in addition to the vegetation treatments to which the 4:1 ratio applies.

It is expected that completion of required mitigation (both vegetation treatments and other actions) in cooperation with other design features (as defined in Section 4.18.2.1.2 of the SDEIS) would produce no net loss of sage-grouse habitat in the short term, and a net benefit to local sage-grouse populations in the

[3] This amount is based on a doubling of the amount that ACD has contracted with USDA Wildlife Services to spend on predator control from 2011 to 2016 as partial mitigation fulfillment for the Coal Hollow permit (see Appendix B of Appendix 3-5 of the *Alton Coal Development Coal Hollow Project Mining and Reclamation Plan* [ACD 2009]).

long term, even with the presence of the coal mining project. This assumption is based in part on documentation of sage-grouse using treated areas immediately after treatment takes place (as described in Section 3.18.3.4.2 of the SDEIS).

UDWR identifies 3,550.8 acres of the tract (99% of the tract and 2.5% of the mitigation plan area) as occupied habitat. This habitat boundary does not represent a survey-grade boundary and is not intended to be the final authority for habitat delineation. The BLM and DOGM would consult with UDWR to determine precise delineation of habitat (as well as exclusion of non-habitat) to determine the exact amount of required mitigation. The exact amount of required mitigation would be determined when the mitigation plan (this document) is finalized by using the most recent and accurate site-specific information, including but not limited to Frey et al. 2013; Frey 2013; Curtis and Frey 2008; Petersen 2007, 2010, 2012, 2013a; and the December 10, 2013 assessment by Dr. Steven Petersen. Table 2 presents the upper limit of required acres of vegetation treatments by alternative using a 4:1 mitigation ratio.

Table 2. Required Acres of Mitigation Vegetation Treatments Based on 4:1 Mitigation Ratio Requirement by Alternative

	Alternative A (No Action)	Alternative B (Proposed Action)	Alternative C	Alternative K1
Occupied habitat	0	7,258.0	6,051.6	3,656.4

Note: Data from this table area based on acres of direct disturbance by alternative, as displayed in Table 1.

As indicated above, reclamation of disturbed lands is considered an action separate from mitigation. Reclamation would be accomplished as a separate permit requirement. However, the mitigative effect of reclamation was taken into consideration when determining the 4:1 mitigation ratio.

11. COMPENSATORY MITIGATION PROJECTS

Habitat improvement actions would target improvements to sage-grouse habitat availability by increasing the spatial extent of available habitats by either creating suitable habitats (restoring burned areas, removing pinyon-juniper in sagebrush-dominated habitats, etc.) or by protecting existing habitats (e.g., reducing threats caused by the spread of invasive annual grasses). Actions to improve habitat quality would focus on management activities that target the herbaceous understory (increasing grass height and cover for nesting females, increasing forb cover and insect density for brooding females, etc.) while maintaining the shrub overstory (Connelly et al. 2000). Treatment for mitigation credit would not apply to areas disturbed by mining activities on the tract (which would be reclaimed consistent with the approved mining plan and design features), but would apply in other pre-existing areas of disturbance and otherwise low-quality habitat. A weed management plan would be drafted and followed for each mitigation project to maintain the desired results of the treatment. Habitat improvement projects could take place on any lands within the mitigation plan area, pending approval of the land surface management agency or owner (in the case of private lands). Treatments conducted as mitigation for the Coal Hollow Mine would not accrue mitigation credit for disturbance associated with the BLM lease.

To effectively manage sage-grouse populations in a proactive manner, habitat improvements must meet two basic requirements:

- Habitat manipulations need to occur in areas where habitat deficiencies exist.
- The type of manipulation needs to result in habitats that are enhanced for the season of interest.

To meet these requirements, off-tract vegetation treatments would be prioritized in areas where conifer removal could be done from areas with an intact sagebrush understory immediately adjacent to habitat occupied by sage-grouse, including those areas analyzed in the BLM's *South Canyon Vegetation Enhancement Project Environmental Assessment and Upper Kanab Creek Watershed Improvement Project Environmental Assessment* (BLM 2010, 2011c). Management planning in these areas revolves around the idea that to enhance sage-grouse populations within a given landscape, the carrying capacity of that landscape needs to be increased.

Success of the on- and off-tract vegetation treatments would not be dependent on whether sage-grouse are documented using the treated habitat; reasons for this are listed in Section 11.2 of this document (Success Criteria).

Several documents outline the steps necessary to implement a successful habitat management program for sagebrush habitats. The Wyoming Game and Fish Department (2011) outlines evaluation criteria that should be considered when proposing vegetation treatments in sagebrush-dominated habitats. Bohne et al. (2007) expand on this list of criteria with sage-grouse-specific recommendations. The criteria described by Bohne et al. include the following:

- Determine if sage-grouse (or other species of interest) seasonal habitats are present, the condition of these habitats, and the relative level of importance of these habitats. In the case of sage-grouse, it is important to know whether the population is resident or migratory when evaluating potential habitats affected by proposed actions.
- Identify how much of the sage-grouse habitat in the area has been previously impacted by fire (prescribed or wild), other habitat conversions, habitat losses, or fragmentation, preferably using a geographic information system–based analysis.
- Determine how much of the area is likely to burn in future wildfire and at what scale (a risk assessment).
- Identify the short-term (1–14 years) effects and the mid-term effects (15–30 years) of prescribed fires or other treatments on vegetation and key wildlife species.
- Assess the presence of undesirable plant species (e.g., cheatgrass, invasive noxious weeds, rabbitbrush, juniper, and other conifer invasion) and the risk of these species increasing under current management and/or as a result of the proposed treatment.
- Determine the likely response of desirable species of vegetation that are present to the type and intensity of treatment being proposed.
- Provide a clear statement of the intended objectives of the prescribed treatment, provide a rational for the treatment, and identify impacts to sage-grouse and other species of interest as part of the management prescription and environmental assessment.
- Establish overall goals along with measurable objectives and an adequate monitoring plan (adequate in terms of funding as well as quantifying the effects of treatment).
- Identify mitigation measures (if any) needed to offset potential adverse impacts on sage-grouse habitat.
- Develop a post-treatment management plan that ensures desired vegetative responses can be achieved and maintained.

11.1. Mitigation Project Types

Five mitigation project types are discussed in detail below: 1) vegetation treatments (including juniper removal, sagebrush restoration, and forb/bunchgrass seeding), 2) increasing natural mesic areas, 3) predator management, 4) fence marking/removal, and 5) other. Conservation easements on private land are another type of mitigation project that can protect sage-grouse habitat. However, they will not be adopted as a requirement because there is no way to enforce such easements on private land. Habitat

treatments on BLM-administered land can be assured protection through conditions requiring avoidance and avoidance through site-specific NEPA analyses. The planning process also provides a means to protect habitat in the long term.

11.1.1. Vegetation Treatment

As stated above, off-tract vegetation treatments would be prioritized in areas where conifer removal could be done from areas with an intact sagebrush understory immediately adjacent to habitat occupied by sage-grouse, such as those areas analyzed in the BLM's *South Canyon Vegetation Enhancement Project Environmental Assessment and Upper Kanab Creek Watershed Improvement Project Environmental Assessment* (BLM 2010, 2011c). However, a range of project types is listed below to provide flexibility to meet the current needs of the population, as assessed by BLM and DOGM at the time of project planning and initiation.

11.1.1.1. JUNIPER REMOVAL

Fire suppression and other post-settlement conditions have allowed juniper (*Juniperus* spp.) trees to spread into areas previously dominated by grasses, forbs, and shrubs. Miller et al. (2005) report that many areas in the west have experienced an estimated 10-fold increase in juniper over the last 130 years. The expansion of juniper and other conifer species reduces habitat for sage-grouse and other sagebrush-obligate species that depend on large patches of sagebrush-dominated vegetation. Sagebrush cover decreases with juniper encroachment as the vegetation transitions into woodland.

Most juniper communities are still in a state of transition. Miller et al. (2005) characterize three stages of woodland succession:

- Phase I (early): Trees are present, but shrubs and forbs are the dominant vegetation that influences ecological processes (hydrologic, nutrient, and energy cycles) on the site.
- Phase II (mid): Trees are co-dominant with shrubs and herbs, and all three vegetation layers influence ecological processes on the site.
- Phase III (late): Trees are the dominant vegetation and the primary plant layer influencing ecological processes on the site.

Sites in Phase I or II successional stages often retain a significant understory of sagebrush (i.e., grasses and forbs); as such, removal of Phase I or II junipers can produce immediate habitat benefits for sage-grouse (Natural Resources Conservation Service 2010).

Juniper/conifer removal projects used for mitigation would focus primarily on the early successive stages of conifer/juniper stands (i.e., Phase I or Phase II juniper) with no cheatgrass component. Removal of juniper/conifer would be done by mechanical means, without the use of chemicals, as follows:

- Phase I juniper/conifer could be treated by having a field crew walk from tree to tree, cutting them into pieces, and scattering them on-site (lop and scatter).
- Phase I or II juniper/conifers could also be removed by being mechanically plucked out of the ground, gathered, and burned.
- Phase II juniper/conifer could be treated using a masticator, a large mechanical device that goes from tree to tree and demolishes the tree with whirling blades; debris is then left on-site (mastication).
- Phase II or III juniper/conifers could be chained.

Some juniper/conifer removal projects would include some level of understory treatment, where needed, and vegetation monitoring until the understory vegetation is established. Locations, methods of treatment,

and understory treatment of removal projects would be approved by the BLM and DOGM so that each treatment site would provide value to the local sage-grouse population.

11.1.1.2. SAGEBRUSH RESTORATION

Sagebrush restoration creates new habitat for sage-grouse and can be used to create corridors between existing patches of sagebrush to produce larger patches of contiguous habitat. Habitat for sage-grouse consists of a mosaic of vegetation communities dominated by sagebrush and a diverse grass and forb understory across the landscape (UDWR 2009). This mitigation project type increases the quality and quantity of habitat within the landscape, contributing to the long-term survival and success of the sage-grouse.

It is important to note that the successful restoration of disturbed areas can be difficult due to alteration of vegetation, nutrient cycles, topsoils, and living (cryptobiotic) soil crusts exceeding recovery thresholds (Sage-grouse Conservation Objectives Team 2012). Furthermore, sagebrush restoration can be very expensive, require a very long time, and involve complicated landowner/manager partnerships.

New habitat for sage-grouse would be created by augmenting the forage and class diversity of existing dense sagebrush stands and increasing the diversity of understory grasses and forbs in disturbed areas (e.g., roads, un-reclaimed pipeline corridors, and burned areas). Sagebrush restoration projects would include understory (grass and forb) treatments.

Where possible, projects would be placed strategically to decrease habitat fragmentation by connecting existing occupied habitats. All treatments would include the implementation of monitoring to ensure success. Criteria specific to each project and in addition to that defined in this plan that define *restoration* and *success* would be developed by the administrative agency (i.e., the landowner, or private, state, or federal management agency).

11.1.1.3. FORB AND BUNCHGRASS SEEDING

Bunchgrasses, as opposed to rhizomatous grasses, are recognized as an important component of sage-grouse nesting and brood-rearing habitats (Connelly et al. 2000; Crawford et al. 2004). The structure and abundance of bunchgrasses influence the quality of a sagebrush/bunchgrass community site for nesting sage-grouse. Residual grass in nesting habitats improves hatching success by providing cover for incubating females (Cagney et al. 2009). Herbaceous cover may provide scent, visual, and physical barriers to potential predators (DeLong et al. 1995, as cited in Connelly et al. 2000). In addition to providing cover from predators, forbs are an important food source for sage-grouse broods.

Sage-grouse nesting and brood-rearing habitat is improved by seeding native bunchgrasses and forbs into existing sagebrush stands or into adjacent disturbance, thereby increasing nest and brood success. This is most effective when combined with treating dense sagebrush stands or by brush-beating in strips or patches and inter-seeding with native grasses and forbs (Connelly et al. 2000); however, depending on the specific location of the project, sagebrush stand treatment may not be necessary to complete this treatment type. Understory seeding project sites would be selected by the BLM and DOGM in coordination with the lessee to maximize the benefit of these projects for sage-grouse. Objectives for these projects and criteria for success would be developed in coordination with the BLM. Seed mixtures would be approved by the BLM and UDWR and would be specific to the project site. Domestic animals would be excluded from grazing on the site for a minimum of two years or until the seeds become established. Any sagebrush removal or thinning would be carefully considered and applied at small scales to ensure mature sagebrush stands are still available for sage-grouse using the area for nesting, brood-rearing, and wintering habitats. Under no circumstances would substantial sagebrush stands be treated.

11.1.2. Mesic and Riparian Habitat Improvements

Although the emphasis of the mitigation plan would be on increasing and improving sagebrush habitat, increasing mesic and riparian habitat could also help the sage-grouse population. Sage-grouse have been documented travelling to mesic areas during the peak of the summer, likely following the availability of forbs provided by wet soils. Forbs are an important source of food for pre-laying hens (spring) and juveniles (Connelly et al. 2004), and they often provide increased cover and insect availability. Lack of mesic areas has not been identified as a limiting factor for the local sage-grouse population. However, developing a water source to create wet meadow, or mesic, habitat or to increase the productivity of riparian habitat and increase availability of forbs could benefit the grouse of the Panguitch population. Target features of this type of habitat improvement would include creating areas with saturated soils and little standing water to increase forb production. This project type would not include the installation of guzzlers.

Riparian habitat improvement projects could center on improving access to existing streams by stabilizing and reclaiming existing streambanks or enhancing existing riparian habitat. The Sevier River, Virgin River, and other perennial water in the mitigation plan area are important to sage-grouse. Many of these waters are in poor shape, with little bank vegetation and erosion. An example of a current stream restoration project is the Upper Sevier River Community Watershed Project, which is a collaborative partnership addressing restoration needs (Upper Sevier River Community Watershed Project 2013). More precise information would be needed to identify areas of perennial waters in the mitigation plan area that are in need of improvement. This precise information would be obtained at the implementation stage through site-specific NEPA analyses.

11.1.3. Predator Management

Primary predators for sage-grouse include a combination of raptors (hawks, eagles, owls), corvids (ravens and crows), and mammals (coyotes, raccoons, bobcats, foxes, weasels) that influence nest success, juvenile survival, and adult survival (Schroeder and Baydack 2001).

Potential predator management tactics include (but are not limited to) the following:

- Remove predators in coordination with USDA Wildlife Services through trapping or poisoning eggs.
- Remove roadkill carcasses from quality sage-grouse habitat to reduce their potential to attract raptors and corvids to the area.
- Increase public safety and awareness in areas of high roadkill to reduce the amount of carcasses needing removal.
- Limit existing perch sites and/or reduce perch sites related to mining activities. This will reduce sites from which raptors might hunt sage-grouse by perch-and-pounce methods.
- Install perch deterrents on mining infrastructure.

These tactics may take place concurrently with any of the mitigation project types discussed in this section or as an activity in and of itself.

11.1.4. Fence Marking and Removal

Based on Christiansen (2009), it has been demonstrated that unmarked fences near an active lek can kill a high number of sage-grouse due to fence strikes. This threat can be eliminated by removing fences or can be significantly reduced by increasing the visibility of fences. Christiansen (2009) estimated a 70%

reduction in mortalities could be expected along marked sections of fence. Stevens (2011) similarly predicted that marking fences with vinyl reflectors (flight diverters) reduced collision rates by up to 74%.

To eliminate the threat of collisions, fences would be removed, marked with flight diverters, or equipped with extra stays similar to those used in the Christiansen (2009), Wolfe et al. (2007), and Stevens (2011) studies to increase fence visibility to sage-grouse. Fences would be removed where possible, although some fence sections are necessary to define range allotment and property boundaries. Where removal is not possible, flight diverters would be installed between each fence span (on the top wire, markers would be 2 feet from the post with 4-foot spacing for each subsequent marker; on the third wire, markers would be 4 feet from the post with 4-foot spacing for each subsequent marker). Priority areas for fence removal and marking would be as follows:

- Sections of fence known to cause sage-grouse collisions
- Fences within 1.2 miles of leks (Braun 2006; Stevens 2011) or other high risk areas
- Fences in areas with low slope and terrain ruggedness (Stevens 2011)
- Fence segments bounded by steel t-posts with spans greater than approximately 13 feet (4 meters; Stevens 2011)

If fences have been a substantial source of mortality, once they have been removed or marked, local and annual mortality due to fence collisions would be substantially reduced.

11.1.5. Other

Other treatment types may effectively mitigate removed or degraded sage-grouse habitat, and they would be evaluated by the BLM and DOGM on a case-by-case basis. Some examples of other treatment types include (but are not limited to) the following:

- Controlling the spread of rabbitbrush habitats
- Treating even-aged or old stands of sagebrush to decrease canopy cover so that they more closely represent nesting, brooding, or wintering habitats
- Increasing the age and class diversity of local sagebrush stands
- Requiring that companies increase employee awareness of the presence of sage-grouse and special treatment of sage-grouse habitat through training and education
- Lowering the speed limits on roads in, adjacent to, or in between sage-grouse habitats

11.2. Success Criteria

Success criteria would be based on creating functioning sage-grouse habitat. Documented use by sage-grouse of the mitigation project would aid in determining success, but would not be required for a successful project. Standards for success of mitigation projects and the statistically valid sampling techniques for measuring success would reflect DOGM's standards of reclamation success, as identified in DOGM's *Vegetation Information Guidelines*, Appendix A (DOGM 1992). Standards for mitigation project success would be based on a comparison of a local reference area of known high-quality sage-grouse habitat with the mitigation project area. The purpose of the comparison would be to evaluate and compare the appropriate vegetation parameters of ground cover, shrub density, frequency, and diversity. Sample adequacy would be determined by the methods outlined in DOGM's *Vegetation Information Guidelines*, Appendix A (DOGM 1992). Methods to be employed to determine that success has been met are presented in Table 3.

Table 3. Methods for Comparison between Project and Reference Areas to Determine Success

Cover	Ocular method by square meter quadrats
Shrub density	Point-quarter method and/or belt transects
Frequency	Relative number of times a certain species occurred in the square meter quadrats
Diversity	Diversity will be measured by several methods. The average number of vascular species per square meter quadrat will be obtained by summing the frequency of all species in an area and dividing by 100. Another diversity measurement will be species richness or simply the total number of species encountered in the quadrats for each area. Finally, total diversity will be measured using the MacArthur and Wilson's (1967) formula, where the proportion of the sum frequency of each species of an area is calculated. The proportion of each species will be squared and the values for all species in the area will be summed. This index integrates the number of species encountered and the degree to which frequency of occurrence is equitably distributed among those species. The formula is represented as $$\text{Total Diversity} = \frac{1}{\sum P_i^2}$$ Where P_i = the proportion of the sum frequency for a community contributed by the ith species.

These parameters would be considered equal to the approved success standard when they are not less than 90% of the success standard. The sampling techniques for measuring success will use a 90% statistical confidence interval (i.e., one-sided test with a 0.10 alpha error).

Success of the on- and off-tract vegetation treatments would not be dependent on whether sage-grouse are documented using the treated habitat. Use is not required for two reasons:

1. It is highly likely that treatments would be successful because of the requirement (as listed above) to prioritize off-tract vegetation treatments in areas where conifer removal can be done from an intact sagebrush understory immediately adjacent to habitat occupied by sage-grouse, such as those areas analyzed in the BLM's *South Canyon Vegetation Enhancement Project Environmental Assessment* and *Upper Kanab Creek Watershed Improvement Project Environmental Assessment* (BLM 2010, 2011c). Vegetation treatments meeting this requirement are highly likely to quickly increase the availability of sage-grouse habitat (Commons et al. 1999; Baruch-Mordo et al. 2013).
2. Unpredictable environmental events, such as extreme drought or very harsh winter conditions, may preclude grouse individuals from using certain habitat, even if it meets all biological needs. It is unfair to hold the selected lessee to a success criterion that may be out of its control.

There is a risk that the habitat improvement project may not meet success criteria; the lessee would contribute a fixed amount of funding based on the average habitat treatment failure rates that would either be used toward achieving project success or carrying out a replacement project. Thus, to compensate for average habitat treatment failure rates, mitigation ratios could be increased (e.g., 4.3:1 or 4.6:1).

11.3. Project Maintenance

All mitigation project sites would be maintained to comply with the established success criteria by the lessee for either the life of the mine or a 10-year bond release period, whichever is greater.

12. GREATER SAGE-GROUSE MONITORING

Monitoring the success of mitigation measures to ensure continued success is an important element of the mitigation plan. Monitoring activities would be tied to the mining permit, funded by the selected lessee, and would be led by the administrative agency.

The final monitoring approach for each mitigation project would be formalized in a monitoring strategy that would be reviewed annually, or as necessary, by the administrative agency in coordination with the lessee and with the involvement of DOGM, BLM, UDWR, and USFWS. Potential monitoring protocols include spotlighting, aerial surveys, pellet group counts (density based), noise monitoring relative to the various sage-grouse habitats during coal operations, and lek and brood counts at different sites at the same time. Monitoring protocols and duration would vary for each mitigation project type, and should be timed to appropriately sample the targeted life phase of sage-grouse (lekking, nesting, brood rearing, wintering). The success of each weed management plan would also be monitored on each mitigation project site.

Results of monitoring would be provided to the BLM, DOGM, UDWR, and USFWS for an annual evaluation. A report summarizing project activities and monitoring results would be prepared (funded by the selected lessee) on an annual basis to inform the annual review. The review should continue until all mitigation is deemed to be successfully completed. The monitoring strategy would also include success criteria for each project and project type. Specific success criteria would be developed prior to initiating these actions. Procedures for implementing additional habitat treatments in the event that monitoring detects a failure to meet prescribed objectives or success criteria would be necessary. The anticipated duration and costs for these procedures would be established by the BLM, UDWR, DOGM, and the lessee. The monitoring would be conducted by the BLM, DOGM, or a third-party contractor that is selected by the BLM or DOGM. The lessee would coordinate with the BLM and UDWR to contribute funding toward monitoring the habitat improvement project for three years after its implementation, though the exact timeframe would depend on the project type and monitoring protocols in place.

13. ANTICIPATED RESULTS FROM ENFORCEMENT OF PRE-MINING VEGETATION TREATMENT, RECLAMATION, AND ON- AND OFF-TRACT MITIGATION MEASURES

The required pre-mining vegetation treatment, reclamation, and mitigation measures, as detailed in the SDEIS (Section 4.18.2.1.2.1), listed in the design features, and listed in this plan, comply with the IM 2012-043 requirement to "cumulatively maintain and enhance Greater Sage-grouse habitat" by instituting the following requirements:

- Avoiding habitat through the designation of limited-touch areas in sagebrush habitats in the tract (see Figure 2)
- Before mining activities, conducting vegetation treatment on Block Sa (comprising 186.3 acres) to reduce conifer encroachment
- Requiring that Blocks S and NW not be mined simultaneously so one would provide a refuge while the other is experiencing disturbances due to mining
- Reclaiming in-tract sagebrush habitats to vegetation standards that would provide sage-grouse habitat in the long term
- Ensuring a 4:1 ratio of mitigation acres to disturbance acres to increase available habitat in the analysis area in the short term
- Prioritizing off-tract vegetation treatments in areas where conifer removal can be done from an intact sagebrush understory immediately adjacent to habitat occupied by sage-grouse, such as those areas analyzed in the BLM's *South Canyon Vegetation Enhancement Project*

Environmental Assessment and *Upper Kanab Creek Watershed Improvement Project Environmental Assessment* (BLM 2010, 2011c; see Figures 3 and 5)

- Requiring that off-tract vegetation treatment mitigation projects intended to comply with the 4:1 mitigation ratio are completed no more than one year after the corresponding on-tract surface disturbance occurs

The anticipated results from the combined pre-mining vegetation treatment, reclamation, and mitigation actions are based on observations from previously conducted telemetry observations, reclamation projects, and vegetation treatments in the KFO, as described in Section 3.18.3 of the SDEIS. These observations indicate the following:

1. Sage-grouse would occupy vegetation treatment areas, consisting of juniper removal from an intact sagebrush understory (both on- and off-tract), shortly after completion of the vegetation treatment, and in many cases within the following year (Frey 2013; Frey et al. 2014), especially when the treated areas are adjacent to already occupied habitat. Use by sage-grouse of previously completed vegetation treatments is described in detail in Section 3.18.3.4.2.
2. An analysis of habitat use from telemetry data collected from 2005 to 2009 documented birds using both Blocks NW and S year-round (Frey et al. 2013), indicating that Block NW could serve as a refuge while mining activities are conducted on Block S, and vice versa.
3. Successfully reclaimed areas would function as sage-grouse habitat within approximately 15–20 years from the date of completion (Petersen 2013b).
4. Off-tract vegetation treatments would enhance habitat availability and connectivity in the long term, thereby contributing to the genetic resilience of the population.

It is anticipated that sage-grouse would continue to use the limited-touch areas of the tract, Block Sa, and habitat adjacent to but outside of the tract while mining takes place. Pre-mining vegetation treatment of Block Sa would create an initial increase in available habitat. Because sage-grouse currently use the habitat of both Blocks NW and S year-round, it is anticipated that Block NW would serve as a refuge and be used by grouse year-round while portions of Block S are experiencing mine-related disturbances, and vice versa. As the vegetation in reclaimed areas becomes established and begins to resemble sage-grouse habitat, individuals are expected to use these parcels. Successful reclamation would represent an increase in available habitat for the species in the long term because many of these areas are currently degraded and under-used by sage-grouse due to juniper encroachment. And finally, the requirement for off-site vegetation treatments at a ratio of 4 acres for every 1 acre disturbed would increase available habitat for the Panguitch population as a whole, as well as increase connectivity and genetic flow among the population breeding groups. The requirement that the off-site projects are completed no more than one year following the corresponding disturbance in combination with the initial increase in available habitat from treating Block Sa would ensure that the amount of available habitat is maintained throughout the life of the mine.

Compliance with these requirements would ensure there would be no net loss of habitat for Greater Sage-Grouse, and would lead to a net increase of available habitat for the population as a whole in both the short and long term. Many of the locations that would be enhanced, reclaimed, and treated may not otherwise be completed without the funding made available by mining activities. In the long term, the enhanced habitats of the tract, mined areas reclaimed to sagebrush, and increased availability of habitat population-wide would further BLM's objectives of maintaining and enhancing habitat for Greater Sage-Grouse, and would thereby aid in the stabilization or increase of the Panguitch population. The ability to increase habitat availability and connectivity between breeding groups would increase the health and resiliency of the group breeding near the tract, as well as increase the capacity for the population as a whole to increase.

14. SUMMARY

This plan outlines the ways in which the successful lessee of the Alton Coal Tract would commit to off-set potential impacts to local populations of sage-grouse from mining activities on the tract. If the BLM's decision following the EIS process is to offer the tract for competitive leasing, the requirements of this mitigation plan would be incorporated as design features appropriate to the alternative selected. Mitigation activities would occur both on and off the tract, but within the mitigation plan area, as defined in Figure 1. The mitigation planning process is intended to be adaptive. The mitigation requirements (listed in Section 10.1) would be accomplished with coordination from the BLM and DOGM. Success and maintenance of mitigation projects would be determined by the BLM and DOGM.

Avoidance measures are described in the project summary, and would reduce impacts to sage-grouse during mining by restricting operations in certain areas and during certain critical times of the year. Compensatory actions (i.e., habitat improvement projects) would be conducted in the mitigation plan area and would consist of 1) vegetation treatments (consisting of juniper removal, sagebrush restoration, and forb/bunchgrass seeding), 2) mesic and riparian habitat improvements, 3) predator management, 4) fence marking/removal, or 5) other. Monitoring sage-grouse use of the mitigation project area would be incorporated into each mitigation project to evaluate success.

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Attachment A.

Alton Coal Tract Lease by Application (LBA) Greater Sage-Grouse Mitigation Plan
Effects on Non-wildlife Resources Analyzed in the SDEIS

INTRODUCTION

The *Alton Coal Tract LBA Greater Sage-grouse Mitigation Plan* (sage-grouse mitigation plan) was developed to enhance and protect Greater Sage-Grouse habitat that would be threatened or disturbed by the action alternatives analyzed in the SDEIS (see Section 1 Introduction of sage-grouse mitigation plan). However, implementation of the sage-grouse mitigation plan would also have effects on other, non-wildlife resources that are analyzed in the SDEIS. These resources include vegetation, livestock grazing, fire management, soils, recreation, visual resources, and cultural resources. The potential effects would primarily result from the vegetation treatments required under the sage-grouse management plan.

SAGE-GROUSE MITIGATION PLAN REQUIREMENTS

The sage-grouse mitigation plan would require the following as design features for the lessee:

- Vegetation treatments (as well as water availability/riparian habitat improvement projects) at a ratio of 4:1 per acre of directly disturbed sage-grouse habitat. Research pertaining to and concurrent with the vegetation treatments (e.g., monitoring bird habitat use, sagebrush canopy measurements) is necessary to ensure appropriate and successful treatments.
- The marking or removal of all fences that occur within 2 miles of the Alton–Sink Valley lek.
- Because coal trucks comprise approximately 4% of the traffic on nearby roads, the proponent would be responsible for funding 4% of the Utah Department of Transportation's roadkill carcass removal on the coal transportation haul route.
- $12,000 will be provided every five years to fund predator control actions in the mitigation plan area, focusing on corvid species and red fox. This amount is based on a doubling of the amount that ACD, LLC has contracted with USDA Wildlife Services to spend on predator control from 2011 to 2016 as partial mitigation fulfillment for the Coal Hollow permit (Appendix B of Appendix 3-5 of the *ACD Coal Hollow Mining and Reclamation Plan* [ACD 2009]).

Section 11 (Compensatory Mitigation Projects) of the sage-grouse mitigation plan provides more details about the required mitigation measures.

The sage-grouse mitigation plan's 4:1 mitigation ratio would require that for every 1 acre of sage-grouse habitat that is disturbed, at least 4 acres of habitat would have to be created or enhanced in the mitigation plan area (see Figure 1). Sage-grouse habitat generally encompasses the sagebrush/grassland, sagebrush/grassland (treated), and rabbitbrush vegetation communities, but sage-grouse have also been known to use meadow, riparian, and annual and perennial grasses vegetation communities.

The alternatives analyzed in the SDEIS would result in varying levels of vegetation treatments being required under the sage-grouse mitigation plan. Under the Proposed Action, approximately 4,612–7,258 acres of sage-grouse habitat in the mitigation plan area would be enhanced through vegetation treatments required by the sage-grouse mitigation plan. Under Alternative C, approximately 3,464–6,052 acres of sage-grouse habitat would be enhanced through vegetation treatments. Under Alternative K1, approximately 1,943–3,656 acres of sage-grouse habitat would be enhanced through vegetation treatments. The effects that these vegetation treatments would have on vegetation, livestock grazing, fire management, cultural resources, visual resources, water resources, and soils in the tract are discussed below.

AFFECTED ENVIRONMENT

The sage-grouse mitigation plan area corresponds to the Panguitch SGMA, an approximately 607,210-acre area that encompasses the approximately 3,577-acre tract. The tract is in Kane County, Utah, approximately 0.10 mile south of the town of Alton and 2.9 miles east of U.S. Highway 89 (US-89). The tract occurs at approximately 6,900 feet above sea level in the semiarid foothills of the Colorado Plateau Semidesert Province (Woods et al. 2001) of south-central Utah. The tract is in the Alton Amphitheater between the Paunsaugunt Plateau to the northeast, Long Valley (Virgin River) to the west, and approximately 5.0 miles north and northwest of the Grand Staircase-Escalante National Monument. Mean annual precipitation in the town of Alton was approximately 16 inches from 1928 to 2006, and mean annual temperature for this same time period was 60.2 degrees Fahrenheit (F) (Western Regional Climate Center 2006). The Colorado Plateau Province receives most of its precipitation in the form of snow during the winter months; summers are generally hot and dry with a mid- to late-summer monsoon period when frequent thunderstorms occur (2006). The tract is characterized by a series of low-rising hills and benches cut by the north-south-running Kanab Creek and by long diagonal washes that flow from the surrounding mountain ranges. Vegetation in the tract is typical of the Great Basin and includes large open areas of bunchgrass, perennial grasses, and sagebrush interspersed with dense stands of juniper and pinyon pine. Tall fir trees are apparent on the more rugged mountains to the northwest of the tract. Generally, the vegetation cover is continuous across most of the tract, broken by two-track dirt roads and fence lines. A map of the tract in relation to surrounding towns, highways, existing and potential fee coal areas, and other area landmarks is presented in Map 1.1 of the SDEIS (BLM 2014).

Vegetation communities on the tract are typical of what is found in the surrounding Colorado Plateau region, namely pinyon-juniper woodlands, sagebrush shrublands, and mountain brush communities. Vegetation on public lands in the tract is managed by the BLM in accordance with the KFO RMP (BLM 2008). Vegetation treatment and management on public lands provide measures to maintain or improve the overall health of vegetation communities (BLM 2008). Specific management for vegetation targets forests and woodlands, uplands, and riparian and wetland communities through implementation of controls on noxious and invasive weed species and application of *Standards for Rangeland Health and Guidelines for Grazing Management on BLM Lands in Utah* (BLM 1997). Vegetation treatments consist of prescribed fire, mechanical, chemical and biological treatments, woodland product removal, and wildland fire. See Sections 3.15 and 3.5 of the SDEIS for more information about vegetation and fire management, respectively, in the tract.

Livestock grazing in the tract is administered by the BLM in accordance with the *Standards for Rangeland Health and Guidelines for Grazing Management on BLM Lands in Utah* (BLM 1997). These standards and guidelines were instituted for all Utah rangelands and are based on ecological principles that underlie the sustainable production of rangeland resources. Seven grazing allotments encompass 2,143 acres of the tract; two occur completely within the tract and five occur partially within the tract. See Section 3.9 of the SDEIS for more information about livestock grazing in the tract.

Information about cultural resources, visual resources, and soils in the tract can be found in Sections 3.4, 3.2, and 3.13 of the SDEIS, respectively.

ENVIRONMENTAL CONSEQUENCES

Vegetation

The Proposed Action, Alternative C, and Alternative K1 would disturb approximately 1,975 acres, 1,650 acres, and 1,005 acres of vegetation, respectively. All of these disturbed acres would be revegetated according to required reclamation standards. Specific revegetation plans, including target communities for restoration, would be implemented by the lessee in accordance with guidance from the BLM and DOGM. Wetland revegetation plans would have to be made in accordance with U.S. Army Corps of Engineers guidelines and mitigation requirements.

Under the Proposed Action, in addition to the 1,975 acres of reclaimed vegetation, approximately 4,612–7,258 acres of sage-grouse habitat in the mitigation plan area would be enhanced through vegetation treatments required by the sage-grouse mitigation plan. Under Alternative C, in addition to the 1,650 acres of reclaimed vegetation, approximately 3,464–6,052 acres of sage-grouse habitat would be enhanced through vegetation treatments. Under Alternative K1, in addition to the 1,005 acres of reclaimed vegetation, approximately 1,943–3,656 acres of sage-grouse habitat would be enhanced through vegetation treatments.

Livestock Grazing

The potential effects that the sage-grouse management plan would have on livestock grazing are related to the plan's effects on vegetation. Because livestock graze in many of the same vegetation communities that sage-grouse use as habitat, the vegetation treatments required by the sage-grouse mitigation plan would also benefit livestock grazing in the tract. The total acres of vegetation reclamation, as well as acres of vegetation treatments required by the sage-grouse mitigation plan, under each alternative are listed above in the Vegetation section.

Fire Management

All acres of vegetation that would be disturbed by the Proposed Action, Alternative C, or Alternative K1 would be revegetated with suitable native and non-native species according to required reclamation standard. These reclamation requirements would suppress invasive annual grasses such as cheatgrass. This could lead to an improved fire regime conditions class (FRCC) rating on the revegetated areas due to the suppression of cheatgrass and the return of the vegetation community to one with a fire regime of less frequent and lower intensity fires. The additional acres of vegetation treatments required by the sage-grouse management plan would also help suppress invasive species and possibly lead to an improved FRCC rating on the revegetated areas. The total acres of vegetation reclamation under each alternative, as well as acres of vegetation treatments required by the sage-grouse mitigation plan, are listed above in the Vegetation section.

Soils

Most soils in the proposed vegetation treatment areas are suitable for the treatment activities designated for pinyon/juniper treatment, sagebrush treatment, and retreatment. Many of the soil types found in the watershed will and likely did support a wider community of grasses and forbs, with pinyon/juniper as a smaller component of the vegetation community. Removal of pinyon/juniper would allow perennial grasses and forbs to return to the site, adding stability to the soil layers and reducing upland erosion.

Where soils are more susceptible to erosion, care would be taken to reduce long-term exposure of the soil surface. This impact would be minimized by planting native and non-native species and leaving "mulch, on-site.

Disturbance to biological crusts from treatment methods may impact existing cryptobiotic communities, but would not impact them any more than may have already occurred from past disturbance activities (grazing, previous land management, wildlife use, etc.).

Recreation

Current recreation uses and opportunities include dispersed activities such as hunting, sightseeing, driving for pleasure, accessing canyons for scenic photography or canyoneering, studying nature, photographing wildlife, and hiking/backpacking/camping. These activities could be temporarily disrupted or displaced during actual vegetation treatments. In the short term, post-treatment areas could become less or more attractive to the recreating public, depending on the nature of their activities and their preferred settings. For instance, creating more open areas could enhance wildlife viewing opportunities, but it could also discourage photographers in search of totally natural-appearing, unaltered landscapes. As native vegetation becomes reestablished on treatment areas, those sites will also probably attract some recreation activities while discouraging others, due to the altered vegetative cover, scenery, naturalness, and use by wildlife species.

Visual Resources

The proposed vegetation treatments would be designed to mimic natural-appearing edges between vegetation types and to resemble natural openings and clearings in the vegetation patterns such that contrasts in form, line, color, and texture would be avoided or minimized to meet VRM objectives. If heavy equipment is used to implement treatments, its presence could create visual contrasts, but these would be short term.

In the long term, when stands of various-aged vegetation and a less homogeneous mix of vegetation are established, the visual variety created by the proposed vegetation treatments could result in a more interesting visual landscape.

Treatment areas could be noticeable to the casual observer during implementation and during the short term when dead vegetation or bare ground is visually obvious, but visual resource objectives would be met for the long term in all VRM Class areas when Proposed Action design criteria are followed.

Cultural Resources

The potential effects that the sage-grouse management plan would have on cultural resources would result from the surface disturbance caused by vegetation treatments. Many of the vegetation treatments required by the sage-grouse mitigation plan would involve removal of pinyon-juniper trees, which entails some surface disturbance. This surface disturbance could affect previously undiscovered cultural resources. To prevent this, site-specific analyses would be conducted prior to implementing any vegetation treatments. The total acres of vegetation treatments required by the sage-grouse mitigation plan under each alternative are listed above in the Vegetation section.

Visual Resources

The vegetation treatments would be designed to mimic natural appearing edges between vegetation types and to resemble natural openings and clearings in vegetation patterns. Thus, contrasts in form, line, color, and texture would be avoided or minimized so as to meet visual resource management (VRM) objectives. If heavy equipment is used to implement the vegetation treatments, its presence could create visual contracts, but these would be short term.

In the long term, when stands of various aged vegetation and a less homogenous mix of vegetation are established, the visual variety created by the proposed action could result in a more interesting visual landscape.

Treatment areas may be noticeable to the casual observer during implementation and during the short term when dead vegetation or bare ground is visually obvious; however, visual resource objectives would be met for the long term in all VRM class areas when design criteria are followed.

Soils

Most of the soils in the tract are suitable for the vegetation treatment activities designated for pinyon-juniper treatment and sagebrush treatment. Many of the soil types found in the tract would likely support a wider community of grasses and forbs, with pinyon-juniper as a smaller component of the vegetation community. Removal of pinyon-juniper would allow perennial grasses and forbs to return to the site, adding stability to the soil layers and reducing upland erosion.

For soil types that are more susceptible to erosion, care should be taken to reduce long-term exposure of the soil surface. This impact would be minimized by planting native and non-native species, leaving mulch on site, and by intermixing smaller (< 1,000 acres) treatment and non-treatment polygons.

Cumulative Effects

The vegetation treatments required by the sage-grouse mitigation plan would add cumulatively to the approximately 75,815 acres of surface disturbance caused by reasonably foreseeable future actions in the cumulative impacts analysis area (CIAA) (see Section 4.19 Cumulative Impacts in the SDEIS). Of these 75,815 acres, approximately 60,000 acres (79%) are expected to result from vegetation treatments. Depending on the alternative selected, the sage-grouse mitigation plan could have a cumulative effect ranging from 0 acres (No Action Alternative) to approximately 7,258 acres (Proposed Action) of surface disturbance. The maximum of 7,258 acres of vegetation treatments under the Proposed Action would represent an approximately 12% increase in the projected 60,000 acres of future vegetation treatments in the CIAA. The potential effects of the sage-grouse management plan would be temporarily adverse in the short term as a result of the surface disturbance required for some of the vegetation treatments, but they would have countervailing beneficial impacts in the long term. The long-term benefits would result from the offsetting of habitat and vegetation impacts caused by mining the tract, as described in the SDEIS.

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APPENDIX F.
RECONNAISSANCE ALLUVIAL VALLEY FLOOR INVESTIGATION IN THE ALTON COAL TRACT LBA AND ADJACENT AREAS, KANE COUNTY, UTAH

Reconnaissance Alluvial Valley Floor Investigation in the Alton Coal Tract LBA and Adjacent Areas, Kane County, Utah

7 June 2011

PETERSEN HYDROLOGIC, LLC
CONSULTANTS IN HYDROGEOLOGY

Reconnaissance Alluvial Valley Floor Investigation in the Alton Coal Tract LBA and Adjacent Areas, Kane County, Utah

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Reconnaissance Alluvial Valley Floor Investigation in the Alton Coal Tract LBA and Adjacent area, Kane County, Utah

1.0 Introduction

The United States Department of the Interior, Bureau of Land Management (BLM) is currently preparing a draft environmental impact statement in conjunction with proposed federal coal leasing actions in the Alton Coal Field at the Alton Coal Tract LBA (LBA). The LBA includes federal coal reserves located near the town of Alton, Utah (Figure 1).

Under the provisions of the Surface Mining Control and Reclamation Act of 1977 (SMCRA), special consideration is given to coal mining in certain types of stream valleys in the western United States west of the 100th meridian. These valleys are called alluvial valley floors (AVF). While the regulatory definition of an alluvial valley floor is rather complex, in the general sense, alluvial valley floors are stream valleys which 1) are located in those topographic valleys having an associated stream channel, 2) are underlain by unconsolidated deposits whose surface usually has the landform appearance of flood plains or terraces, and 3) have agricultural importance derived from the availability of surface-water or groundwater (OSM, 1983). Under SMCRA, certain alluvial valley floors are prohibited from disturbance by coal mining activities, while other alluvial valley floors may be mined, but are subject to higher standards of reclamation than are other coal mined areas.

Because of the complexities of alluvial valley floor identification, a multi-step investigative identification process is often implemented in coal leasing and permitting actions. Initial

identification studies are typically performed at a reconnaissance level using currently available or easily obtainable information. The performance of detailed, site-specific AVF studies typically involves the collection and analysis of large amounts of data and requires considerable effort and expense. Consequently, where necessary, detailed site-specific AVF studies are typically performed at a later time (often during the mine permitting stage). The primary purpose of a reconnaissance-level initial identification study is to identify those areas in and adjacent to proposed coal mining areas that clearly are not alluvial valley floors as defined by SMCRA. Additionally, those areas that are determined to be probable alluvial valley floors, based on the reconnaissance-level information and identification criteria, are delineated in these studies. The results of these reconnaissance-level AVF identification studies are useful to regulatory agencies in making initial decisions regarding leasing actions and permitting of coal mining areas. Where considered necessary, additional more detailed investigations may subsequently be performed in those areas where the presence or absence of a regulatory alluvial valley floor is less clear.

It should be emphasized here that the delineation of an area as a probable alluvial valley floor at the reconnaissance-level identification stage should not result in any scientific or other bias with regards to any future post-identification-stage AVF determinations in that area. This is because 1) the AVF delineation criteria utilized at the reconnaissance-level investigatory stage are different and more generalized than those utilized at the detailed-study identification phase, and 2) the identification-stage determinations are typically based on regional-scale information that is commonly less refined and more general than the types of data obtained from detailed study investigations.

Specifically, the primary purpose of this investigation is to delineate those areas within the Alton Coal Tract LBA and the adjacent area that are clearly not alluvial valley floors. The secondary purpose of this investigation is to provide an initial identification of those areas that are probable alluvial valley floors based on a reconnaissance-level investigation.

Including this introduction, this report contains the following sections:

1. Introduction
2. Methods of Study
3. Alluvial Valley Floor Initial Identification Criteria
4. Regional Agricultural Practices
5. Mine Site Study Area
6. Water Availability
7. Presently Irrigated Lands
8. Subirrigated Areas
9. Lands Which Have the Capability of Being Flood Irrigated
10. Surficial Geology and Geomorphology
11. Reconnaissance-Level Alluvial Valley Floor Determinations
12. References Cited

2.0 Methods of Study

This reconnaissance-level alluvial valley floor identification study was performed using the following methods of study.

- Existing geologic and hydrogeologic maps and reports pertinent to this investigation were obtained and reviewed.

- A field reconnaissance survey was performed that included traversing each of the primary stream drainages in the study area as well as the upland portions of the area that could conceivably contain alluvial valley floors.

- The surficial geologic and geomorphologic characteristics of the surveyed areas were examined in the field and noted. Additional geologic information was obtained from the geologic map of the 7.5-minute Alton, Utah quadrangle (Tilton, 2001).

- Stream valleys and their associated stream channels were photographed for analysis.

- Aerial photographs were obtained and analyzed that included high-resolution color aerial photography, high-resolution color infrared imagery, and oblique color aerial photography.

- An analysis of high-resolution stereoscopic aerial photography was performed to delineate geomorphologic features.

- Information relating to the AVF identification criteria was plotted on a 1:24,000 United States Geological Survey topographic base for analysis.

3.0 Alluvial Valley Floor Identification Criteria

The identification criteria used to delineate probable alluvial valley floors in this reconnaissance investigation are based on the information provided in the document *Alluvial Valley Floor Identification and Study Guidelines,* which is published by the Office of Surface Mining Reclamation and Enforcement (OSM, 1983). It is important to note that, although the concept of an alluvial valley floor may have a technical meaning to a geologist, in the context of SMCRA, an alluvial valley floor is a *regulatory term* that has been defined in statute and clarified in legislative history, court decisions, regulations, and ongoing administrative decisions (OSM, 1983). Consequently, in this investigation, the AVF identification criteria established by SMCRA and as outlined by OSM have been strictly followed . These delineation criteria are summarized below.

The SMCRA definition of an alluvial valley floor is based on agricultural water use and surficial geologic characteristics of a stream valley. An alluvial valley floor is defined by SMCRA as:

> *the unconsolidated stream-laid deposits holding streams with water availability sufficient for subirrigation or flood irrigation agricultural activities but does not include upland areas which are generally overlain by a thin veneer of colluvial deposits composed chiefly of debris from sheet erosion, deposits formed by unconcentrated runoff or slope wash, together with talus, or other mass-movement accumulations and windblown deposits.*

Regulations, judicial review, and administrative decisions have expanded and clarified the statutory definition as follows (OSM, 1983):

The geologic criteria of an alluvial valley floor are understood to be:

(a) A topographic valley with a continuous perennial, intermittent, or ephemeral stream channel running through it; and
(b) Within that valley, those surface landforms that are either flood plains or terraces if these landforms are underlain by unconsolidated deposits; and
(c) Within that valley, those side-slope areas that can reasonably be shown to be underlain by alluvium and which are adjacent to flood plain or terrace landform areas.

The water availability criteria are met if:

(a) Water is available by surface-water irrigation or subirrigation and is being or has successfully been used to enhance production of agriculturally useful vegetation; or
(b) Surface water is available in sufficient quantities to support agricultural activities.

It is apparent that alluvial valley floors, in the regulatory sense, are not merely those valleys filled with alluvium. Additionally, stream valleys which do not have any agricultural importance or whose importance is not related to the greater water availability of the valleys are not alluvial valley floors (OSM, 1983).

The acquisition of the types and quantity of data required to make a definitive determination of a stream valley's alluvial valley floor status is typically a labor-intensive and expensive task. Commonly, the types of data utilized to make a final AVF determination at the detailed study level may include detailed subsurface characterization of alluvial sediments (typically performed by drilling and/or the excavation of soil pits), soil moisture characterizations, alluvial groundwater characterizations, baseline hydrologic information on groundwater and surface-water quantity and quality, detailed geomorphologic studies, detailed vegetative studies, and detailed evaluation of the agricultural potential of the land. At the preliminary land management and coal leasing stage, these types of data are typically not available to decision makers. Consequently, the determination of the AVF status of a stream valley is commonly performed in a multi-step process.

Commonly, prior to the performance of any detailed AVF investigation, a reconnaissance-level identification stage is performed in a coal lease study area. The reconnaissance-level identification study relies primarily on previously existing or easily obtained data from the project area. The primary goal of an identification stage study is to establish whether or not alluvial valley floors exist in the study area (OSM, 1983). Clearly, because the quantity and level of detail in the data utilized in a reconnaissance-level identification study are not of a detailed nature, the results of the reconnaissance-level identification study are utilized for general purposes only, and possibly to provide direction for future studies in the area.

Based on guidelines outlined by OSM, for the purpose of the reconnaissance-level identification study, the study procedure and criteria utilized to identify potential alluvial valley floors generally include the following:

Water Availability study procedure and Criteria (identification stage study)

- Presently irrigated lands are identified and mapped.

- All lands which appear to have the capability of being flood irrigated, based on a previous evaluation of commonly employed regional irrigation practices, are identified and mapped. If the type of undeveloped stream valley is not typically developed for irrigation elsewhere in the region, those valley floors are not AVF.

- Potential subirrigated lands which are of agricultural importance are identified and mapped.

Geologic study procedure and Criteria (identification stage study)

- Surficial geologic data are collected and flood plain or terrace areas are identified and mapped.

The water availability and geologic data in a reconnaissance-level study are typically plotted at a scale of 1:24,000 (1 inch = 2,000 feet).

Any areas meeting the geologic criteria and one of the water availability criteria can be considered alluvial valley floors for the purposes of initial identification (OSM, 1983).

4.0 Regional Agricultural Practices

This discussion of common agricultural practices in the study area is based on inspection of agricultural operations in the area and on discussions with local farmers and ranchers.

In the Alton, Utah and surrounding areas, the limiting factor for agricultural activity is typically the availability of a reliable supply of adequate water. In the Alton Coal Field area, near-surface groundwater resources are generally not sufficient to allow the pumping of groundwater for substantial crop irrigation. Groundwater in the near-surface formations in agricultural areas is generally limited to groundwater in shallow alluvial groundwater systems. Geologic conditions in the near-surface bedrock formations are not conducive to the production of appreciable quantities of groundwater (Petersen Hydrologic, 2007). It should be noted that appreciable groundwater resources are likely available in deep aquifers beneath the Alton Coal Field (i.e. the Navajo Sandstone regional aquifer). However, the difficulties and expense of producing groundwater from these deep formations are likely prohibitive. Consequently, appreciable production of groundwater from the deep aquifers for irrigation use is not known to have occurred in the area. Groundwater discharging from springs is commonly utilized for stock watering in the region.

Because of the unavailability of appreciable groundwater resources, the irrigation of croplands in the region is most commonly carried out using surface waters in streams originating in the upland areas of the adjacent Paunsaugunt Plateau located to the east of the study area (Figure 1). Because of the highly seasonal character of the discharge in these mountain streams (i.e. much of the annual yield from these streams occurs during the springtime snowmelt event prior to the growing season, while discharge usually declines dramatically thereafter in the summer months) surface waters are commonly diverted into earthen holding ponds and stored for use later in the growing season. Because of the appreciable stream gradients and topographic relief present in the area, surface water can be routed from up-stream diversions to irrigated fields at lower topographic elevations via earthen ditches or other conveyance mechanism under gravity flow. Crop yields in the region commonly show considerable variability from year to year depending on the surface-water availability as determined by the prevailing climatic conditions.

It is most commonly observed that irrigation of croplands is limited to parcels of land that are reasonably flat and of large enough acreage to warrant the effort required to design, construct, and maintain the irrigation system and to perform the irrigation. Commonly,

irrigated crop lands are irrigated using flood irrigation techniques. In other areas, sprinkler systems utilizing wheel lines and pivot systems (sourced with stored surface water) are increasingly being utilized.

5.0 Mine Site Study Area

The area of study for this reconnaissance-level identification study is shown on Plate 1. The study area boundaries encompass all of the Alton Coal LBA and the adjacent area. The boundaries of the study area have been delineated to facilitate the identification of alluvial valley floors within all areas possibly affected by coal mining activities in the Alton Coal Tract LBA.

It should be noted that a detailed alluvial valley floor study has previously been performed in the Coal Hollow Project and adjacent area in conjunction with the mine permitting activities with the Utah Division of Oil, Gas and Mining (Petersen Hydrologic, 2008). The study area for that investigation, which also includes portions of the Alton Coal LBA, is shown on Plate 1. The reader is referred to the report of that investigation (Petersen Hydrologic, 2008) for specific information regarding alluvial valley floors within that region. It should be noted that, prior to the issuance of the mining permit for the Coal Hollow Mine, the Utah Division of Oil, Gas and Mining made a finding that there are no alluvial valley floors present within the Coal Hollow Project area.

6.0 Water Availability

For general informational purposes, discharge hydrographs depicting seasonal flows rates measured historically in streams in the study area are provided in Figure 2. The discharge data used to create these hydrographs were obtained from data submitted to the Utah Division of Oil, Gas and Mining on-line hydrology database (UDOGM, 2008) by operators

in conjunction with mine permitting actions. It should be noted that these hydrographs depict instantaneous discharge measurements performed monthly or quarterly during times when the monitoring sites are accessible. These hydrographs do not depict a continuous, uninterrupted flow record, but rather are presented here to assist in evaluating the general magnitude of seasonal discharge rates in these streams.

It is apparent in Figure 2 that the most significant source of surface water in the study areas is from Kanab Creek. Kanab Creek provides irrigation water that is largely used in the Alton, Utah and nearby areas. Further downstream, flows diminish in the drainage, both as a result of upstream irrigation diversions and from losses to evapotranspiration. It is not uncommon for Kanab Creek to have little or no discharge south of the study area during much of the year.

Surface water flows in Sink Valley Wash below Sink Valley are usually present only in direct response to snowmelt and during torrential precipitation events. Consequently, Sink Valley Wash is not considered a significant source of irrigation water in the study area.

Water availability criteria in this alluvial valley floor identification study include 1) the identification and mapping of all presently irrigated lands, 2) the mapping of all lands which appear to have the capability of being flood irrigated, and 3) the mapping of potentially subirrigated areas. The results of these activities as performed for this investigation are summarized in the following three sections of this report.

7.0 Presently irrigated lands

A map showing presently irrigated lands in the study area is presented in Plate 2. The mapping of presently irrigated lands is based on 1) field observations of irrigated areas, and 2) analysis of high-resolution color IR aerial imagery.

Presently irrigated areas in the study area have been identified in two main regions. These include irrigated lands in the northern portion of the study area near the town of Alton, Utah, and irrigated lands located in the narrow valley bottoms adjacent to Kanab Creek in the central and southern portion of the study area about 2.5 miles south of Alton, Utah. The characteristics of these two irrigated areas are described below.

Alton area

Currently irrigated areas near the town of Alton, Utah are comprised mostly of irrigated hay fields. These fields are irrigated predominantly with sprinklers using wheel lines and pivots. The source of irrigation water is predominantly surface-water diverted from Kanab Creek into earthen storage ponds in upstream areas. Some apparently flood irrigated areas are also present, but these are generally smaller sized areas than are the sprinkler irrigated areas. It should be noted that all of the town has been mapped as presently irrigated lands. Irrigation within the town consists predominantly of irrigation of domestic and municipal landscaping and the irrigation of domestic gardens and pastures.

It is apparent that irrigation return water running off the irrigated fields immediately south of the town of Alton enhances the growth of vegetation and increases soil moisture in adjacent rangelands immediately south of the irrigated fields (see Plate 2). This conclusion is based in part on analysis of infrared imagery, which clearly shows the zones of increased wetness and vegetation occurring immediately below lowest elevation areas of the irrigated fields. Similar wet zones are not apparent in adjacent areas at similar elevations which are not adjacent to irrigated fields. Infiltration of springtime snowmelt runoff water from the fields and other up-gradient areas may also contribute to the increased wetness of these areas during the springtime. It is unlikely that there is an appreciable component of natural groundwater discharge in this area as the geologic conditions are not favorable for this to occur. The bedrock formation underlying the area consists of relatively impermeable Tropic Shale, which is overlain by an apparently thin veneer of alluvium and soil. The identification of a likely recharge location that could support appreciable natural groundwater discharge to these areas is also problematic.

Southern Kanab Creek valley area

Irrigated lands have been identified in the narrow valley bottoms adjacent to Kanab Creek about 2.5 miles south of Alton, Utah (Plate 2). Irrigation in these areas is by flood irrigation techniques. Water for irrigation of these areas is diverted from Kanab Creek into transmission ditches at upstream locations. This surface water is stored in earthen storage ponds for use in flood irrigation of the irrigable lands during the growing season.

It is apparent that at times in the past, hay production has likely occurred in these fields. However, during at least the past four years, it appears that these fields have been utilized primarily as pasture lands for seasonal cattle grazing.

8.0 Subirrigated Areas

Areas that appear to be potentially subirrigated and are of agricultural importance have not been identified within the study area. Narrow strips of riparian vegetation are present in some areas immediately adjacent to stream channels. While these narrow riparian areas are likely subirrigated, they are not considered significant to local agricultural activities and, consequently, are not mapped here. Subirrigation of the broader valley bottoms adjacent to the major stream drainages is generally not observed in the study area (other than in the narrow strip of riparian vegetation sometimes present near the stream channel). This condition is likely the result of several factors including 1) the lack of appreciable discharge in many of the stream reaches during much of the year, 2) the abundant presence of low permeability clayey sediments in the alluvial materials adjacent to the streams that limits the potential for appreciable lateral migration of water, and 3) the fact that many of the stream drainages in the study areas are deeply incised in their channels, often by several tens of feet, which results in an increased vertical distance between the active stream level and the vegetation present on the abandoned adjacent terrace.

9.0 Lands which appear to have the capability of being flood irrigated

Lands which appear to have the capability of being flood irrigated are mapped on Plate 3. The delineation of these areas is based on typical regional irrigation practices as described in Section 4 above. Regionally, those topographic valley areas which are reasonably flat and of a sufficient acreage to justify the effort and expense required to construct and maintain an irrigation system are often developed for irrigation. Narrow canyon bottoms and steep side slopes are generally not irrigated regionally. Because of the appreciable topographic relief present in the study area which provides the hydraulic head required to transport water through ditches or pipes under gravity flow, it has been assumed that surface waters could be conveyed via conveyance ditches to most valley bottom locations.

It should be noted that the mapping of potentially flood irrigable lands in Plate 3 is considered conservative. With sufficient effort, almost any lands in the project area (with the probable exception of some hill tops) could conceivably be flood irrigated. However, upland areas similar to those in the areas intervening between the major drainages in the study area are rarely irrigated in the region. For this investigation, essentially all of the valley bottoms and adjacent moderate side slope areas along the major drainages have been mapped as flood irrigable. It is acknowledged that many of these areas are probably too narrow to justify the efforts required to develop these lands for flood irrigation.

10.0 Surficial Geology and Geomorphology

A geologic map of the Alton, Utah 7.5 minute quadrangle was prepared by the Utah Geological Survey in cooperation with the United States Geological Survey in 2001 (Tilton, 2001).

As discussed above, detailed geologic information (particularly subsurface characteristics of alluvial sediments) is typically not available for reconnaissance-level AVF investigations. Consequently, for the purposes of the reconnaissance-level initial identification study, delineations of alluvial geomorphological features (flood plains and alluvial terraces) are usually relied upon as the basis for the geologic criteria for the identification-stage AVF delineation (OSM, 1983). The locations of flood plains and alluvial terraces identified in the study area are mapped in Plate 4. It should be noted that the shaded area on Plate 4 delineates regions where either flood plain or terrace geomorphic features have been identified. Regions including either of these geomorphic features (flood plains or terraces) were mapped together as the shaded region on Plate 4. However, these geomorphic features are not individually delineated on Plate 4. This methodology is considered appropriate as a determination of the presence of either flood plains or terrace landforms is inherent in a probable alluvial valley floor identification at the reconnaissance level.

The identification of geomorphologic features in this investigation were determined using high-resolution aerial photographs, high-resolution stereoscopic imagery, published geologic maps, and reconnaissance-level field investigations in the study area. It is apparent on Plate 4 that the mapable flood plains and terraces in the study area are located adjacent to Kanab Creek and lower Sink Valley Wash.

It is noteworthy that flood plains and alluvial terraces were not identified in the region near the town of Alton. Much of the region surrounding the town of Alton is underlain by bedrock of the Tropic Shale, which is a low-permeability marine shale (Tilton, 2001). Within the town itself, an apparently thin veneer of alluvium directly overlies the Tropic Shale. Alluvial sediments that would be consistent with those that would typically comprise an alluvial valley with associated flood plains and terrace complex are not present in this area.

11.0 Reconnaissance-Level Alluvial Valley Floor Determinations

As described in the OSM Alluvial Valley Floor Identification Guidelines (1983), those areas meeting the geologic criteria of the presence of alluvial flood plains and terraces, and also meeting one of the water availability criteria (lands presently irrigated, lands with the capability of being flood irrigated, or potentially subirrigated lands) are classified as probable alluvial floors for the purposes of the reconnaissance-level identification study.

Based on the reconnaissance-level identification study criteria outlined in Section 3 above, six Identification Areas have been identified in the study area. These areas encompass those lands within the study area that appear to have the greatest likelihood for being potential alluvial valley floors. Accordingly, these regions are considered areas for potential future detailed-level AVF delineation studies should additional characterization of the AVF status of these lands be warranted. The six Identification Areas are shown on Plate 5. Details summarizing the delineations of the AVF status of each of these areas are presented below.

Identification Area 1

Identification Area 1 is located in the Kanab Creek drainage in the northern portion of the study area east of the town of Alton, Utah (Plate 5). Photographs of the land surface in Area 1 are included in the Photographs Section of this report. Agricultural activities in Area 1 include the production of hay in irrigated fields in the flat lands adjacent to Kanab Creek. Pasture lands used for cattle grazing are also present in Area 1. The flat lands adjacent to Kanab Creek appear at the reconnaissance level to have the geomorphologic characteristics of flood plains. Consequently, at the reconnaissance-stage identification study level, the land in Area 1 is considered a probable alluvial valley floor.

It is noteworthy that bedrock outcrops are present along both the east and west margins of Area 1 with the land surface sloping toward the stream channel on both sides of the drainage. Additional information regarding the subsurface characteristics of the alluvial sediments and

the lateral alluvium/bedrock interface locations in Area 1 would facilitate the further refinement of the boundaries of the flood plain and to confirm the presence of an alluvial valley floor.

It should be noted that on satellite images, agricultural activities have been observed in upland areas (that are either alluvial fan or terrace geomorphic landforms) northeast of Identification Area 1 (beyond the study area extents of this investigation). The geomorphic character of these features, being outside the study area for this investigation, has not been definitively determined. However, within the study area for this investigation, upland alluvial terraces (beyond the flood plain and terrace complexes delineated in Plate 4) have not been identified. Accordingly, there is no identified potential for irrigation of any such upland alluvial terraces within the study area.

Identification Area 2

Identification Area 2 is located in the Kanab Creek drainage in the central portion of the study area (Plate 5). Photographs of the land surface in Area 2 are included in the photograph section of this report. The width of the valley bottom in Area 2 is much narrower than that of Area 1. A narrow flood plain is also present in Area 2. However, there has apparently not been any substantial agricultural development in Area 2, likely because of the narrowness of the valley. A narrow strip of riparian vegetation exists adjacent to the stream in the active channel area, but this does not seem to be large enough to be of appreciable agricultural importance for grazing. The surrounding land (outside the riparian area) consists mostly of undeveloped rangeland. While the land surface in Area 2 could conceivably be irrigated, the irrigation of valleys of similar geometry in the region has generally not been observed. Consequently, at the reconnaissance-stage identification study level, the land in Area 2 is considered a possible (though unlikely) alluvial valley floor. Refinement of the locations of the lateral margins of the stream-laid deposits overlying the flood plains could be accomplished with additional study of the subsurface characteristics of the sediments in the valley bottom.

It should be noted that grazing lands are present in regions located east of the northeast portion of Area 2 (which include privately owned lands in the southwestern quarter of Section 18, Township 39 South, Range 5 West). While some of these areas are mapped as alluvium in the Tilton (2001) geologic map of the area, the geomorphic landforms present in this region, which generally slope from the adjacent mountainous regions toward lower-lying regions adjacent to Kanab Creek, have been identified in this investigation as alluvial fan landforms. These areas do not show characteristics of flood plain or terrace geomorphic landforms. Accordingly, because of the absence of flood plain or terrace landforms, these areas are not considered as probable alluvial valley floors.

Within the study area for this investigation, upland alluvial terraces (beyond the flood plain and terrace complexes delineated in Plate 4) have not been identified. It should be noted that broad, sloping alluvial fan geomorphic features (which generally slope away from adjacent upland areas) have been identified in some areas, but these are not associated with either flood plain or terrace geomorphic features. Accordingly, there is no identified potential for irrigation of any such upland alluvial terraces within the study area (including the regions adjacent to Investigation Area 2).

Identification Area 3

Identification Area 3 is located in the Kanab Creek drainage in the central portion of the study area (Plate 5). The stream valley associated with Area 3 is a small tributary to Kanab Creek. A narrow, well-defined flood plain is present in the lower reaches of this tributary (See Photographs Section). A narrow corridor with increased vegetation is present in the bottom of this stream valley. As with Area 2 described previously, this stream drainage generally satisfies most of the reconnaissance-level identification criteria for AVF. However, its small size and narrow width probably preclude its development for irrigation and limit its agricultural importance. While the land surface in Area 3 could conceivably be irrigated, the irrigation of valleys of similar geometry in the region has generally not been observed. Consequently, at the reconnaissance-stage identification study level, the land in Area 2 is considered a possible (though unlikely) alluvial valley floor.

Identification Area 4

Identification Area 4 is located in the southwestern portion of the study area in the Kanab Creek drainage (Plate 5). Photographs showing the land surface in Area 4 are included in the Photographs Section of this report. It is apparent that the agricultural fields in Area 4 are currently utilized primarily for cattle grazing. The fields are currently flood irrigated using Kanab Creek surface water diverted from the creek at upstream diversions and conveyed through ditches to a series of earthen storage ponds (Plate 2). It appears likely that hay was produced in the past in some of the fields in Area 4 (dilapidated hay production equipment is still present at the site). In the southernmost portion of Identification Area 4, the Kanab Creek stream channel is incised below the adjacent abandoned terrace areas by more than 50 feet in some locations. The lands on the upland terrace adjacent to the active stream channel consist primarily of undeveloped rangelands. The flat lands adjacent to Kanab Creek that comprise Area 4 appear at the reconnaissance level to have the geomorphologic characteristics of flood plains. Consequently, at the reconnaissance-stage identification study level, the land in Area 4 is considered a probable alluvial valley floor.

Identification Area 5

Identification Area 5 is located in the southern portion of the study area in the Kanab Creek drainage immediately below Area 4 (Plate 5). Photographs showing the land surface in Area 5 are included in the Photographs Section of this report. The Kanab Creek stream drainage in Area 5 is deeply incised relative to the surrounding abandoned terrace areas. It is apparent that the lands in Area 5 outside the narrow, incised active stream channel area consist primarily of undeveloped rangelands with sagebrush and juniper vegetation. The riparian vegetation adjacent to the active stream channel in Area 5 is appreciably less extensive than in upstream locations. It is likely that the quantity of surface water available in this area for irrigation is meager during most of the year, given the numerous upstream irrigation diversions and potential losses to evapotranspiration in the considerable distance between Area 5 and the Paunsaugunt Plateau source areas for the stream. Consequently, the importance of this land for agricultural use seems low. However, the flat lands adjacent to Kanab Creek in Area 5 appear at the reconnaissance level to have the geomorphologic

characteristics of flood plains, and the relatively flat lands on the upper terrace appear to have the physical capability of being flood irrigated (although the availability of water for irrigation purposes is meager). Consequently, at the reconnaissance-stage identification study level, the land in Area 5 is considered a possible (although unlikely) alluvial valley floor.

Identification Area 6

Identification Area 6 is located in Sink Valley Wash in the southern portion of the study area (Plate 5). Photographs showing the land surface in Area 6 are included in the Photographs Section of this report. Surface water flows in Sink Valley Wash in this area are usually absent, with water usually being present in the drainage only in direct response to snowmelt or during torrential precipitation events. Consequently, the availability of water for irrigation of the land in Area 6 is very low and irrigation of these lands is probably a practical impossibility.

The land surface in lower Sink Valley Wash below the county road-136 crossing is relatively broad and consists predominantly of undeveloped rangeland. The relatively flat lands adjacent to Sink Valley Wash that comprise Area 6 appear at the reconnaissance level to have the geomorphologic characteristics of flood plains. In the adjacent region above the county road-136 crossing, a well-defined flood plain is not apparent. Based on these factors, at the reconnaissance-stage identification study level, the land in Area 6 is considered a possible (although unlikely) alluvial valley floor.

Alton Town Area

It should be noted that AVF status of the lands within and immediately south of the town of Alton and west of the Tropic Shale bedrock ridge that divides that area from the Kanab Creek stream valley were considered in this investigation. Although significant agricultural activity takes place on these lands, it is readily apparent that these lands do not meet the regulatory criteria described in Section 3 above to qualify as alluvial valley floors. The lands immediately south of the agricultural fields at the southern end of the town of Alton, and also the lands immediately to the west and east of the town consist of Tropic Shale bedrock

(Tilton, 2001). The apparently thin veneer of alluvial sediments overlying the Tropic Shale in the town of Alton does not show geologic characteristics consistent with stream-laid deposits associated with flood plains and terraces. Additionally, the presence of a continuous stream channel that runs though the area and which resulted in the deposition of stream-laid sediments with flood plains or terraces is not apparent. It seems most probable that the thin alluvial sediments near the town of Alton are associated with residuum or slope wash deposits derived from the adjacent soft Tropic Shale bedrock and mud slide deposits located topographically above the town (Tilton, 2001). For these reasons, this area is not considered to be an alluvial valley floor in this investigation.

Lower Robinson Creek Area

Most of the Lower Robinson Creek area is contained within the previously evaluated Coal hollow Project study area (Plate 1). Previously, the Utah Division of Oil, Gas and Mining found that there are no alluvial valley floors in the Lower Robinson Creek area within the Coal Hollow Project area study boundary. As part of this investigation, Identification Area 4, which includes lands adjacent to Kanab Creek and the lowest reaches of Lower Robinson Creek have been identified as a probable alluvial valley floor at the reconnaissance-stage identification study level. It should be noted here that the approximately 0.25 mile reach of the Lower Robinson Creek drainage between the previous Coal Hollow Project study area boundary and the eastern edge of Identification Area 4 has also been evaluated for AVF potential as part of this investigation. While alluvial sediments have been identified in this region and minor stream flows are commonly present in this reach of the creek, flood plain and terrace landforms have not been identified in this area. The narrow valley adjacent to Lower Robinson Creek in this portion of the drainage generally slopes from the adjacent upland areas towards Lower Robinson Creek. The land in this area consists of undeveloped rangeland. Accordingly, this area is not considered to be an alluvial valley floor in this investigation.

12.0 References Cited

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Tilton, T.L., 2001, Geologic map of the Alton Quadrangle, Kane County, Utah, Utah Geological Survey, Miscellaneous Publication 01-4, 7.5 minute geologic map, cross-sections, and text.

UDOGM, 2008, Utah Division of Oil, Gas and Mining, Utah coal mine water quality database, on-line at http://ogm.utah.gov/coal/edi/wqdb.htm.

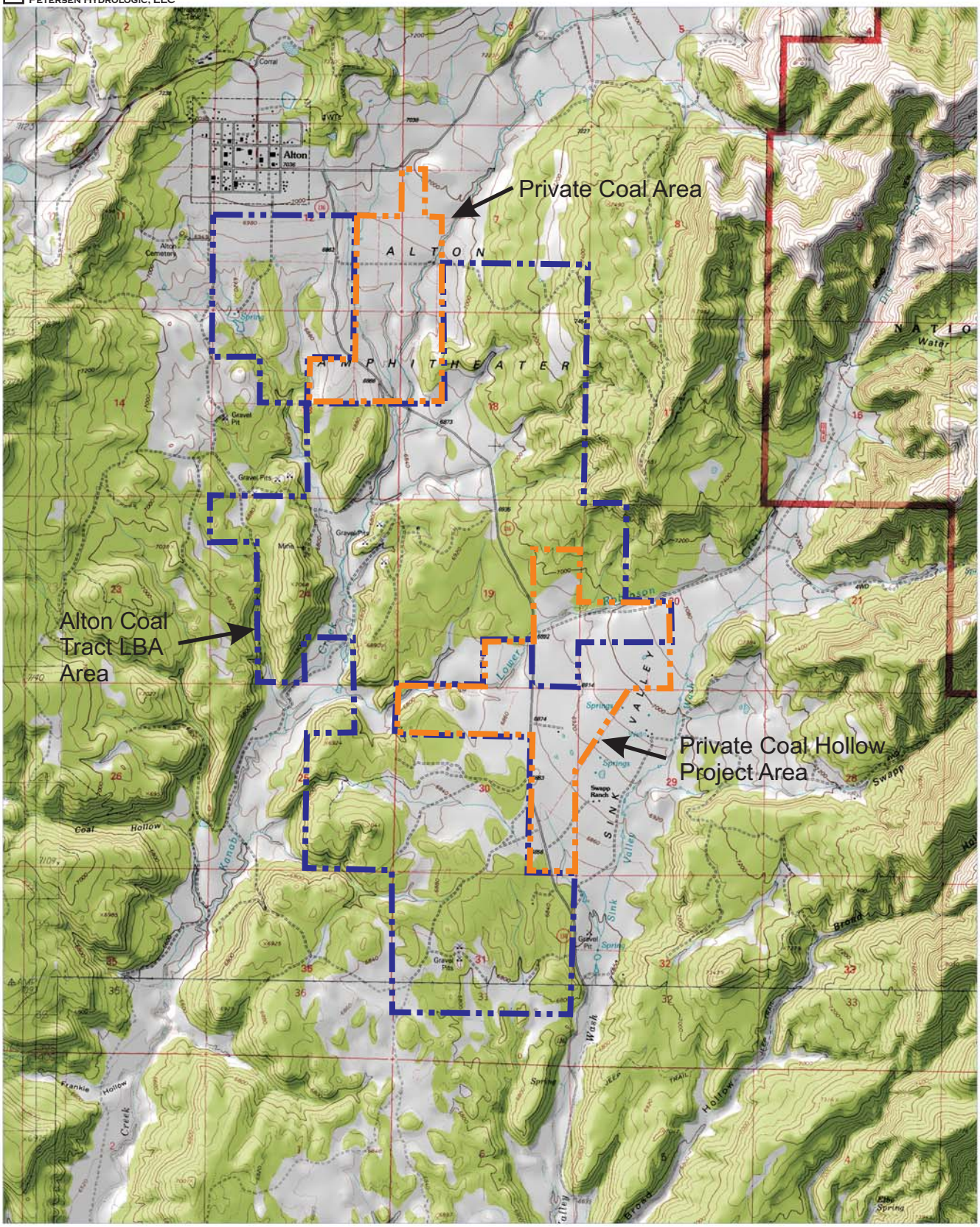


Figure 1 Location map showing the Alton Coat Tract LBA and adjacent areas and the town of Alton, Utah.

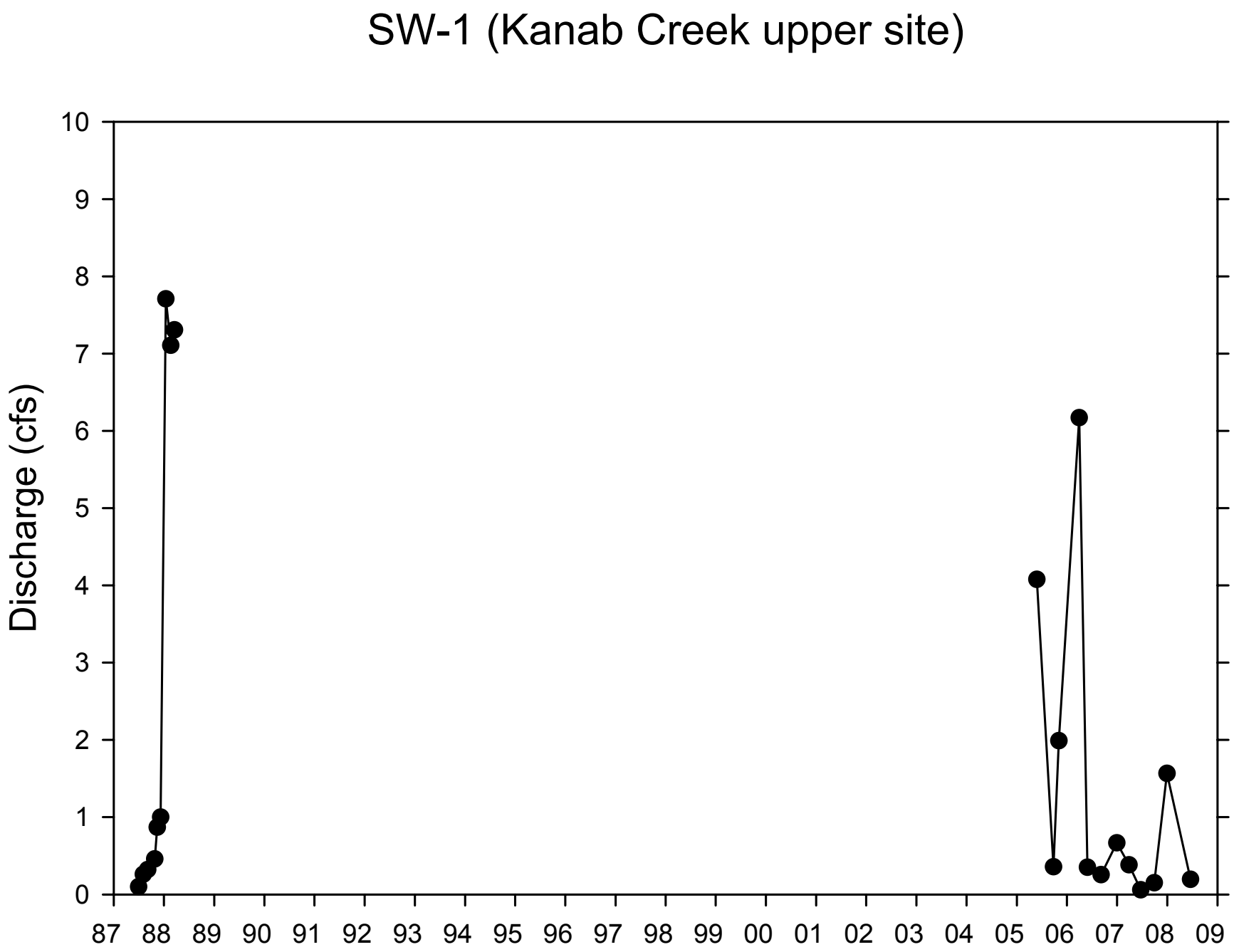


Figure 2a Discharge measured in Kanab Creek at site SW-1
(See Plate 2 for monitoring site location).

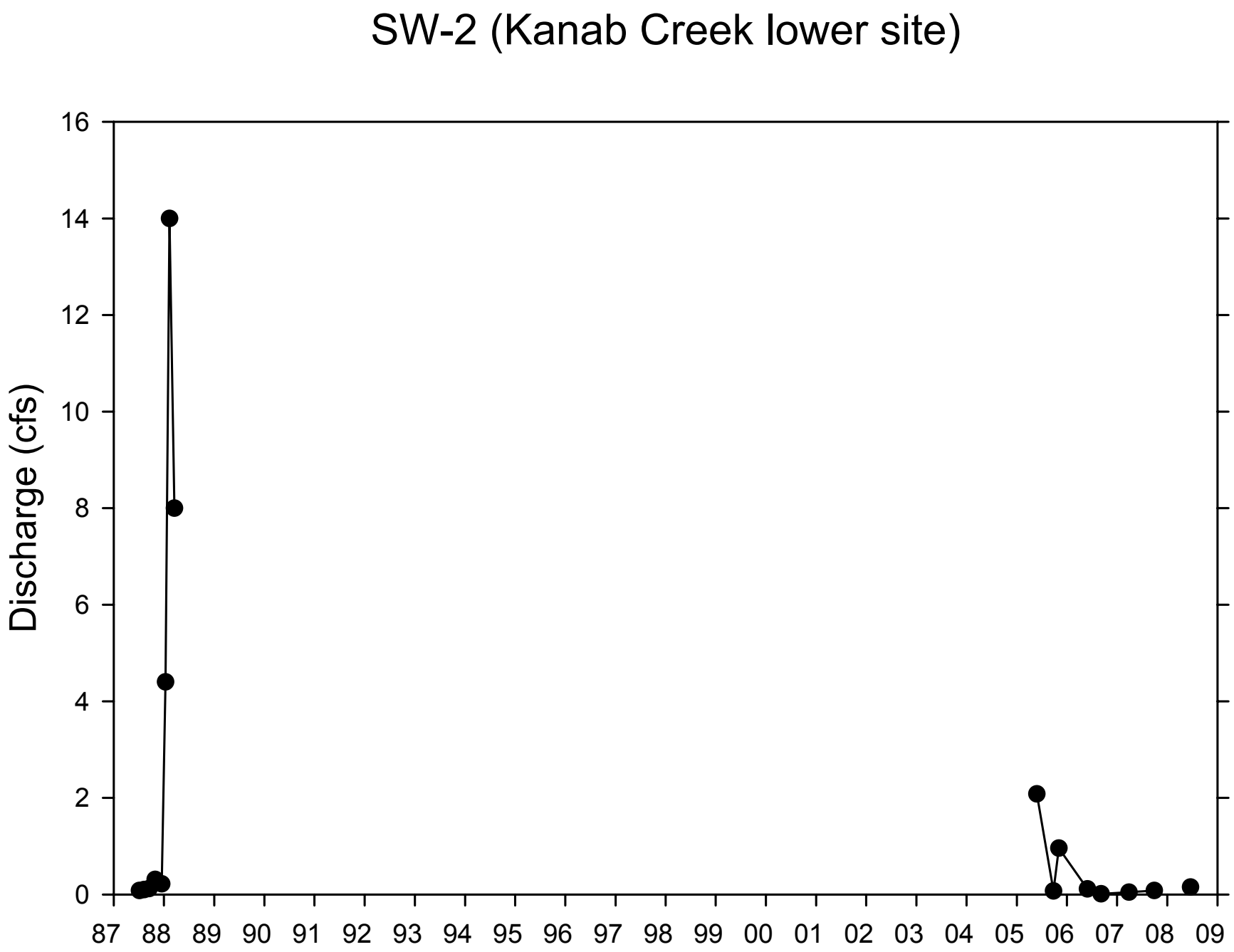


Figure 2b Discharge measured in Kanab Creek at site SW-2
(See plate 2 for monitoring site location).

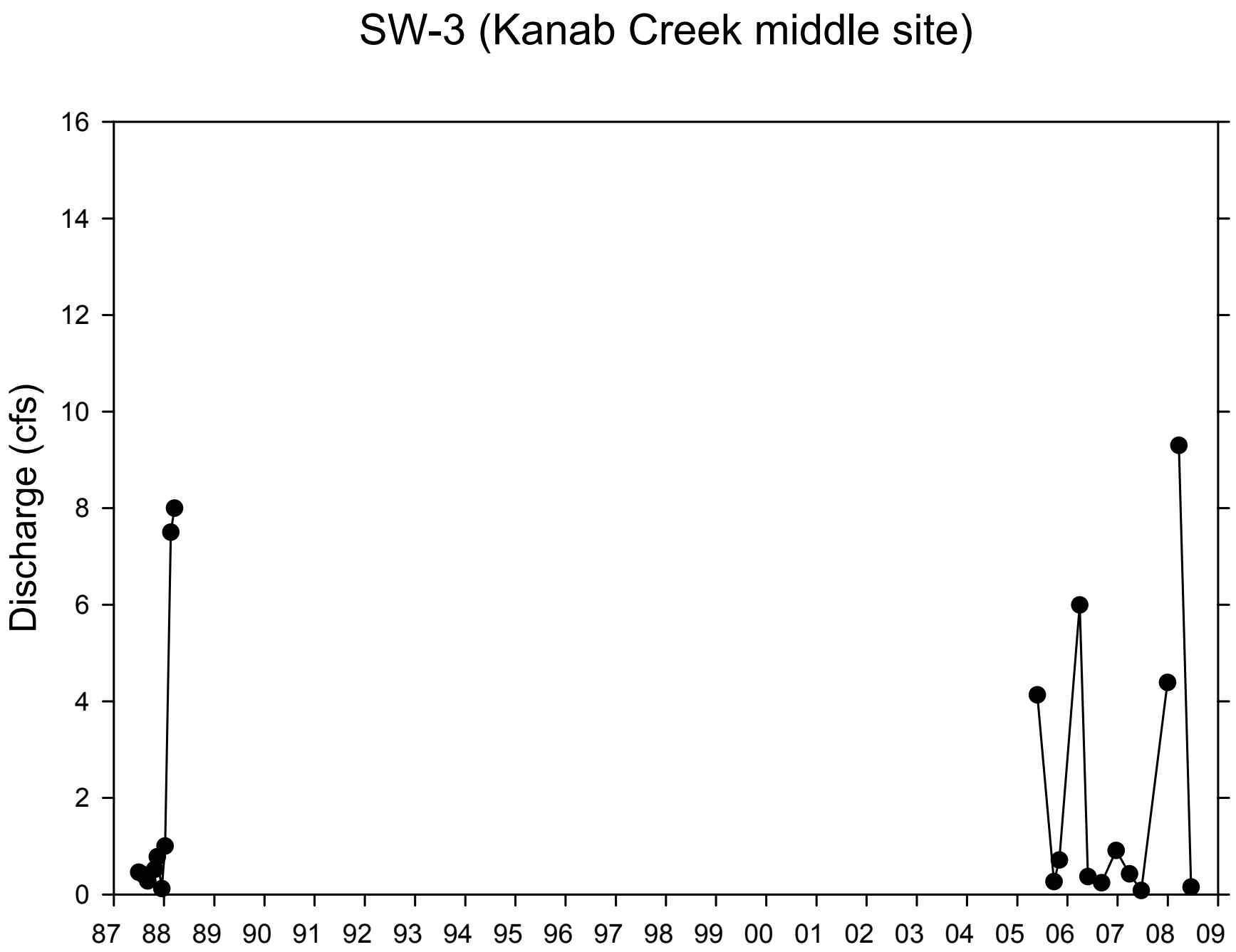


Figure 2c Discharge measured in Kanab Creek at site SW-3
(See Plate 2 for monitoring site location).

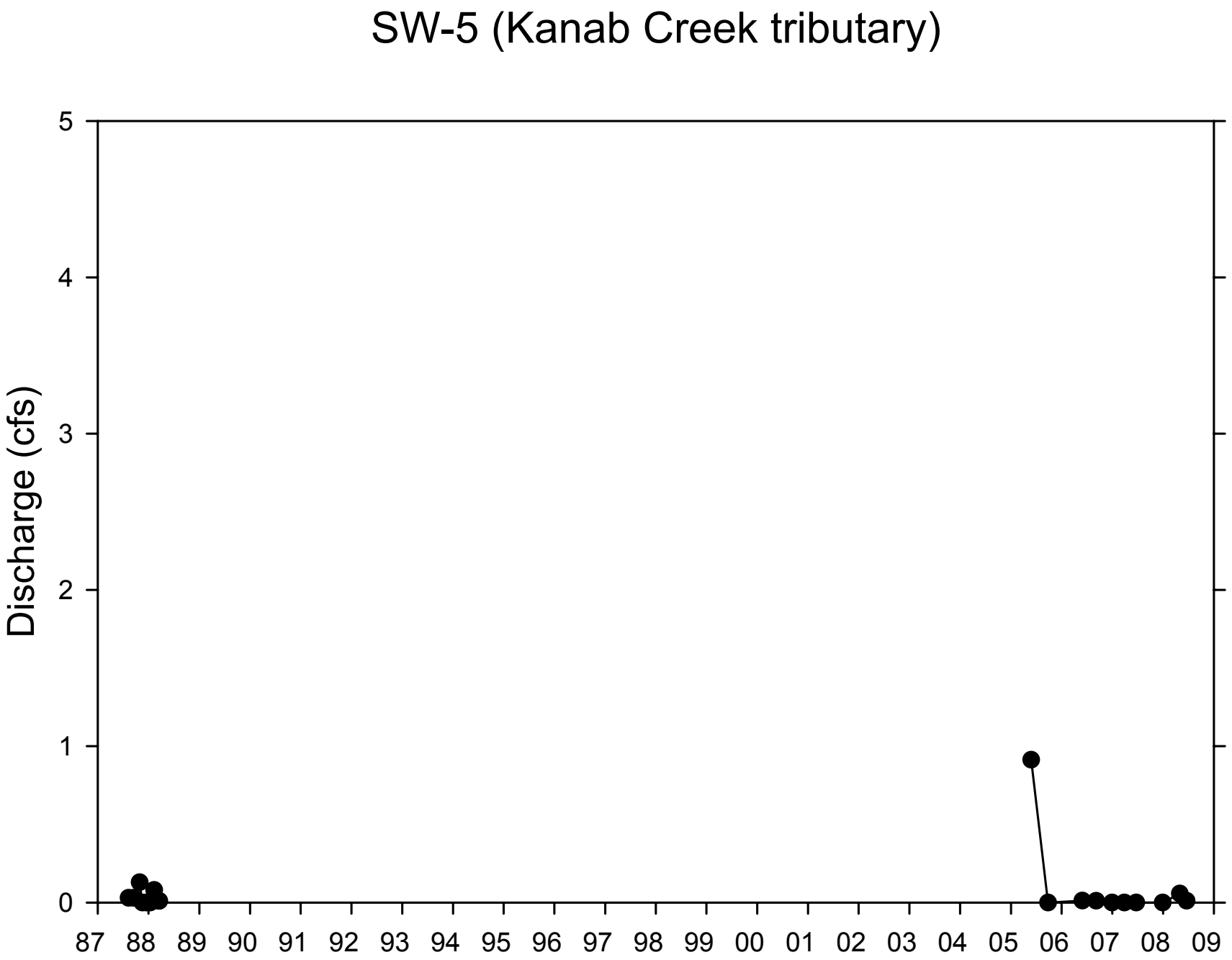


Figure 2d Discharge measured in Lower Robinson Creek, a tributary of Kanab Creek at site SW-5 (See Plate 2 for monitoring site location).

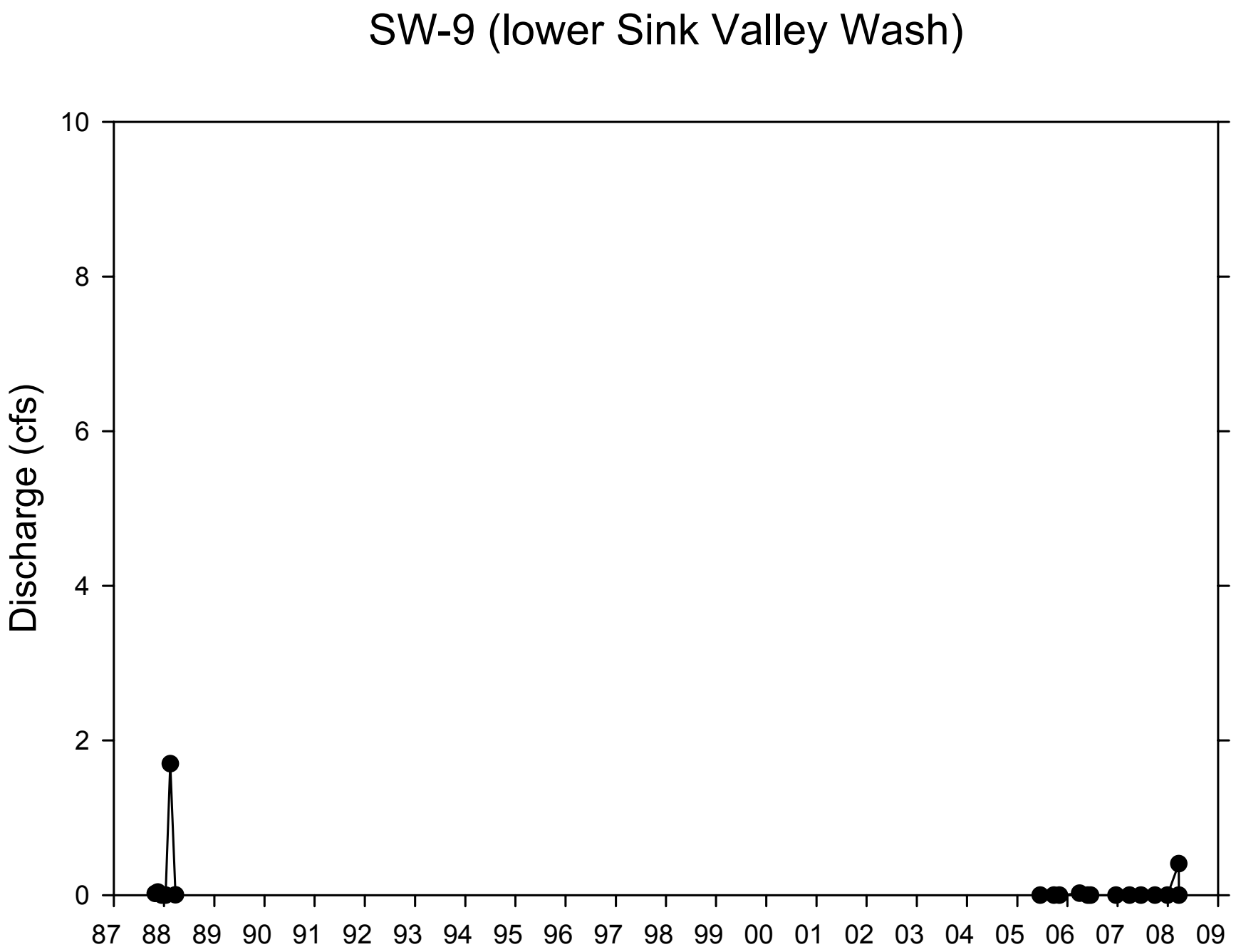


Figure 2e Discharge measured in Sink Valley Wash
(See Plate 2 for monitoring site location).

Table 1 Instananeous stream discharge measurements in streams in the study area.

Notes: Data from Utah Division of Oil, Gas and Mining on-line coal hydrology database.
See Plate 1 for monitoring site locations.

Site	Date	Discharge (cfs)
Kanab Creek upper monitoring site		
SW-1	7/1/1987	0.10
SW-1	8/3/1987	0.26
SW-1	9/4/1987	0.32
SW-1	10/26/1987	0.46
SW-1	11/13/1987	0.87
SW-1	12/8/1987	1.00
SW-1	1/15/1988	7.71
SW-1	2/20/1988	7.11
SW-1	3/17/1988	7.31
SW-1	5/27/2005	4.08
SW-1	9/25/2005	0.36
SW-1	11/3/2005	1.99
SW-1	3/31/2006	6.17
SW-1	5/30/2006	0.35
SW-1	9/7/2006	0.26
SW-1	12/30/2006	0.67
SW-1	3/29/2007	0.38
SW-1	6/22/2007	0.06
SW-1	9/29/2007	0.15
SW-1	12/30/2007	1.57
SW-1	6/18/2008	0.20
Kanab Creek upper lower monitoring site		
SW-2	7/7/1987	0.08
SW-2	8/10/1987	0.10
SW-2	9/14/1987	0.12
SW-2	10/29/1987	0.31
SW-2	12/16/1987	0.22
SW-2	1/13/1988	4.40
SW-2	2/11/1988	14.00
SW-2	3/17/1988	8.00
SW-2	5/27/2005	2.08
SW-2	9/25/2005	0.07
SW-2	11/3/2005	0.96
SW-2	5/30/2006	0.11
SW-2	9/7/2006	0.01
SW-2	3/29/2007	0.05
SW-2	9/29/2007	0.08
SW-2	6/18/2008	0.15

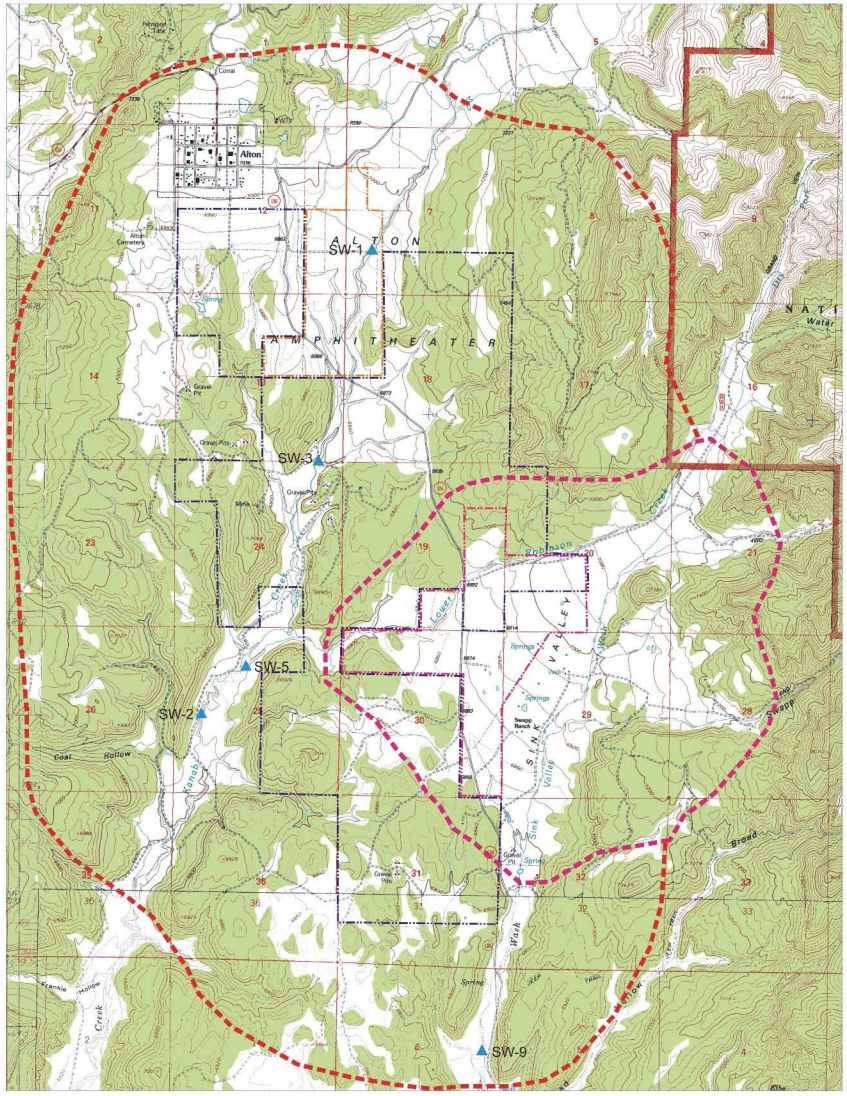
Site	Date	Discharge (cfs)
Kanab Creek upper middle monitoring site		
SW-3	7/1/1987	0.46
SW-3	8/3/1987	0.41
SW-3	9/4/1987	0.28
SW-3	10/26/1987	0.52
SW-3	11/13/1987	0.78
SW-3	12/16/1987	0.12
SW-3	1/9/1988	1.00
SW-3	2/20/1988	7.50
SW-3	3/17/1988	8.00
SW-3	5/27/2005	4.13
SW-3	9/25/2005	0.27
SW-3	11/3/2005	0.71
SW-3	3/31/2006	5.99
SW-3	5/30/2006	0.37
SW-3	9/7/2006	0.24
SW-3	12/21/2006	0.91
SW-3	3/29/2007	0.43
SW-3	6/22/2007	0.08
SW-3	12/30/2007	4.39
SW-3	3/22/2008	9.30
SW-3	6/18/2008	0.15
Lower Robinson Creek tributary at confluence with Kanab Creek		
SW-5	8/10/1987	0.03
SW-5	9/14/1987	0.03
SW-5	10/29/1987	0.13
SW-5	11/18/1987	0.00
SW-5	12/16/1987	0.00
SW-5	1/13/1988	0.00
SW-5	2/11/1988	0.08
SW-5	3/17/1988	0.01
SW-5	3/17/1988	0.01
SW-5	5/27/2005	0.91
SW-5	9/25/2005	0.00
SW-5	5/30/2006	0.01
SW-5	9/7/2006	0.01
SW-5	12/30/2006	0.00
SW-5	3/29/2007	0.00
SW-5	6/22/2007	0.00
SW-5	12/29/2007	0.00
SW-5	5/1/2008	0.06
SW-5	6/18/2008	0.01
Sink Valley Wash monitoring site		
SW-9	10/29/1987	0.02
SW-9	11/17/1987	0.04
SW-9	12/16/1987	0.00

Site	Date	Discharge (cfs)
SW-9	1/13/1988	0.00
SW-9	2/16/1988	1.70
SW-9	3/24/1988	0.00
SW-9	6/17/2005	0.00
SW-9	9/24/2005	0.00
SW-9	11/3/2005	0.00
SW-9	3/30/2006	0.02
SW-9	5/29/2006	0.00
SW-9	6/18/2006	0.00
SW-9	12/20/2006	0.00
SW-9	3/29/2007	0.00
SW-9	6/20/2007	0.00
SW-9	9/30/2007	0.00
SW-9	12/29/2007	0.00
SW-9	3/21/2008	0.41
SW-9	3/22/2008	0.00

Table 2 Summary of Alton Coal LBA reconnaissance-level Identification study designations

	Water Availability Criteria					Geologic Criteria	
Identifica ion Area	Presently irrigated?	Potentially Irrigable?	Sufficient water for irriga ion?	Subirrigated lands?	Agriculturally important?	Flood plains/terraces present?	Identification-stage AVF designation
Area 1	Yes	Yes	Yes	No	Yes	Yes	Probable AVF
Area 2	No	Yes	Probably	No	Probably not	Yes	Possible AVF (unlikely)
Area 3	No	Yes	Probably not	No	Probably not	Yes	Possible AVF (unlikely)
Area 4	Yes	Yes	Yes	No	Yes	Yes	Probable AVF
Area 5	No	Yes	Probably not	No	Probably not	Yes	Possible AVF (unlikely)
Area 6	No	Yes	Probably not	No	Probably not	Yes	Possible AVF (unlikely)
Alton Town and adjacent	Yes	Yes	Yes	No	Yes	No	Not an AVF
Lower Robinson Creek	No	Yes	Probably not	No	Probably not	No	Not an AVF

Note: Other areas within the study area were determined to have not met the identification-stage AVF identification criteria.



1927 North American Datum; UTM grid zone 12
Generated by BigTopo7 (www.igage.com)
Map compiled from USGS Quads: Long Valley Junction; UT Alton; UT Glendale; UT Bald Knoll; UT

0 ¼ ½ 1 2 Miles
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NORTH

BigTopo Map

PETERSEN HYDROLOGIC, LLC
CONSULTANTS IN HYDROGEOLOGY

LBA AVF Recon.cdr
21 October 2009

Study area boundary

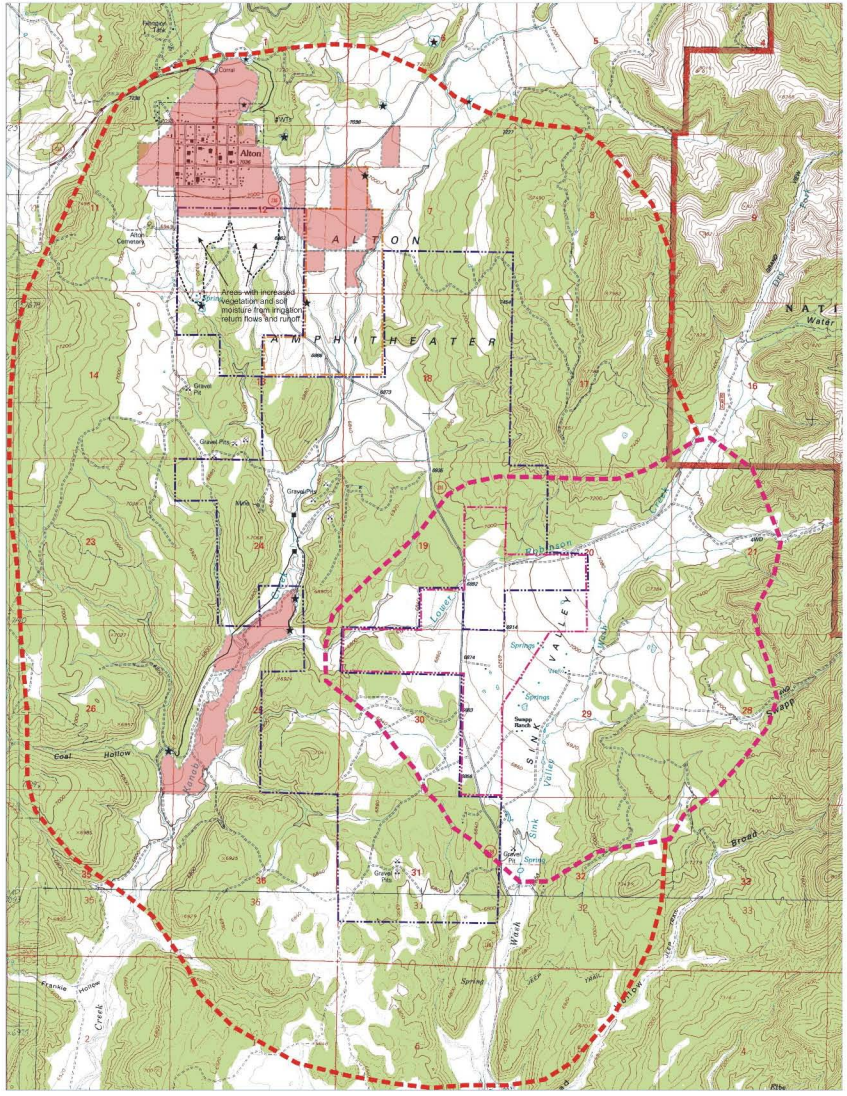
Coal Hollow Project study area boundary (separate investigation)

SW-2 Surface-water monitoring site.

Alton Coal LBA boundaries

Private coal boundaries

Plate 1 Study area location and surface-water data sites.



1927 North American Datum; UTM grid zone 12
Generated by BigTopo7 (www.igage.com)
Map compiled from USGS Quads: Long Valley Junction; UT Alton; UT Glendale; UT Bald Knoll; UT

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NORTH

BigTopo Map

PETERSEN HYDROLOGIC, LLC
CONSULTANTS IN HYDROGEOLOGY

LBA AVF Recon.cdr
21 October 2009

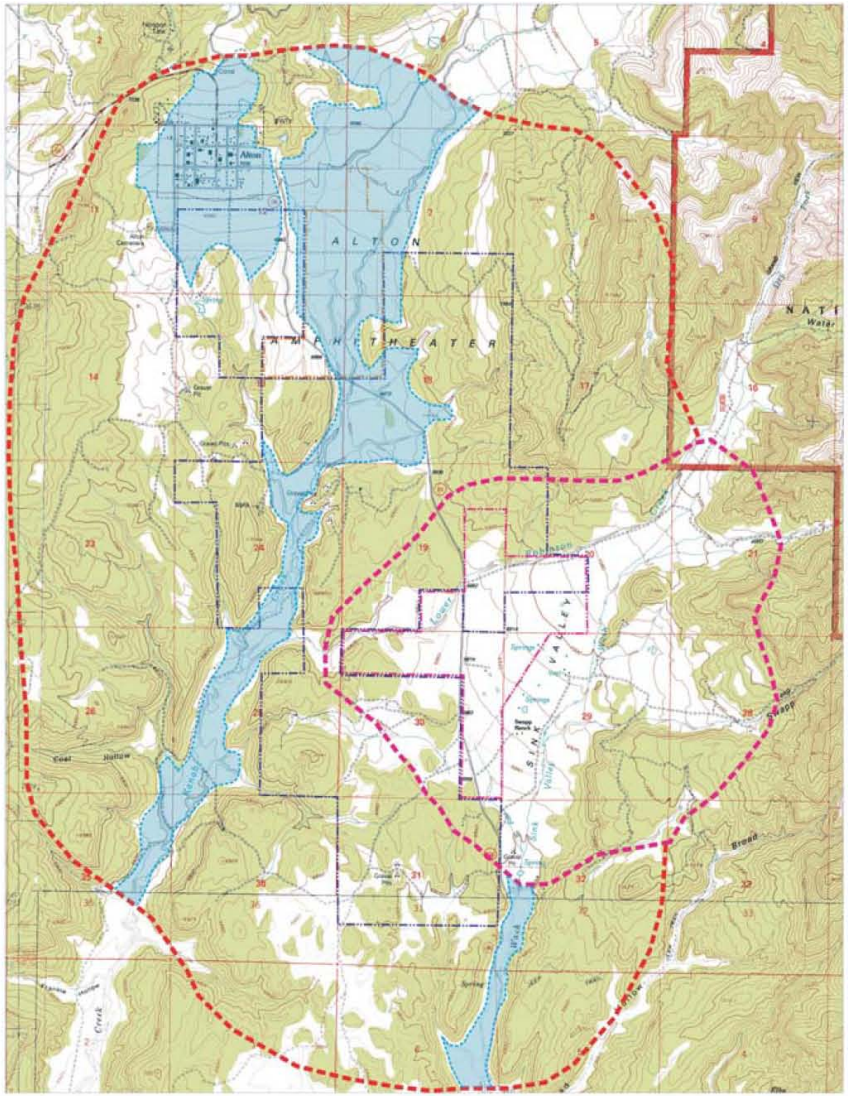
Presently irrigated lands

Irrigation diversion

Pond

Irrigation canal/ditch

Plate 2 Locations of presently irrigated lands, irrigation ditches, diversions, and ponds.



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Generated by BigTopo7 (www.igage.com)
Map compiled from USGS Quads: Long Valley Junction; UT Alton; UT Glendale; UT Bald Knoll; UT

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NORTH

BigTopo Map

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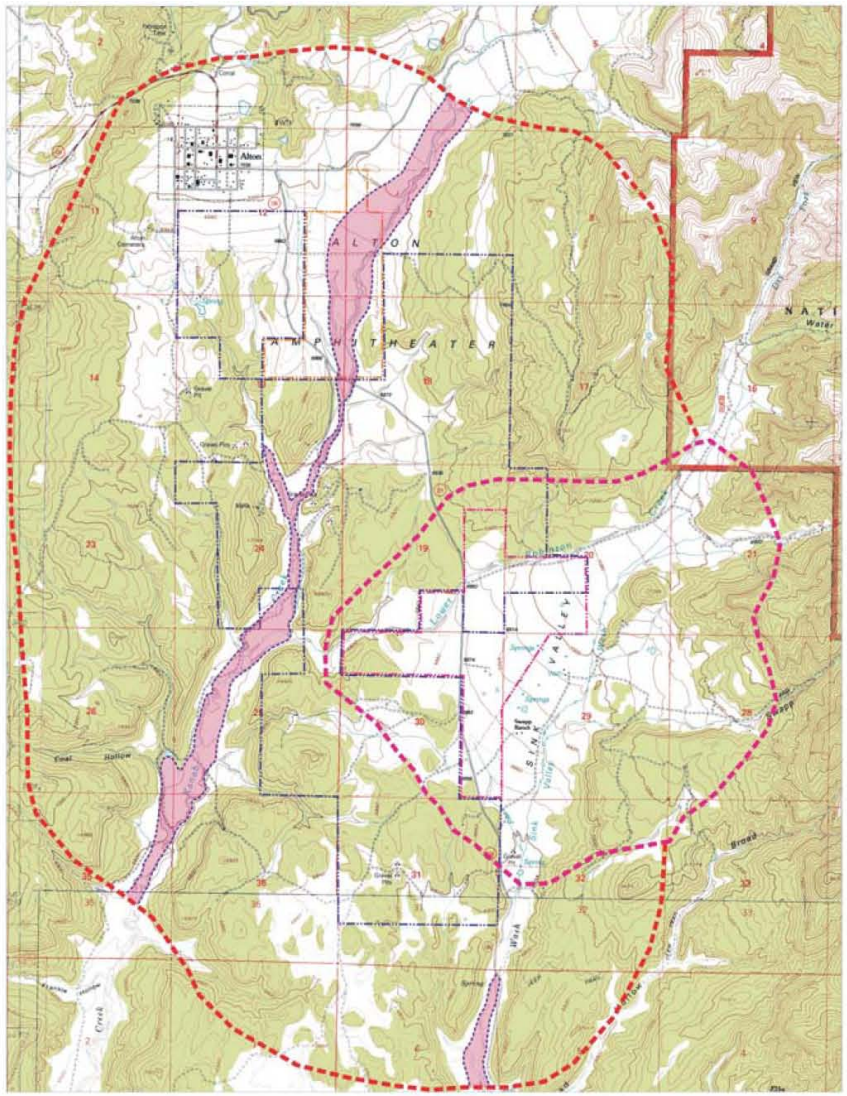
Lands which appear to have the capability of being flood irrigated

L8A AVF Recon.cdr
21 October 2009

Plate 3 Lands which appear to have the capability of being flood irrigated.



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Generated by BigTopo7 (www.igage.com)
Map compiled from USGS Quads: Long Valley Junction; UT Alton; UT Glendale; UT Bald Knoll; UT

0 ¼ ½ 1 2 Miles
1000 0 2000 4000 6000 8000 10,000 Feet
1,000 Meters 500 0 ½ 1 2 Kilometers

NORTH

BigTopo Map

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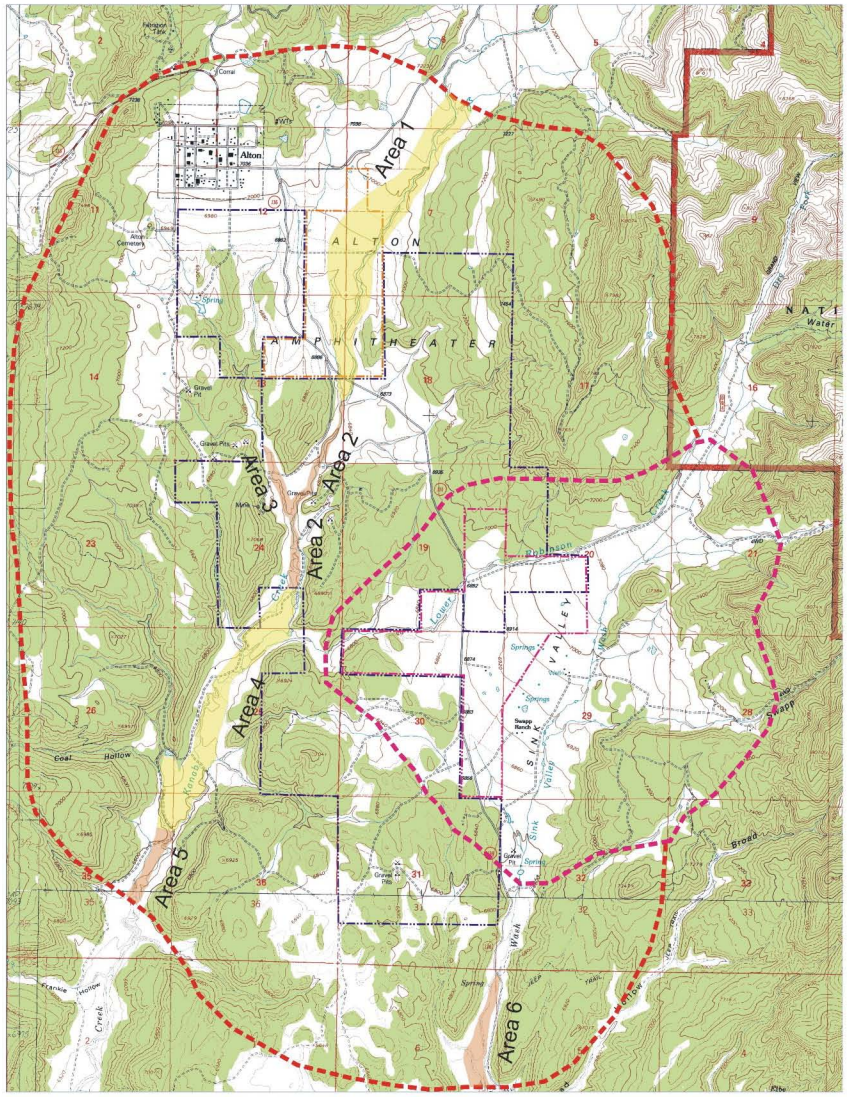
21 October 2009

flood plains and terraces (approximate locations)

Plate 4 Map of flood plain and terrace locations (approximate).



0 ¼ ½ 1 2 Miles

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1,000 Meters 500 0 ½ 1 2 Kilometers

NORTH

1927 North American Datum; UTM grid zone 12
Generated by BigTopo7 (www.igage.com)
Map compiled from USGS Quads: Long Valley Junction; UT Alton; UT Glendale; UT Bald Knoll; UT

BigTopo Map

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Probable AVF area

Potential AVF area

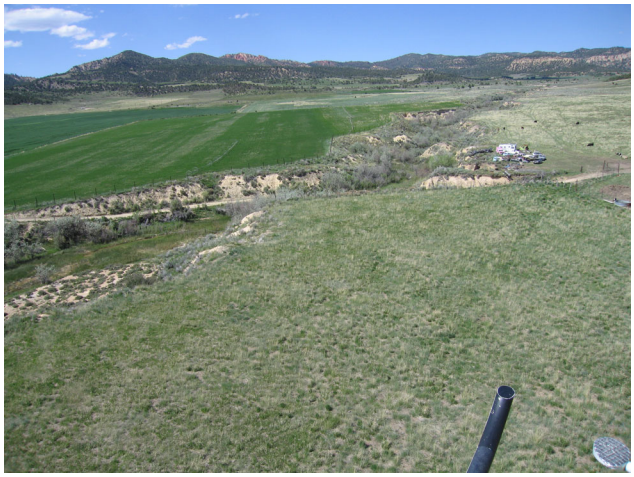
LBA AVF Recon.cdr
21 October 2009

Note: The delineations presented here are for reconnaissance level evaluations and are not presented for final coal mine permitting actions.

Plate 5 Delineation of probable and potential AVF areas as determined by reconnaissance level investigation.

Photograph #1
View of central portion of Area 1.
Note incised Kanab Creek drainage.

Photograph #2
View of central portion of Area 1.
Note incised Kanab Creek drainage
and sprinkler irrigation.



Photograph #3
View looking north from cenral Area 1
near stream monitoring site SW-1.
Note incised Kanab Creek drainage.

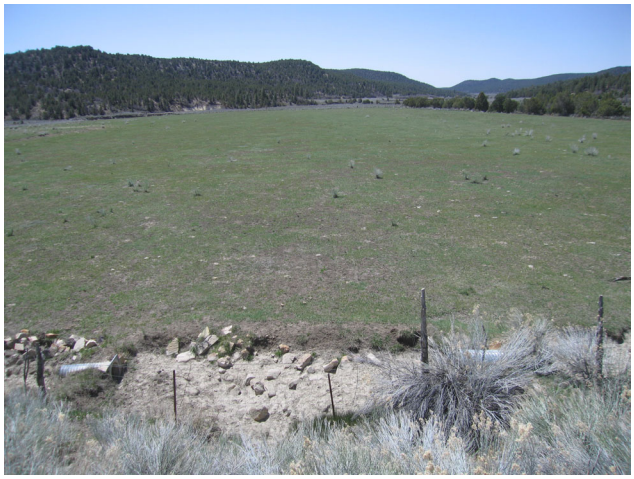
Photograph #4
View looking south in Area 2.
Note narrow valley bottom and
active flood plain area.

Photograph #5
View looking north in Area 2.
Note narrow valley bottom.

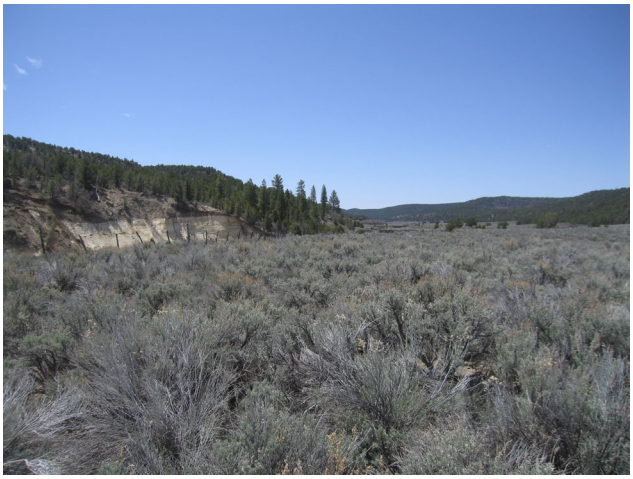
Photograph #6
View looking north in Area 3.
Note narrow valley bottom.

Photograph #7
View looking south in Area 3.

Photograph #8
View looking south in Area 4.
Note flood irrigated pasture/hay
field in foreground.



Photograph #9
View looking south from high bench below pond in southern part of Area 4.
Note irrigation infrastructure in foreground.



Photograph #10
View looking south in southern portion of Area 4.
Note lack of agriculture and bedrock outcrop in incised Kanab Creek steam channel on left.

Photograph #11
View looking south in Area 5.
Note deeply incised Kanab Creek stream channel.

Photograph #12
View looking south from Area 6.
Note deeply incised Sink Valley Wash stream channel.

Photograph #13
Aerial view of Area 6 below the county road crossing of Sink Valley Wash.
Note deeply incised stream channel.

Photograph #14
View looking east in the central upland portion of the Alton Coal LBA area.
Note rolling hills and chipped pinyon And juniper trees.

APPENDIX G.
INTERDISCIPLINARY TEAM ANALYSIS RECORD CHECKLIST

INTERDISCIPLINARY TEAM ANALYSIS RECORD CHECKLIST

INSTRUCTIONS: **Follow these instructions and then remove this text box by selecting the box with the left mouse button, then clicking on edit then cut.**

GENERAL INSTRUCTIONS

This Interdisciplinary Team Analysis Record Checklist should be completed at an interdisciplinary team meeting to identify issues, conflicts or potential impacts that may oNPccur as a result of a proposed action. Each item of the analysis checklist will only be completed by the appropriate resource specialist – *NOT BY THE PROJECT LEADER* (unless the project leader is the appropriate specialist). For example, only the Archaeologist should fill out the sections on Cultural Resources and Native American Religious Concerns. The EA/DNA/CX preparer then uses the information from the checklist to guide preparation of the EA/DNA/CX.

SPECIFIC INSTRUCTIONS

Column 1 **- Write in one of the following:**

- "NP" (*not present in project area*);
- "NI" (*present in project area but not impacted by the proposed project*)
- "PI" (*present and potentially impacted by the proposed project*) – this item or resource will be carried forward in the EA as an issue.
- "NC" (*this is for DNAs only – anticipated resource impacts are not changed from those analyzed in the original NEPA document from which you are basing the DNA*).

Column 2 **- List of Critical Elements of the Human Environment/Resources/Other Concerns**
Critical Elements are listed first.

Column 3 - **Date Reviewed**
Enter the date the proposed project is reviewed/checklist is filled out by that particular specialist.

Column 4 - **Signature**
Resource specialist signs in this column (after reviewing proposed project and providing input on whether his/her particular element/resource/concern is present in the project area and may be impacted by the action).

Column 5 - **Review Comments**
This is the rationale section. The resource specialist gives his/her reasoning for the determination made in Column 1. It should include information explaining how he/she came to their conclusion.

- ***NP*** - How does specialist know the element/resource/concern is not present? Site visit conducted (if so, list date of visit)? Familiarity with location? Etc.
- ***NI –*** What is the rationale/reason why this element/resource/concern would not be impacted by the proposed action? (See EA Template section of the Guidebook for examples.) This rationale must show that serious consideration was given as to why no impacts would be expected – "trust me" statements without substance (such as *"No impacts anticipated as a result of the proposed action"*) are not acceptable.
- ***PI*** – Give a brief summary of what the issue is (this will be carried forth into Chapter I of the EA as the introductory issue statement).
- ***NC*** – Explain why the resource impacts from the current proposed action would be the same as those in the original EA.

INTERDISCIPLINARY TEAM ANALYSIS RECORD CHECKLIST

Project Title: Alton Coal EIS

NEPA Log Number:

File/Serial Number:

Project Leader: Keith Rigtrup

FOR EAs/CXs: NP: not present; NI: resource/use present but not impacted; PI: potentially impacted
FOR DNAs only: NC: no change (anticipated resource impacts not changed from those analyzed in the NEPA document on which the DNA is based)

STAFF REVIEW OF PROPOSAL:

NP/NI/PI NC	Resource	Date Reviewed	Signature	**Review Comments** (required for all NIs and PIs. PIs require further analysis**.)**
CRITICAL ELEMENTS				
PI	Air Quality *(Carson)*	4/28/08	/s/ C. Gubler	Standard Operating procedures and other mitigating measures would need to be incorporated into the mining operation to ensure that Air quality is maintained.
NP	Areas of Critical Environmental Concern *(Tom C.)*	4/25/08	/s/T. Christensen	
PI	Cultural Resources *(Matt Z.)*	4/25/08	/s/ M. Zweifel	Cultural resource inventories have been completed and numerous cultural resource sites have been identified. A Cultural Resource Management Plan detailing proposed mitigation is under development.
NP	Environmental Justice *(Keith)*	4/28/08	/s/ K. Rigtrup	No low income or minority populations in the project area.
NP	Farmlands (Prime or Unique) *(John)*	4/25/08	/s/ J. Reese	
NI	Floodplains *(Carson)*	4/28/08	/s./ C. Gubler	Flood plains will be put back the same, and on site mitigation will take place as a result of compliance with UDOGM.
PI	Invasive, Non-native Species *(Carson)*	4/28/08	/s./ C. Gubler	Some invasives are found within the LBA, the potential for them to increase is there if mitigating measures are not taken.
PI	Native American Religious Concerns *(Matt Z.)*	4/25/08	/s/ M. Zweifel	Initial Native American consultation has been performed, and will be updated as required. Comments regarding the potential loss of cultural resource sites have been received from at least one Tribe, and Tribal comments and input to the Cultural Resources Management Plan will be sought when a draft plan is available.
NI	Threatened, Endangered or Candidate Plant Species *(Carson)*	4/28/08	/s/ C. Gubler	No Threatened Endangered or Candidate Plant species are known to exist within the project area.
PI	Threatened, Endangered or Candidate Wildlife Species *(Lisa)*	4/24/08	/s/L. Church	Current USFWS list needs to be utilized for analysis. Presence and absence of habitat would need to be determined. No known T and E or C animals in the project area, wintering raptors ie Bald Eagles, may utilize habitat for wintering roosting.
PI	Wastes (hazardous or solid) *(Doug P.)*	4/25/2008	/s/ Doug Powell	Large industrial operations such as the proposed action have a potential for solid and hazardous waste issues. Standard operating procedures and other mitigating measures would need to be incorporated.

NP/NI/PI NC	Resource	Date Reviewed	Signature	**Review Comments** (required for all NIs and PIs. PIs require further analysis**.)**
PI	Water Quality (drinking/ground) *(Carson)*	4/28/08	/s/ C. Gubler	The potential exists for Water Quality to be degraded or impacted as a result of this action. Mitigating measures would need to be incorporated into the project to ensure water quality above and below ground are not impacted.
PI	Wetlands/Riparian Zones *(Lisa)*	4/24/08	/s/ L.Church	Portions of Robinson Creek may be temporarily diverted for life of project will be 404 permitted and restored. Mitigations and reclamation plans would be part of project.
NP	Wild and Scenic Rivers *(Tom C.)*	4/25/08	/s/T. Christensen	
NP	Wilderness *(Tom C.)*	4/25/08	/s/T. Christensen	
OTHER RESOURCES / CONCERNS*				
PI	Rangeland Health Standards and Guidelines *(Carson)*	4/28/08	/s/ C. Gubler	Rangeland Health standards and Guidelines will be affected by the proposed action. Reclamation will have to occur to ensure that the land is returned to a functioning state.
PI	Livestock Grazing *(John)*	4/28/08	/s/ J. Reese	Livestock grazing in the project area may be impacted during mining activities; mitigation may be required with grazing permittees. Reclamation planning would need to consider reconstructing all fences and other range improvements located within effected area.
PI	Woodland / Forestry *(John)*	4/28/08	/s/ J. Reese	Woodland/Forestry in the project area would be impacted by mining activities. The removal of invaded Pinyin and Juniper trees would be a positive impact on the land.
PI	Vegetation *(John)*	4/28/08	/s/ J. Reese	Vegetation in the project area would be impacted by mining activities. Reclamation planning must include a re-vegetation and reseeding plan using species currently on site along with others the BLM specialists feel appropriate for the site.
PI	Fish and Wildlife *(Lisa)*	4/24/08	/s/L.Church	Sage grouse and brooding and winter habitat in the project area may be impacted by mining activities, mitigations could be required. Reclmation planning would need to consider this species, deer, elk, turkeys and other sagebrush obligates, including pygmy rabbits. Raptors may utilize are winter roosting , and or nesting.
PI	Soils *(John)*	4/28/08	/s/ J. Reese	Soils in the project area would be impacted by the mining activities. Reclamation planning must consider a soil stabilization plan which may include re-contouring and the construction of water bars where appropriate. (see vegetation) for re-vegetation requirements.
PI	Recreation *(Tom C.)*	4/25/08	/s/T. Christensen	Minor occasional recreation uses/activities (hunting, nature study, photography, etc.) would be impacted on project site itself. Recreation on adjacent public lands would be affected somewhat by noise, dust and visual intrusions from mining operation.
PI	Visual Resources *(Tom C.)*	4/25/08	/s/T. Christensen	Substantial visual contrast expected due to nature of operation and size of disturbance area. Visual contrasts would remain until site portions are rehabilitated after removal of coal layer.
PI	Geology / Mineral Resources *(Doug P.)*	4/25/2008	/s/ Doug Powell	Geologic and mineral resources would be impacted by the proposed action. Geologic hazards relating to mining may also exist.
	Paleontology *(Alan T.)*			
PI	Lands / Access *(Hugh)*	4/28/2008	/s/ Hugh Wolfe	Possible Re-routing of the county road would be needed. This would create the need for a temporary FLPMA Tile V right-of-way for the length of the project.

NP/NI/PI NC	Resource	Date Reviewed	Signature	**Review Comments** (required for all NIs and PIs. PIs require further analysis**.)**
PI	Fuels / Fire Management *(Carson)*	4/28/08	/s/ C. Gubler	Fuels and Fire management may be impacted by the proposed action, however most impacts would be positive as invaded Pinyon Juniper lands are cleared.
PI	Socio-economics *(Keith)*	4/28/08	/s/ K. Rigtrup	The mining operations would have beneficial economic impacts to local and state tax revenue as well as to local businesses. There could also be social impacts with new workers moving into local communities.
NP	Wilderness characteristics *(Tom C.)*	4/25/08	/s/T. Christensen	

FINAL REVIEW:

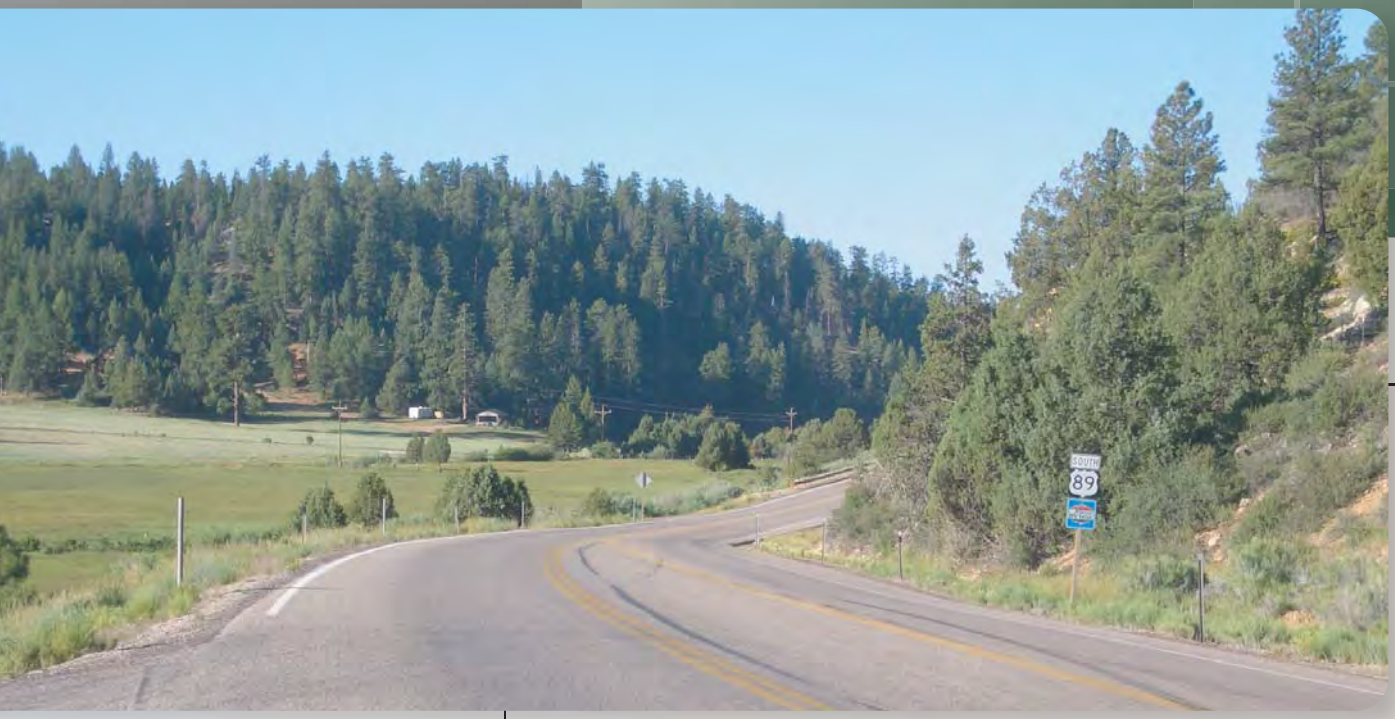
Reviewer Title	Date	Signature	Comments
NEPA Coordinator (Dennis)			
Manager ( )			

NOTE: Review Comments should include information explaining how the specialist came to their conclusion - how does he/she know the element/resource is not present (site visit and date of visit, familiarity with location, etc.). For all 'NIs' give a brief explanation as to why that element/resource would not be impacted.

* The list of Other Resources / Concerns to be considered may vary by individual field office. Note: Native American Trust Responsibilities should be considered for FO's with Indian Mineral interests.

APPENDIX H.
COAL HOLLOW DEVELOPMENT ALTON COAL EIS - TRAFFIC TECHNICAL REPORT

FEHR PEERS



Coal Hollow Development
Alton Coal EIS - Traffic Technical Report

Submitted to:

SWCA Environmental Consultants
Revised July 2013
UT06-721

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APPENDICES

Appendix A: Traffic Counts
Appendix B: Detailed of Service Reports
Appendix C: Detailed Crash Data

1. Introduction

This section provides a brief summary of the overall project, the traffic analysis methodology, the analysis scenarios, and the report organization.

1.1. Background

The Alton Coal Development, LLC is proposing a new coal mine near the town of Alton, Utah. The project study area is in Southern Utah south of Panguitch and Bryce Canyon National Park and north of Glendale. Figure 1 displays the study area location.

1.2. Study Purpose and Analysis Scenarios

This report documents the analysis of traffic operations associated with existing conditions, existing plus coal truck conditions, future 2020 background conditions, and future 2020 plus coal truck conditions. These scenarios will provide information on current traffic conditions and for comparison of the additional project coal trucks.

The one signalized intersection that was evaluated along the proposed truck route includes:

1) I-15 SB Off-ramp / SR-56 (Cedar City)

The four unsignalized intersections that were evaluated along the proposed truck route include:

1) US-89 / SR-14
2) US-89 / SR-12
3) US-89 / SR-143 (Main St. Panguitch)
4) US-89 / SR-20

Twenty-four hour pneumatic tube counts were recorded at the following locations:

1) US-89, approximately two miles south of the SR-14 junction
2) US-89, approximately three miles north of the SR-12 junction
3) US-89, approximately two miles south of the SR-20 junction
4) SR-20, just east of the summit (westbound upslope, eastbound downslope)

1.3. Analysis Methodology

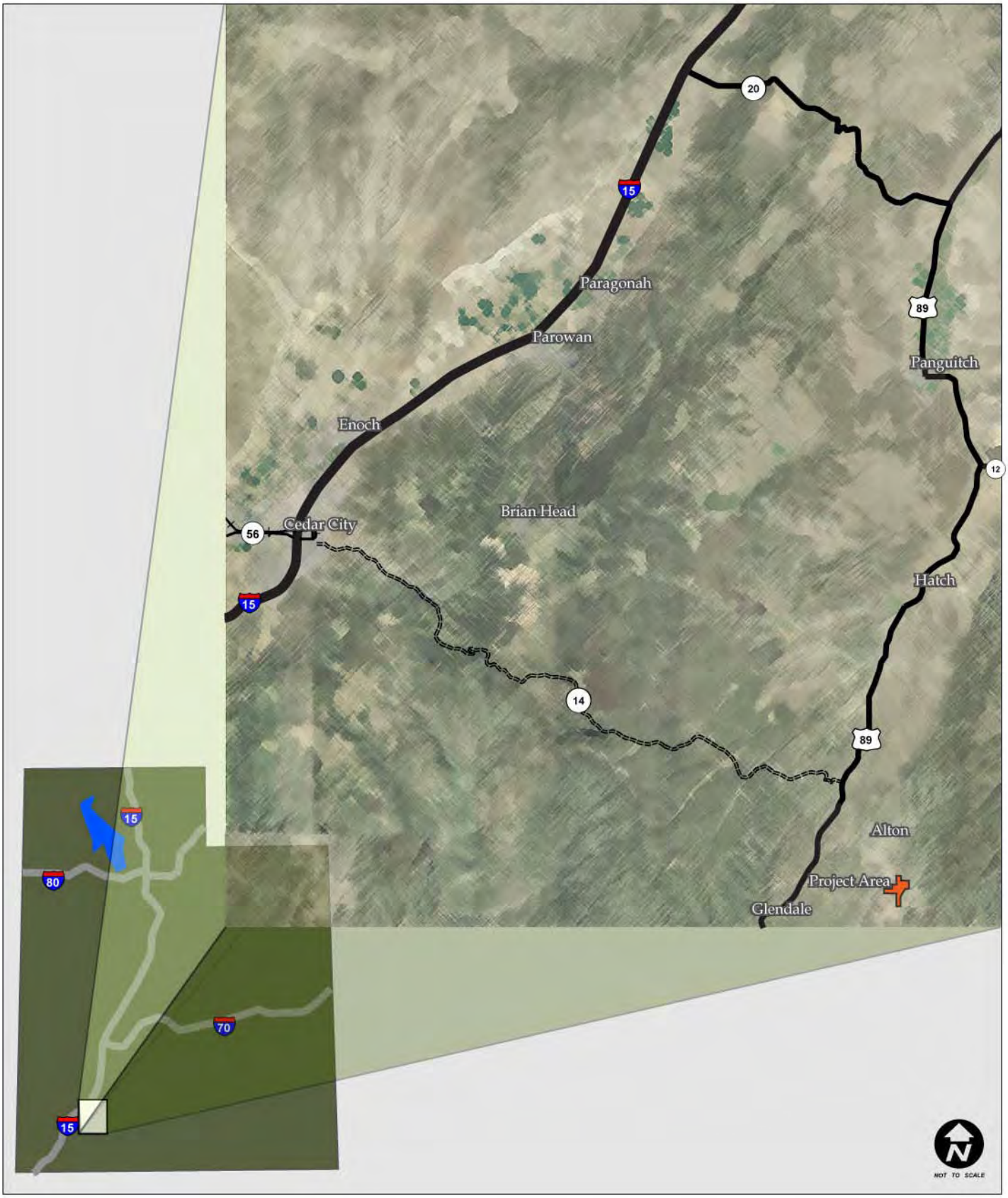
The Highway Capacity Manual 2000 (HCM 2000) methodology was used in this study to remain consistent with “state-of-the-practice” professional standards. Synchro and HCS software’s were used to apply this methodology.

1.3.1. Measures of Effectiveness

Two Measures of Effectiveness (MOEs) were used to quantify traffic conditions for the various scenarios. The MOEs for two lane highways are Level of Service (LOS) and Time-Spent-Following, and the MOEs used for intersections are LOS and delay (seconds per vehicle).

Intersection

LOS is a measure of traffic operating conditions, which varies from LOS A (the best) to LOS F (the worst). LOS reflects the amount of congestion and delay motorists experience at intersections. Table 1 describes the LOS and delay criteria from the *HCM 2000* for signalized and unsignalized intersections. The *HCM 2000* methodology has different quantitative evaluations for signalized and unsignalized intersections. For signalized intersections, the LOS is provided for the overall intersection (weighted average of all approach delays).



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STUDY AREA
COAL HOLLOW TRAFFIC TECHNICAL REPORT
FIGURE 1

For unsignalized intersections, LOS is reported based on the worst approach. Fehr & Peers has also calculated overall delay values for unsignalized intersections, which provides additional information and represents the overall intersection conditions rather than just the worst approach. Both are reported in their respective tables throughout the report.

Table 1
Intersection Level of Service Descriptions

Level of Service	Description of Traffic Conditions	Signalized Intersections	Unsignalized Intersections
		Average Delay[1] (sec / veh)	Delay[2] (sec / veh)
A	*Free Flow / Insignificant Delay* Extremely favorable progression. Individual users are virtually unaffected by others in the traffic stream.	0 to 10	0 to 10
B	*Stable Operations / Minimum Delays* Good progression. The presence of other users in the traffic stream becomes noticeable.	> 10 to 20	> 10 to 15
C	*Stable Operations / Acceptable Delays* Fair progression. The operation of individual users is affected by interactions with others in the traffic stream.	> 20 to 35	> 15 to 25
D	*Approaching Unstable Flows / Tolerable Delays* Marginal progression. Operating conditions are noticeably more constrained.	> 35 to 55	> 25 to 35
E	*Unstable Operations / Significant Delays Can Occur* Poor progression. Operating conditions are at or near capacity.	> 55 to 80	> 35 to 50
F	*Forced, Unpredictable Flows / Excessive Delays* Unacceptable progression with forced or breakdown of operating conditions.	> 80	> 50

1. Overall intersection LOS and average delay (seconds/vehicle) for all approaches.
2. Worst approach LOS and delay (seconds/vehicle) only.
Source: Fehr & Peers Descriptions, based on *Highway Capacity Manual,* 2000 Methodology (Transportation Research Board).

Two-Lane Highway Segment

The MOEs used for two-way segments are: LOS and Percent Time-Spent-Following. LOS is a measure of traffic flow conditions, which varies from LOS A (the best) to LOS F (the worst). For Class I highways, LOS reflects the percent time-spent-following and average travel speed. For Class II highways, LOS is defined by percent time-spent-following. Table 2 shows the association of LOS with Percent Time-Spent-Following and Average Travel Speed based on criteria from the *HCM 2000* for two-lane Class I highways and Table 3 for Class II highways (Chapter 20).

Table 2 Two-Lane Highways (Class I) Level of Service Descriptions		
Level of Service	**Percent Time-Spent Following**	**Average Travel Speed (mi/h)**
A	0 to 35	> 55
B	> 35 to 50	> 50 to 55
C	> 50 to 65	> 45 to 50
D	> 65 to 80	> 40 to 45
E	> 80	40 to 0
F	See note below[1]	
1. LOS F applies whenever the flow rate exceeds the segment capacity. Source: *Highway Capacity Manual,* 2000 Methodology (Transportation Research Board).		

Table 3 Two-Lane Highways (Class II) Level of Service Descriptions	
Level of Service	**Percent Time-Spent Following**
A	0 to 40
B	> 40 to 55
C	> 55 to 70
D	> 70 to 85
E	> 85
F	See note below[1]
1. LOS F applies whenever the flow rate exceeds the segment capacity. Source: *Highway Capacity Manual,* 2000 Methodology (Transportation Research Board).	

The *HCM 2000* states that Directional Segment methodology addresses three types of directional segments: extended directional segments, specific upgrades, and specific downgrades. The methodology for directional segments is analogous to the two-way segment methodology, except that it estimates traffic performance measures and LOS for one direction of travel at a time. However, the operational assessment of one direction of travel on a two-lane highway necessarily considers the opposing traffic volume.

1.4. Report Organization

The report is organized into the following four sections:

- ***Section 1 - Introduction*** discusses the purpose, analysis methodology, and organization of the report.

- ***Section 2 - Existing Conditions*** describes the existing roadway network, data collection efforts, traffic characteristics, and results.
- ***Section 3 – Existing Plus Trucks Conditions*** addresses existing volumes with the additional project coal trucks traffic conditions including traffic operational results.
- ***Section 4 – Future 2020 Background Conditions*** addresses future 2020 background (without project coal trucks) traffic conditions including a description of the traffic forecasting process and traffic operational results.
- ***Section 5 – Future 2020 Plus Trucks Conditions*** addresses future 2020 background volumes with the additional project coal trucks traffic conditions including the traffic operational results.
- ***Section 6 – Commonly Used Acronyms*** lists acronyms used in the report and their meanings.
- ***Section 7 - References*** lists the references cited throughout the report.

2. Existing Conditions

This section of the report describes the existing study area characteristics and summarizes the data collection effort. The purpose of the existing (year 2007) analysis is to evaluate the intersections and roadways during the peak travel periods of the day under existing traffic and geometric conditions. Technical data supporting these findings are included in the appendix.

2.1. Roadway Characteristics

There are four Federal and State roads along the proposed Alton Coal project haul route.

US-89 is a north/south state highway that extends through many cities and jurisdictional boundaries. In the project study area, a majority of US-89 is classified as a Category 2 (System Priority Rural) roadway. However, in the vicinity of towns of Hatch and Panguitch, US-89 is classified as a Category 4 (Regional Rural) roadway on the outskirts of town and a Category 7 (Community Rural) roadway in the center of town. US-89 has a two-lane cross section with occasional passing lanes on steep upgrades. The cross section is expanded to four-lanes through the town of Panguitch. US-89 also serves as the main tourist connection to National Parks such as Bryce Canyon and Zion Canyon. Within the study area, the speed limit is 65 mph except through the town of Hatch and Panguitch, where it is reduced to 40 mph and 35 mph respectively. The existing Average Daily Traffic (ADT) and percent heavy trucks along US-89 is as follows: 4,000 vpd and 18% trucks (South of SR-14 Junction), 4,100 vpd and 21% trucks (North of SR-12 Junction), 3,600 vpd and 25% trucks (South of SR-20 Junction).

SR-20 is an east/west state road that serves as a connector road between I-15 and US-89. SR-20 is classified as a Category 4 (Regional Rural) roadway. SR-20 has a two-lane cross section with a climbing lane for slower traffic on the steep updgrade towards the summit. SR-20 has a posted speed limit of 60 mph from the US-89 junction to the steep upgrade, 35 mph climbing the steep upgrade to the summit, and 65 mph from the summit to I-15. The existing ADT is 2,509 vpd with 27% heavy trucks.

I-15 is a four-lane divided interstate freeway that runs north/south through Utah and also traverses through the States of Idaho to the north and Nevada and Arizona to the south. Along the proposed coal truck haul route, I-15 has a speed limit of 75 mph from SR-20 to Cedar City. The existing ADT between SR-20 and Cedar City is 16,200 vpd with 26% heavy trucks.

SR-56 is an east/west state road that runs from SR-130 in Cedar City to the Nevada Stateline. SR-56 is labeled as 200 North running through the center of Cedar City. SR-56 is classified as a Category 5 (Regional Priority Urban) roadway through the center of Cedar City, a Category 3 (System Priority Urban) on the outskirts of Cedar City, a Category 4 (Regional Rural) outside of Cedar City, and a Category 9 (Other) towards the Nevada Stateline. SR-56 has a posted speed limit of 45 mph on the proposed coal truck haul route. The cross section varies from four-lanes in the center of Cedar City to two-lanes outside of the city. The existing ADT near the I-15 Junction is 8,600 vpd with 10% heavy trucks.

2.2. Land Use Characteristics

The project study area consists of a variety of land uses including residential and commercial through the towns and rural undeveloped areas outside of the towns.

2.3. Data Collection Effort

The data collection effort for the existing conditions included daily, a.m. and p.m. peak period traffic volumes, intersection geometry, GPS travel time runs, and accident information. This information was used provide a quantitative evaluation of existing traffic conditions.

2.3.1. Daily and Peak Hour Volume Counts

Twenty-four hour traffic counts were conducted from June 19 to June 25, 2007 at three locations on US-89 and one location on SR-20. These locations were selected to provide a general understanding of traffic conditions along the proposed coal truck haul route. Table 4 shows existing directional ADT volumes.

Table 4
Existing Average Daily Traffic (ADT) Volumes

Location	Direction of Travel		Total	Percentage Heavy Trucks
	Northbound[1]	Southbound[2]		
US-89 (south of SR-14)	2,110	1,866	3,978	24%
US-89 (north of SR-12)	2,064	1,998	4,062	26%
US-89 (south of SR-20)	1,790	1,806	3,596	25%
SR-20 (east of summit)	1,242	1,267	2,509	28%

1. Eastbound for the count on SR-20
2. Westbound for the count on SR-20
Source: Fehr & Peers, 2008

Peak period traffic counts were collected on June 19-26, 2007 at the following intersections:

- US-89 / SR-14 – (2-Way Stop)
- US-89 / SR-12 – (One-Way Stop/Yield)
- US-89 / SR-143 (Main St.) – (All-Way Stop)
- US-89 / SR-20 – (One-Way Stop)
- I-15 SB Off-ramp / SR-56 – (Signalized)

These counts were seasonally adjusted using information obtained from the Utah Department of Transportation (UDOT) permanent count stations. The appendix contains the traffic count data.

2.3.2. Intersection Geometry

Intersection geometries were measured during field visits to the study area.

2.4. Crash Information

UDOT Traffic and Safety generated a three-year crash history for US-89, SR-20, I-15, and SR-56. Accident rates are calculated by determining the number of accidents per million vehicle-miles traveled. Severity is a measure of damage that is caused by an accident. A severity of 1 indicates that the accident caused property damage and a severity of 5 indicates that there was a fatality; see Table 5 for these descriptions.

Table 5 Accident Severity	
Severity	**Description**
1	Property Damage
2	Possible Injury
3	Bruises and Abrasions
4	Broken Bones or Bleeding Wounds
5	Fatal
Source: UDOT, Division of Traffic and Safety CARS Codes, 2001.	

Accidents were summarized for the three-year period from 2003 to 2005. The detailed Operational Safety Report's (OSR) that were done by UDOT can be found in the Appendix. Below is a summary of the OSR's broken down by roadway:

US-89 – Mile Post (MP) 90.04 to 156.36 (Glendale to Jct. SR-20)

- Total Accidents: 287
- Total Fatalities: 0
- 3 Year Accident Average: 95.67

US-89 Summary

	Actual	Expected
Severity Rate:	1.59	1.70
Crash Rate:	2.59	1.46

As shown above, the actual rate of accidents over the three-year study period indicates that there is a higher occurrence of accidents than would be expected and a lower severity rate as would be expected for a roadway similar to US-89. The OSR states that the predominant crash type is the single vehicle, accounting for 81.2% or 233 of the total number of crashes. The following list shows the breakdown of the single vehicle crashes:

Crash Type	**No.**	**% of Single Vehicle Crashes**
1. Wildlife Related	126	51.1
2. Ran Off Road Right	63	27.0
3. Ran Off Road Left	24	10.3
4. Fixed Object	10	4.3
5. Domestic Animal Related	5	2.1
6. Other Object	4	1.7
7. Overturned in Roadway	1	0.5
	233	100.0%

US-20 – MP 0.00 to 20.61 (I-15 to Jct. US-89)

- Total Accidents: 79
- Total Fatalities: 0
- 3 Year Accident Average: 26.33

US-20 Summary

	Actual	Expected
Severity Rate:	1.50	1.72
Crash Rate:	2.59	1.96

As shown above, the actual rate of accidents over the three-year study period indicates that there is a higher occurrence of accidents than would be expected, but a lower severity rate than would be expected for a roadway similar to SR-20. The OSR states that the predominant crash type is the single vehicle, accounting for 86.1% or 68 of the total number of crashes. The following list shows the breakdown of the single vehicle crashes:

Crash Type	**No.**	**% of Single Vehicle Crashes**
1. Ran Off Road Right	31	45.5
2. Ran Off Road Left	12	17.7
3. Wildlife Related	12	17.7
4. Fixed Object	10	14.7
5. Other Non-Collision	3	4.4
	68	100.0%

The OSR states that there were no clusters of crashes at any location and approximately 70% of these crashes occurred under inclement weather conditions (snowy/icy). The main contributing factor for crashes where vehicles ran off the road was excessive speed.

I-15 – MP 59.05 to 100.2 (Cedar City to SR-20)

- Total Accidents: 441
- Total Fatalities: 14
- 3 Year Accident Average: 147.00

I-15 Summary

	Actual	Expected
Severity Rate:	2.01	1.83
Crash Rate:	0.75	0.87

As shown above, the actual rate of accidents over the three-year study period indicates that there is a lower occurrence of accidents than would be expected, but a higher severity rate than would be expected for a roadway similar to I-15. The OSR states that the predominant crash types are:

- Single Vehicle Crashes, accounting for 77.6% or 342 of the total number of crashes.
- Rear End Crashes, accounting for 11.1% or 49 of the total number of crashes.
- Same Direction Side Swipe, accounting for 9.8% or 43 of the total number of crashes.

The following list shows the breakdown of the single vehicle crashes:

Crash Type	**No.**	**% of Single Vehicle Crashes**
1. Ran Off Road Right	108	31.6
2. Ran Off Road Left	68	19.9
3. Ran Off Road Thru Median	44	12.9
4. Wildlife Related	39	11.4

5. Other Object	25	7.3
6. Fixed Object	23	6.7
7. Other Non-Collision	22	6.4
8. Overturned in Roadway	10	2.9
9. Pedestrian Related	1	0.3
10. Bicycle Related	1	0.3
11. Domestic Animal Related	1	0.3
	342	100.0%

The OSR states that there were no clusters of crashes at any location. The primary factors for crashes where vehicles ran off the road were:

1. Excessive speed
2. Falling asleep at the wheel
3. Other improper driver behavior

Rear end crashes occurred mostly as some drivers were following too closely and sideswipe crashes were caused primarily by drivers attempting an unsafe passing maneuver.

The total of 12 fatal crashes resulted in 14 fatalities. The following are the crashes that are associated with the fatal crashes:

Crash Type	**No.**
1. Running Off Road	11 (6 caused by falling asleep at the wheel)
2. Rear End	1
3. Pedestrian Related	1
4. Sideswipe	1
	12

SR-56 – MP 9.80 to 61.39

- Total Accidents: 174
- Total Fatalities: 2
- 3 Year Accident Average: 58.00

SR-56 Summary

	Actual	Expected
Severity Rate:	1.69	1.77
Crash Rate:	2.03	2.14

As shown above, the actual rate of accidents over the three-year study period indicates that there is a lower occurrence of accidents than would be expected and a lower severity rate as would be expected for a roadway similar to SR-56. The OSR states that the predominant crash types are:

- Single Vehicle Crashes, accounting for 48.3% or 84 of the total number of crashes.
- Rear End Crashes, accounting for 19.0% or 33 of the total number of crashes.
- Right Angle Crashes, accounting for 16.1% or 28 of the total number of crashes.
- Left Turn Crashes, accounting for 6.90% or 12 of the total number of crashes.

The following list shows the breakdown of the single vehicle crashes:

Crash Type	No.	% of Single Vehicle Crashes
1. Wildlife Related	34	40.5
2. Ran Off Road Left	16	19.0
3. Ran Off Road Right	16	19.0
4. Domestic Animal Related	6	7.1
5. Fixed Object	4	4.8
6. Other Non-Collision	3	3.6
7. Other Object	2	2.4
8. Bicycle Related	2	2.4
9. Pedestrian Related	1	1.2
	84	100.0%

The OSR states that there were no clusters of crashes at any location. The primary factors for crashes where vehicles ran off the road were:

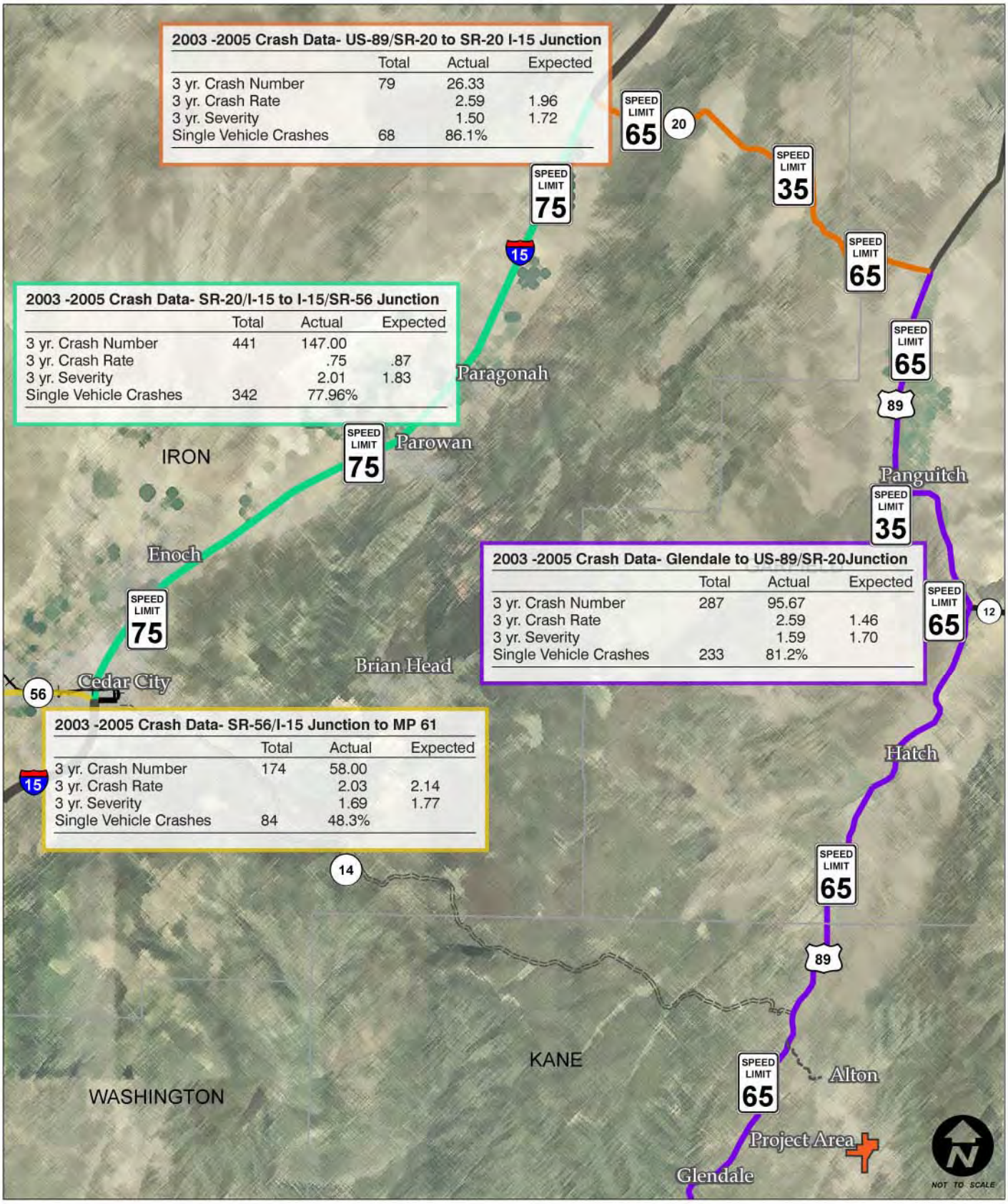
1. Excessive speed
2. Falling asleep at the wheel
3. Driving Under the Influence (DUI)

Rear end, left turn, and right angle crashes occurred mostly at intersections on the western boundary of Cedar City.

One of the two fatal crashes was the result of a single vehicle that ran off the road. The other fatal crash was the result of an eastbound driver crossing the centerline and impacting the westbound driver head on. Figure 2 shows the study roadways with the associated crash data.

2.4.1 Future Crash Information

It is difficult to project increases in crashes due to the increase in truck traffic from the project. Historic crash data may not be indicative of future crash trends due to the disproportionate increase in truck traffic relative to general traffic. Given the increase in truck traffic that is anticipated with the project, the total number of crashes due to trucks could potentially increase; however, there is no supporting evidence that increased traffic will result in a higher crash rate for an uncongested highway facility with a lower than expected crash rate currently.



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POSTED SPEEDS AND CRASH DATA
COAL HOLLOW DEVELOPMENT TRAFFIC TECHNICAL REPORT
FIGURE 2

2.5. Existing Traffic Conditions Results

The existing conditions analysis was done using the Highway Capacity Software (HCS) for the unsignalized intersections and the Synchro 6.0 software for the signalized intersection. HCS was also used for the roadway segment LOS analysis.

2.5.1. Intersection Conditions

Existing conditions MOEs are reported in LOS and delay. Table 6 displays the existing 2007 a.m. LOS and delay (seconds/vehicle) for the study intersections. Figure 3 shows the a.m. and p.m. intersection volumes and LOS results.

Table 6
Existing 2007 a.m. Peak Hour LOS and Delay

Intersection	Worst Approach[1]			Overall Intersection[2]	
	Approach	LOS	Delay	LOS	Delay
US-89 / SR-14	EB	A	9.4	A	3.8
US-89 / SR-12	WB	A	9.5	A	5.8
US-89 / SR-143 (Main St.)	SB	A	8.7	A	8.1
US-89 / SR-20	SB	A	9.5	A	8.1
I-15 SB Off-ramp / SR-56				C	21.1

Notes:
1. This represents the worst approach LOS and delay (seconds / vehicle) and is only reported for unsignalized intersections.
2. This represents the overall intersection LOS and delay (seconds / vehicle).

Source: Fehr & Peers, 2008

As shown in Table 6, all intersections operate at LOS C or better during the a.m. peak hour. Table 7 displays the existing 2007 p.m. LOS and delay for the study intersections.

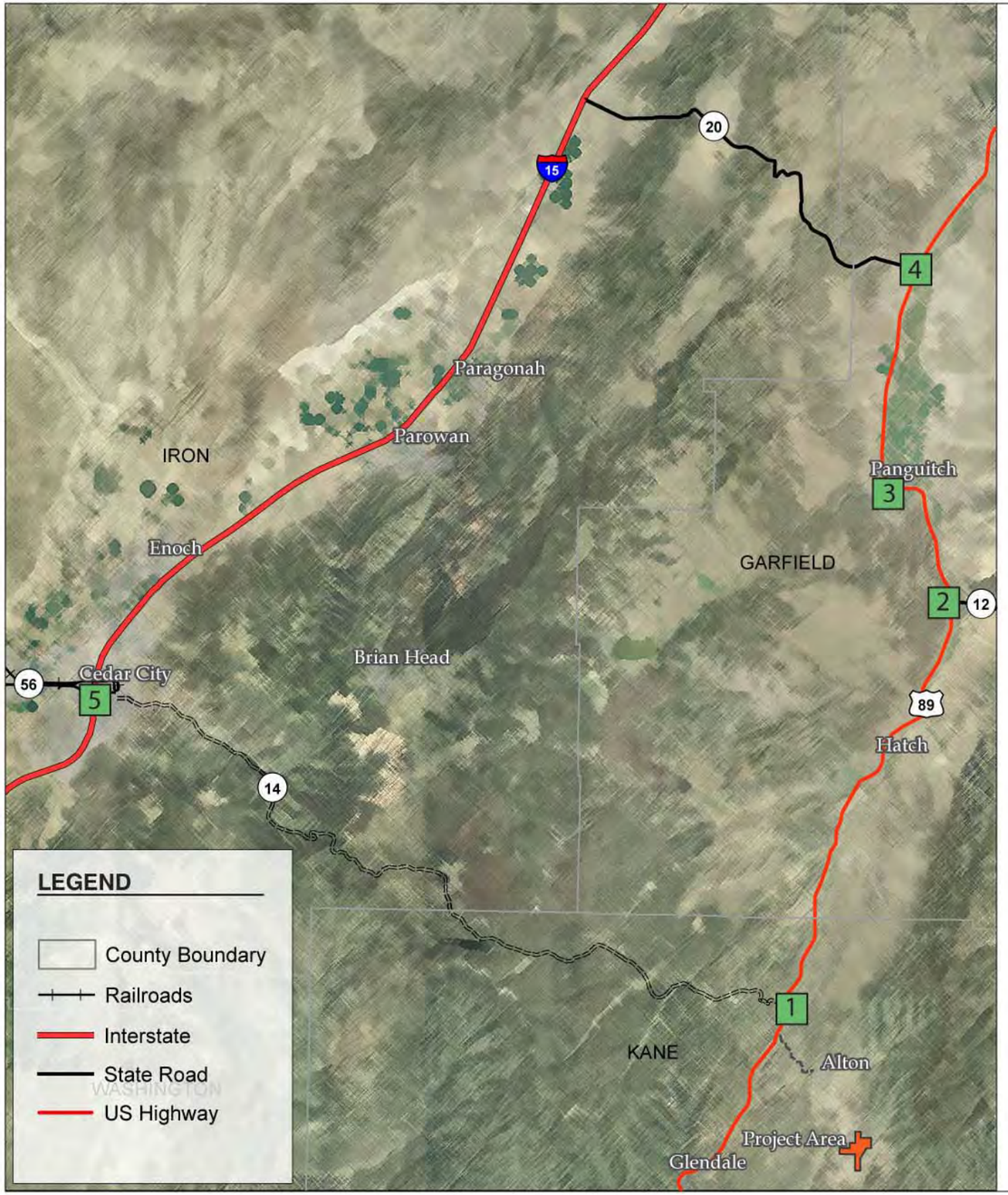
Table 7
Existing 2007 p.m. Peak Hour LOS and Delay

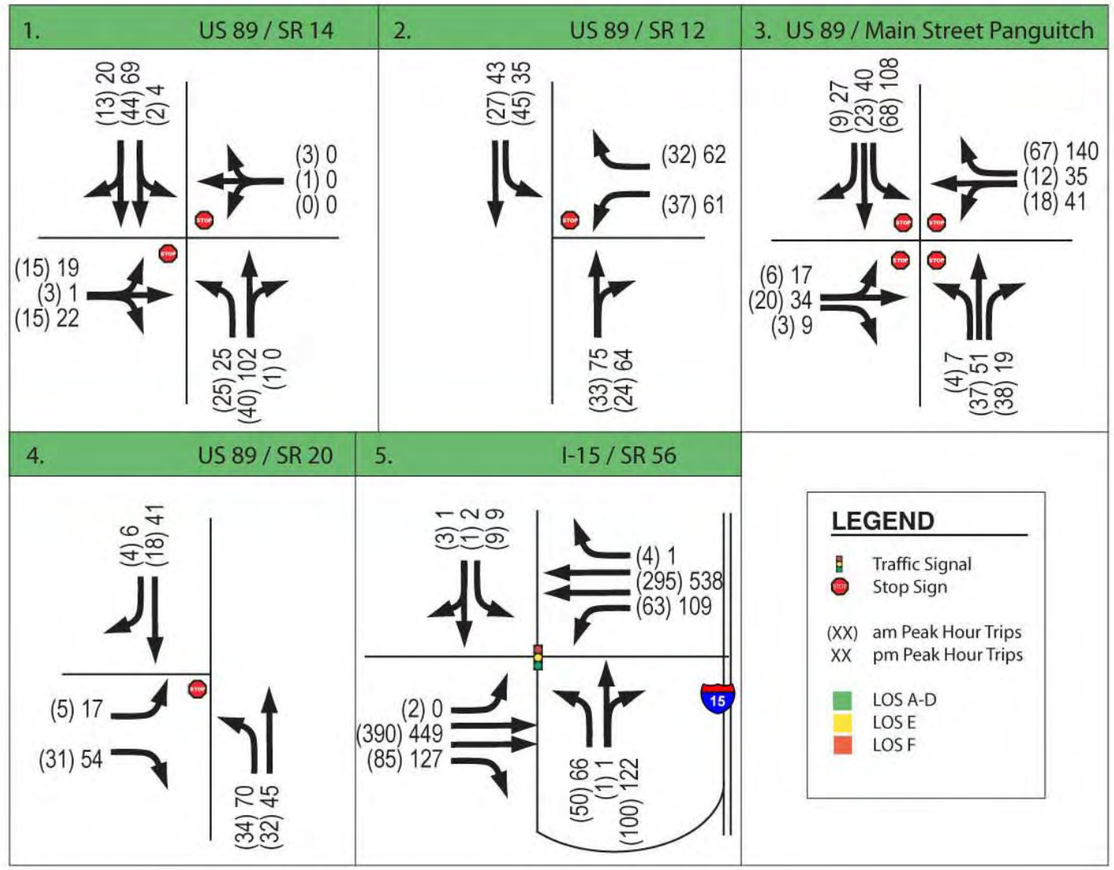
Intersection	Worst Approach[1]			Overall Intersection[2]	
	Approach	LOS	Delay	LOS	Delay
US-89 / SR-14	EB	A	9.8	A	2.1
US-89 / SR-12	WB	A	9.7	A	4.8
US-89 / SR-143 (Main St.)	SB	A	9.7	A	9.3
US-89 / SR-20	SB	A	9.8	A	7.5
I-15 SB Off-ramp / SR-56				C	20.6

Notes:
1. This represents the worst approach LOS and delay (seconds / vehicle) and is only reported for unsignalized intersections.
2. This represents the overall intersection LOS and delay (seconds / vehicle).

Source: Fehr & Peers, 2008

As shown in Table 7, all intersections operate at LOS C or better during the p.m. peak hour.





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EXISTING a.m. & p.m. TRAFFIC CONDITIONS
COAL HOLLOW DEVELOPMENT TRAFFIC TECHNICAL REPORT
FIGURE 3

2.5.2. Directional Segment Conditions

Table 8 displays the existing 2007 weekday and weekend LOS and Percent Time-Spent-Following for the study roadway segments. Figures 4 and 5 show the results of the weekday and weekend directional segment LOS analysis.

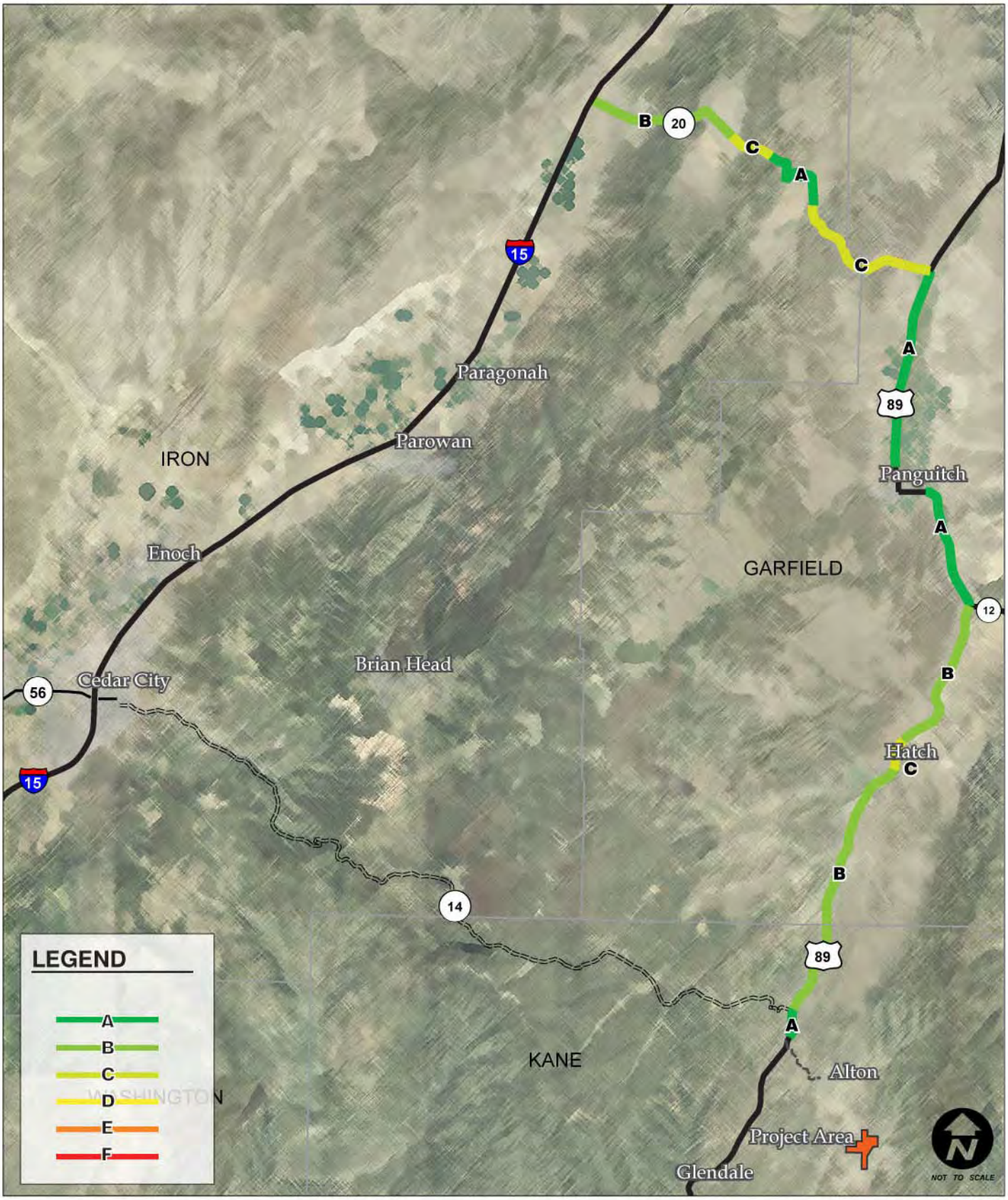
Table 8
Existing 2007 Directional Segment
Peak Hour LOS and Percent Time-Spent-Following

Intersection	Weekday			Weekend		
	Direction	LOS	% Time-Spent-Following	Direction	LOS	% Time-Spent-Following
US-89: Alton to SR-14	NB	A	33.3	NB	B	37.5
US-89: SR-14 to Hatch	NB	B	40.3	NB	B	45.2
US-89: Center of Hatch[1]	NB	C	87.0	NB	C	97.0
US-89: Hatch to SR-12	NB	B	39.5	NB	B	41.1
US-89: SR-12 to Panguitch	NB	A	27.6	NB	A	28.4
US-89: Panguitch to SR-20	NB	A	28.4	NB	A	30.8
SR-20: US-89 to Upslope	WB	C	33.4	WB	C	34.2
SR-20: Upslope to Summit[2]	WB	A	10.7	WB	A	13.7
SR-20: Summit to Downslope	WB	C	43.3	WB	C	45.2
SR-20: Downslope to I-15	WB	B	38.7	WB	C	39.0

Notes:
1. The analysis for the center of Hatch was done using HCS HIGHPLAN software due to the reduced highway speeds through town.
2. This segment of roadway was analyzed with a passing lane and as a Class II highway due to the low posted speed limit of 25 mph.

Source: Fehr & Peers, 2008

As shown in Table 8, all roadway segments operate at an LOS C or better except.



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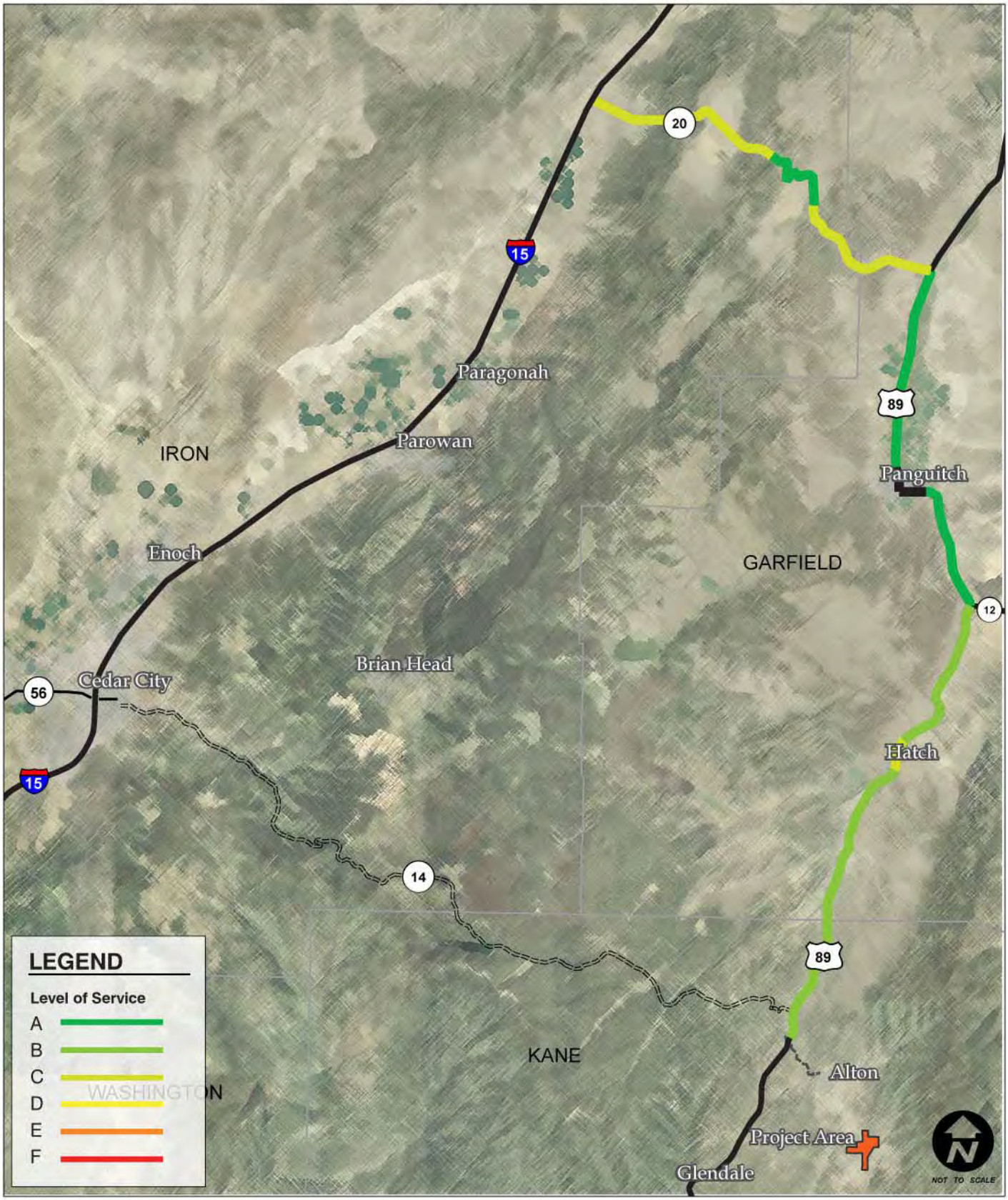
EXISTING WEEKDAY DIRECTIONAL LEVELS OF SERVICE
COAL HOLLOW DEVELOPMENT TRAFFIC TECHNICAL REPORT
FIGURE 4



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EXISTING WEEKEND DIRECTIONAL LEVELS OF SERVICE
COAL HOLLOW DEVELOPMENT TRAFFIC TECHNICAL REPORT

FIGURE 5

2.6. Travel Time Runs

Travel time runs were performed using a Global Positioning System (GPS) along the proposed coal truck haul route on US-89 and SR-20 traveling northbound on US-89 and westbound on SR-20. One travel time run was performed at free flow speeds and the other was performed while following a heavy truck to best simulate following a coal truck along the haul route.

Free Flow Run

	Travel Time (min)	Avg. Speed (mph)	Posted Speed (mph)
US-89: From Alton to SR-20	36	65	ranges from 35 to 65
SR-20: From US-89 to I-15	20	60	ranges from 25 to 65

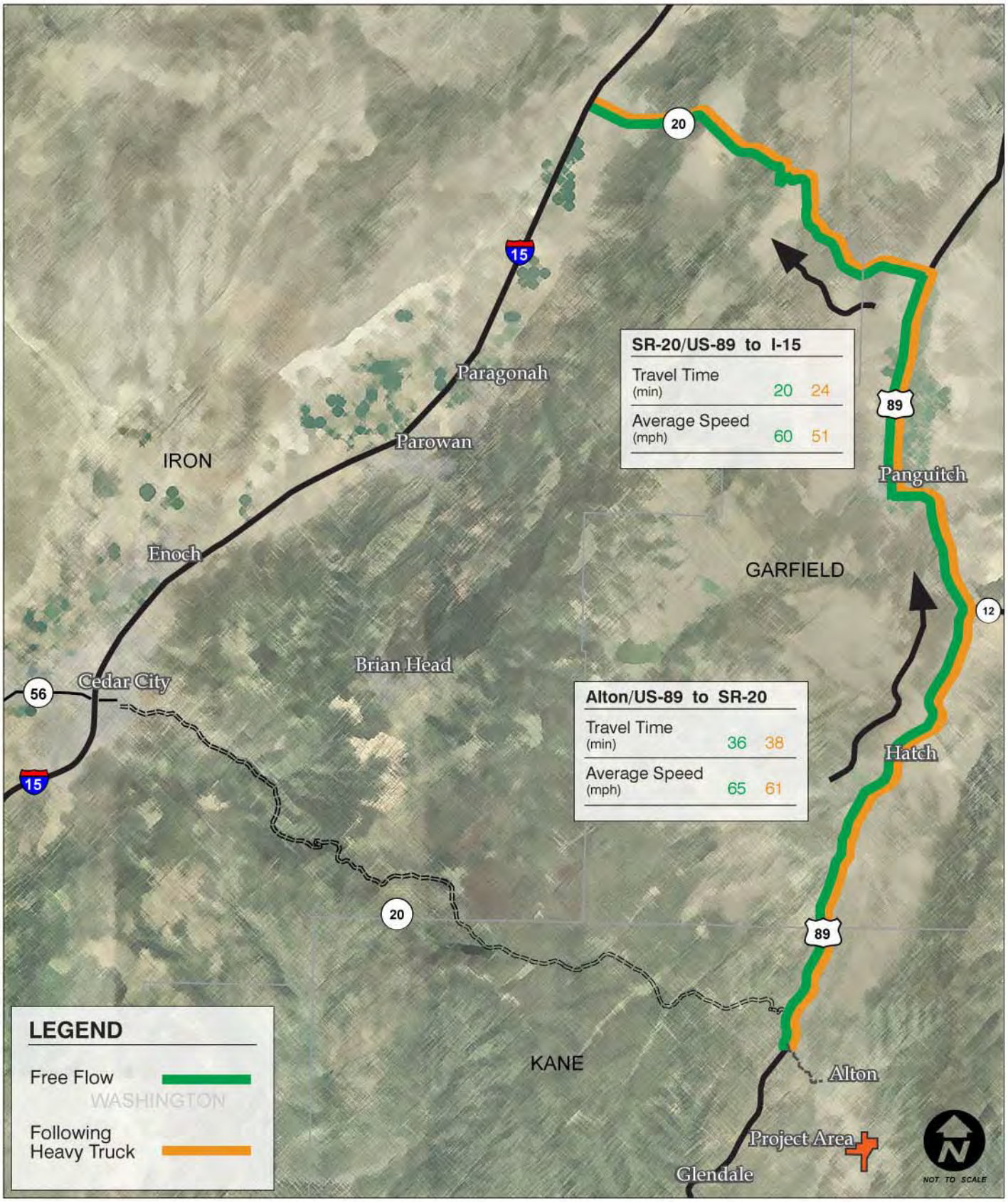
Following Heavy Truck

	Travel Time (min)	Avg. Speed (mph)	Posted Speed (mph)
US-89: From Alton to SR-20	38	61	ranges from 35 to 65
SR-20: From US-89 to I-15	24	51	ranges from 25 to 65

This shows that it takes an additional two minutes to travel from Alton to the SR-20 on US-89 while following a heavy truck and an additional four minutes to travel from US-89 to I-15 on SR-20. Figure 6 displays the travel time runs.

2.7. Existing Conditions Summary

Existing conditions at the study intersections have low delays per vehicle and little to no congestion. Existing conditions on the study roadways are low volumes with a substantial amount of capacity for future growth. Traffic generally flows at free flow speeds on all study roadways.



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TRAVEL TIME RUNS
COAL HOLLOW DEVELOPMENT TRAFFIC TECHNICAL REPORT

FIGURE 6

3. Existing Plus Trucks Conditions

This section of the report describes the existing plus trucks study area characteristics. The purpose of the existing plus trucks analysis is to evaluate the intersections and roadways during the peak travel periods of the day under existing traffic and geometric conditions plus the additional coal trucks that are proposed with the project coal mine. Technical data supporting these findings are included in the appendix.

Employees
The Alton Coal Development is estimating 100 employees for the mining operation. Based on a proposed estimated employee shift schedule and the work week schedule (Monday through Saturday), the project could generate between 25 and 50 (depending on how the shift schedules coincide) employee trips in the peak hours.

Due to the expected low number of employee trips generated by the mine development, the available capacity on the US-89 and the road to Alton, and the fact that a certain number of the employee trips will likely be captured internally to the town of Alton itself, no analysis was performed for employee generated traffic.

Trucks
The Alton Coal Development is proposing the mine operate 24 hours/day for six days a week (Monday through Saturday). The development estimates 150 coal trucks a day, or six trucks an hour, will be hauling coal from the mine site in Alton, UT north on US-89, west on SR-20, south on I-15, and west on SR-56 in Cedar City. The coal trucks are proposed to leave the coal mine site at nine and a half to ten minute headways.

3.1. Roadway Characteristics

The study roadways for the existing plus trucks conditions consists of the same geometry as the existing conditions; however, acceleration and deceleration lanes will need to be constructed at the proposed access onto US-89 near Alton.

3.2. Existing Plus Trucks Traffic Conditions Results

The existing plus trucks conditions analysis was done using HCS software for the unsignalized intersections and Synchro 6.0 software was used for the signalized intersection. HCS was also used for the roadway segment LOS analysis. As a conservative measure seven trucks an hour was used in the analysis.

Table 9 shows the increase in the percentage heavy trucks and the percentage increase in trucks with the additional trucks from the proposed development. The estimated 150 trucks were added in each direction to obtain the Existing + Project ADT and percentage of heavy trucks.

Table 9 Existing + Project Average Daily Traffic (ADT) Volumes					
Location	Direction of Travel		Total	Percentage Heavy Trucks[3]	Percentage Increase in Trucks[4]
	Northbound[1]	Southbound[2]			
US-89 (south of SR-14)	2,260	2,016	4,276	29%	31%
US-89 (north of SR-12)	2,214	2,148	4,362	31%	28%
US-89 (south of SR-20)	1,940	1,956	3,896	31%	33%
SR-20 (east of summit)	1,392	1,417	2,809	36%	43%

1. Eastbound for the count on SR-20
2. Westbound for the count on SR-20
3. The percent heavy trucks from existing volumes plus project truck volumes
4. The percent increase in heavy trucks with the addition of the project

Source: Fehr & Peers, 2008

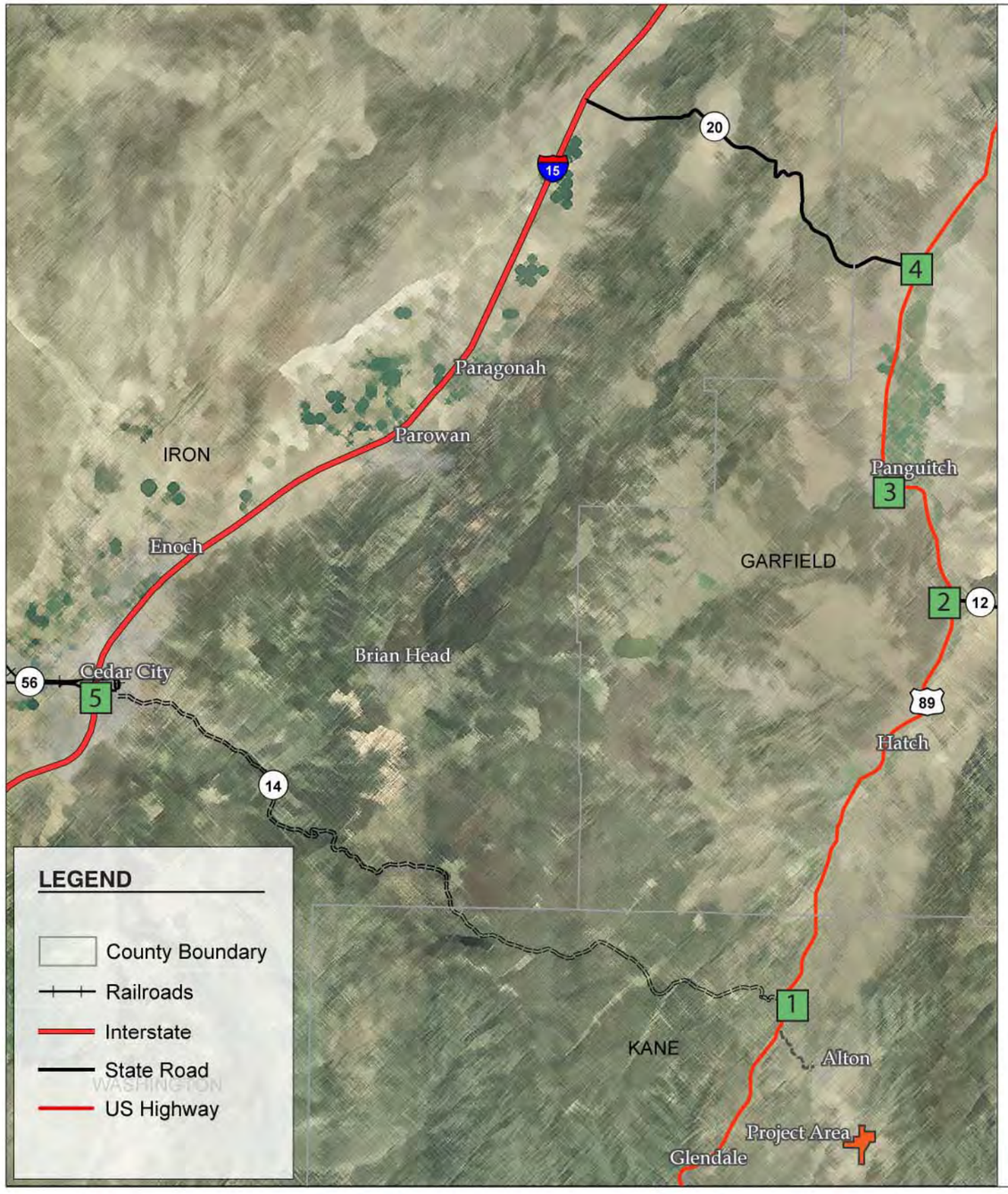
3.2.1. Intersection Conditions

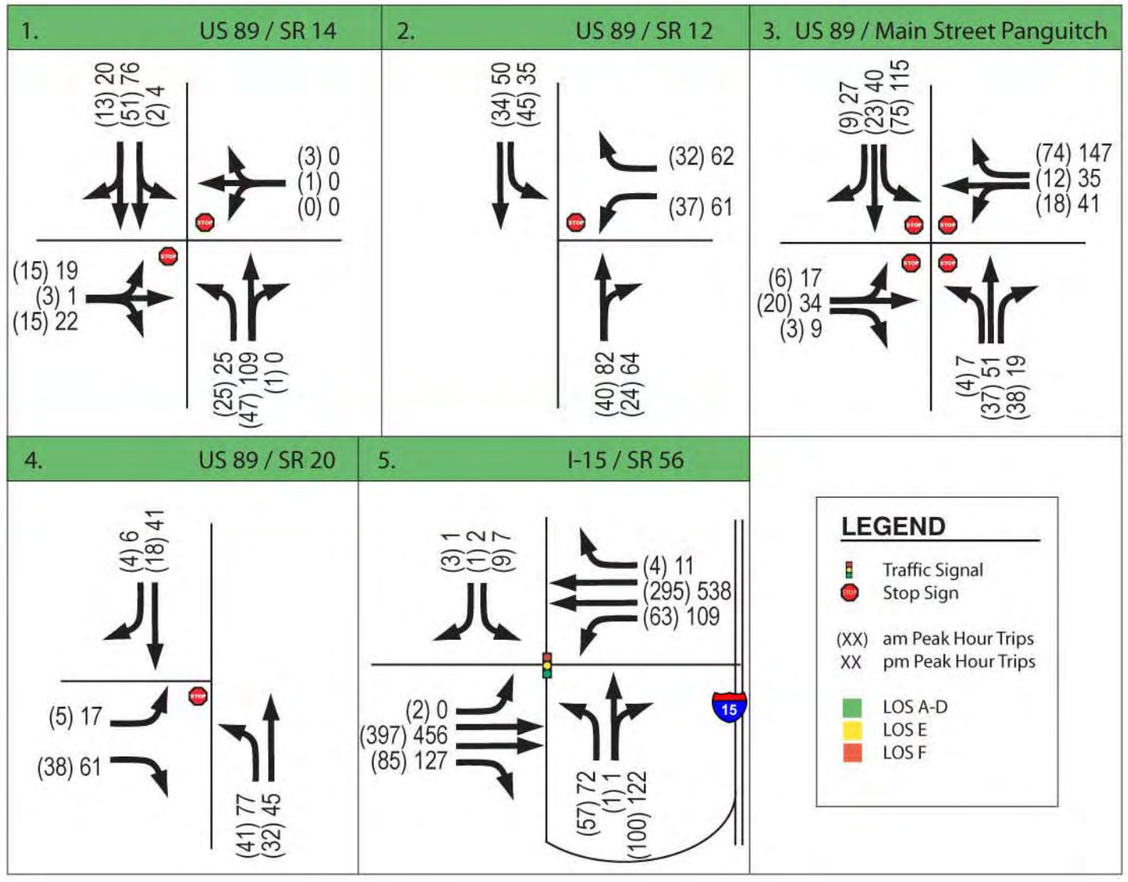
Existing plus trucks conditions MOEs are reported in LOS and delay. Table 9 displays the existing plus trucks a.m. LOS and delay for the study intersections. Figure 7 shows the a.m. and p.m. intersection volumes and LOS results.

Table 10 Existing Plus Trucks a.m. Peak Hour LOS and Delay					
Intersection	Worst Approach[1]			Overall Intersection[2]	
	Approach	LOS	Delay	LOS	Delay
US-89 / SR-14	EB	A	9.5	A	4.1
US-89 / SR-12	WB	A	9.5	A	5.5
US-89 / SR-143 (Main St.)	SB	A	8.9	A	8.3
US-89 / SR-20	SB	A	9.5	A	8.2
I-15 SB Off-ramp / SR-56				C	21.0

Notes:
1. This represents the worst approach LOS and delay (seconds / vehicle) and is only reported for unsignalized intersections.
2. This represents the overall intersection LOS and delay (seconds / vehicle).

Source: Fehr & Peers, 2008





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EXISTING PLUS TRUCKS A.M. & P.M. TRAFFIC CONDITIONS
COAL HOLLOW DEVELOPMENT TRAFFIC TECHNICAL REPORTS
FIGURE 7

As shown in Table 10, all intersections operate at LOS C or better during the a.m. peak hour. Table 10 displays the existing plus trucks p.m. LOS and delay for the study intersections.

Table 11
Existing Plus Trucks p.m. Peak Hour LOS and Delay

Intersection	Worst Approach[1]			Overall Intersection[2]	
	Approach	LOS	Delay	LOS	Delay
US-89 / SR-14	EB	A	9.9	A	2.5
US-89 / SR-12	WB	A	9.8	A	4.5
US-89 / SR-143 (Main St.)	SB	B	10.0	A	9.5
US-89 / SR-20	SB	A	9.8	A	7.5
I-15 SB Off-ramp / SR-56				C	20.6

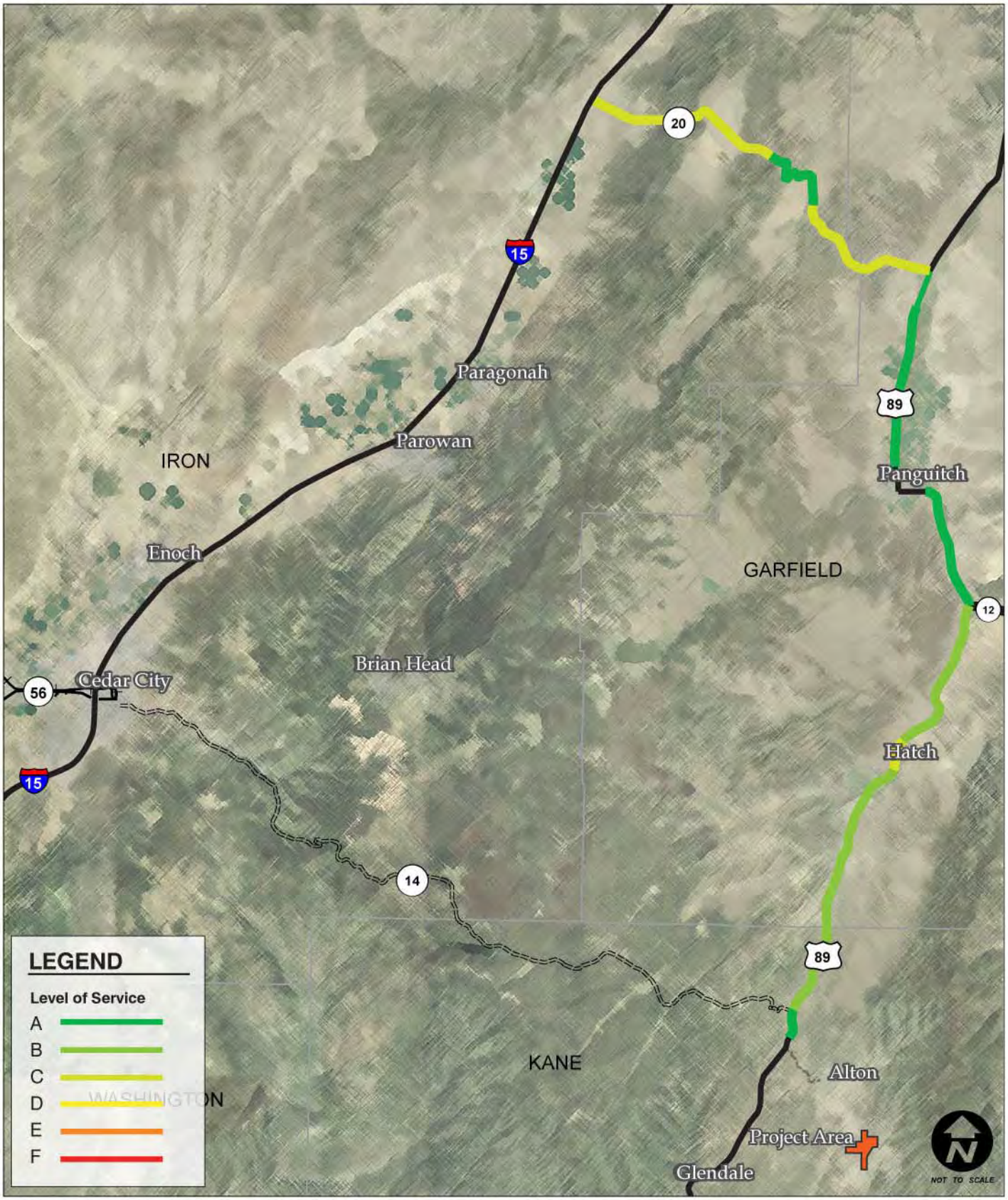
Notes:
1. This represents the worst approach LOS and delay (seconds / vehicle) and is only reported for unsignalized intersections.
2. This represents the overall intersection LOS and delay (seconds / vehicle).

Source: Fehr & Peers, 2008

As shown in Table 11, all intersections operate at LOS C or better during the p.m. peak hour.

3.2.2. Directional Segment Conditions

Existing plus trucks conditions MOEs for the two-lane highway directional segment analysis are reported in LOS and Percent Time-Spent-Following. Table 10 displays the existing plus trucks weekday and weekend LOS and Percent Time-Spent-Following for the study roadway segments. Figures 8 and 9 show the results of the weekday and weekend directional segment LOS analysis.



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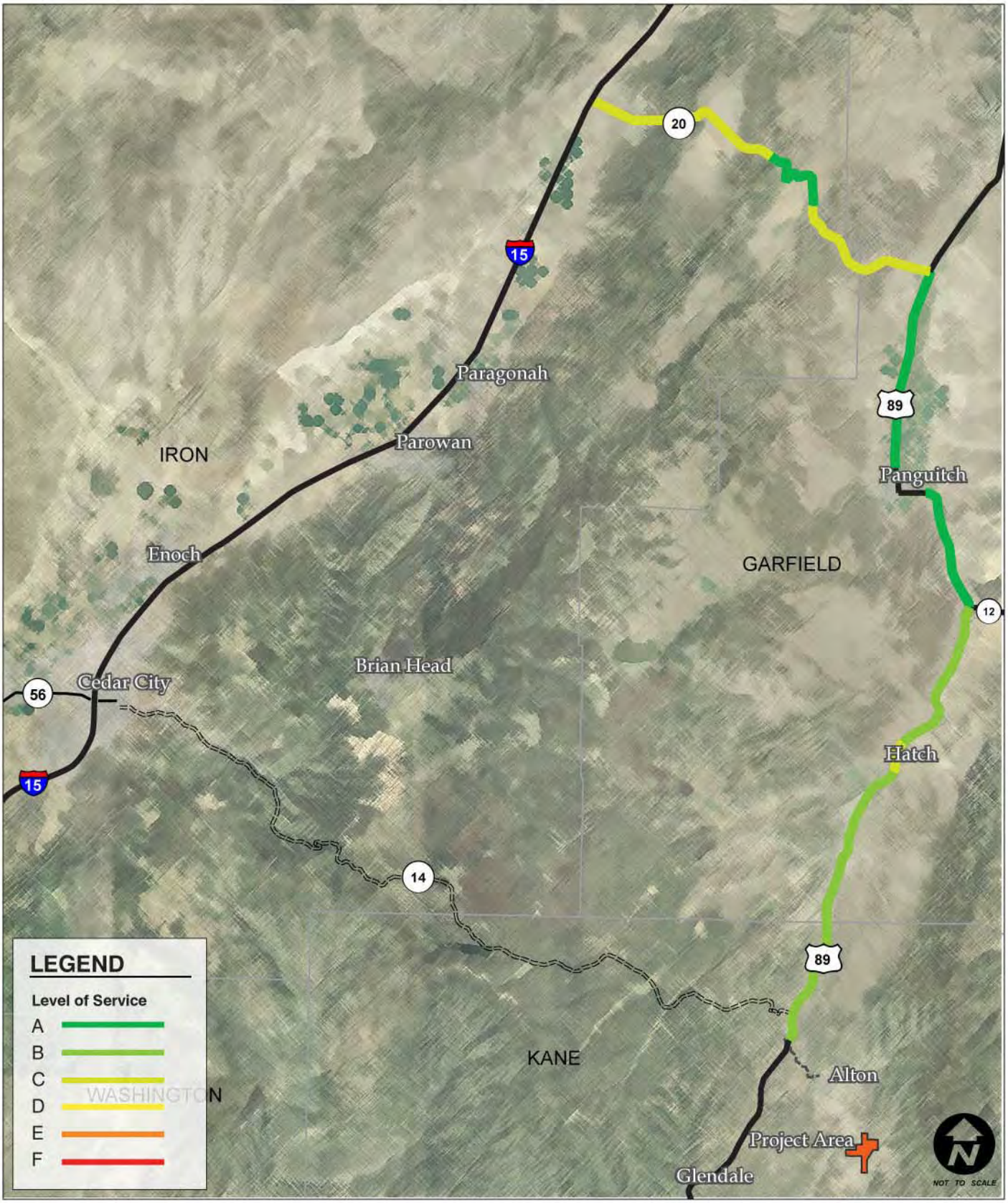
EXISTING PLUS TRUCKS
WEEKDAY DIRECTIONAL LEVELS OF SERVICE
COAL HOLLOW TRAFFIC TECHNICAL REPORT
FIGURE 8



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EXISTING PLUS TRUCKS
WEEKEND DIRECTIONAL LEVELS OF SERVICE
COAL HOLLOW DEVELOPMENT TRAFFIC TECHNICAL REPORT
FIGURE 9

Table 12
Existing Plus Trucks Directional Segment
Peak Hour LOS and Percent Time-Spent-Following

Intersection	Weekday			Weekend		
	Direction	LOS	% Time-Spent-Following	Direction	LOS	% Time-Spent-Following
US-89: Alton to SR-14	NB	A	34.5	NB	B	38.7
US-89: SR-14 to Hatch	NB	B	41.5	NB	B	46.3
US-89: Center of Hatch[1]	NB	C	91.0	NB	C	97.0
US-89: Hatch to SR-12	NB	B	41.1	NB	B	42.4
US-89: SR-12 to Panguitch	NB	A	28.1	NB	A	29.6
US-89: Panguitch to SR-20	NB	A	30.0	NB	A	31.9
SR-20: US-89 to Upslope	WB	C	34.3	WB	C	35.7
SR-20: Upslope to Summit[2]	WB	A	11.8	WB	A	14.8
SR-20: Summit to Downslope	WB	C	42.8	WB	C	48.7
SR-20: Downslope to I-15	WB	C	40.1	WB	C	40.9

Notes:
1. The analysis for the center of Hatch was done using HCS HIGHPLAN software due to the reduced highway speeds through town.
2. This segment of roadway was analyzed with a passing lane and as a Class II highway due to the low posted speed limit of 35 mph.

Source: Fehr & Peers, 2008

As shown in Table 12, all roadway segments operate at an LOS C or better.

3.3. Existing Plus Trucks Conditions Summary

Existing plus trucks conditions at the study intersections continue to have low delays per vehicle and little to no congestion. The intersections continue to operate at acceptable LOS with the additional heavy coal trucks. Existing plus trucks conditions on the study roadways are low volumes with a substantial amount of capacity for future growth.

4. Future 2020 Background Conditions

This section of the report describes the future 2020 background study area characteristics. The purpose of the 2020 background analysis is to evaluate the intersections and roadways during the peak travel periods of the day under future 2020 traffic and geometric conditions. Technical data supporting these findings are included in the appendix.

4.1. Roadway Characteristics

The study corridor for the 2020 background conditions consists of the same geometry as the existing conditions.

4.2. Traffic Forecasting Process

Twenty years of UDOT's historic data was used to develop the future 2020 traffic volumes for the roadways and intersections in the study area. The resulting future 2020 a.m. and p.m. peak hour traffic volumes are shown in Figure 10 on page 27. Table 13 shows the future 2020 ADT for the respective roadways.

Traffic volumes for the future year 2020 were forecasted using the following linear growth rates for thirteen years:

- 3.6% for US-89, SR-14 to Garfield County Line
- 1.8% for US-89, Garfield County Line to Hatch
- 2.1% for US-89, Hatch to SR-12
- 1.9% for US-89, SR-12 to east side of Panguitch
- 1.9% for US-89, East side of Panguitch to SR-143
- 1.5% for US-89, SR-143 to north side of Panguitch
- 1.8% for US-89, North side of Panguitch to SR-20
- 2.3% for SR-14, SR-148 to US-89
- 3.5% for SR-20, US-89 to Iron County Line
- 3.6% for SR-20, Iron County Line to I-15
- 1.1% for SR-56, I-15 Junction

Table 13
Future 2020 Average Daily Traffic (ADT) Volumes

Location	Direction of Travel		Total
	Northbound[1]	Southbound[2]	
US-89 (south of SR-14)	3,100	2,750	5,850
US-89 (north of SR-12)	2,600	2,500	5,100
US-89 (south of SR-20)	2,200	2,200	4,400
SR-20 (east of summit)	1,800	1,800	3,600

1. Eastbound for the count on SR-20
2. Westbound for the count on SR-20
Source: Fehr & Peers, 2008

4.3. Future 2020 Background Traffic Conditions Results

The future 2020 background conditions analysis was done using HCS software for the unsignalized intersections and Synchro 6.0 software was used for the signalized intersection. HCS was also used for the roadway segment LOS analysis.

4.3.1. Intersection Conditions

Future 2020 background conditions MOEs are reported in LOS and delay. Table 14 displays the future 2020 a.m. LOS and delay for the study intersections. Figure 10 shows the future 2020 a.m. and p.m. intersection volumes and LOS results.

Table 14
Future 2020 a.m. Peak Hour LOS and Delay

Intersection	Worst Approach[1]			Overall Intersection[2]	
	Approach	LOS	Delay	LOS	Delay
US-89 / SR-14	EB	A	9.9	A	3.6
US-89 / SR-12	WB	A	9.8	A	6.0
US-89 / SR-143 (Main St.)	SB	A	9.1	A	8.4
US-89 / SR-20	NB	A	9.5	A	8.0
I-15 SB Off-ramp / SR-56				C	20.4

Notes:
1. This represents the worst approach LOS and delay (seconds / vehicle) and is only reported for unsignalized intersections.
2. This represents the overall intersection LOS and delay (seconds / vehicle).

Source: Fehr & Peers, 2008

As shown in Table 14, all intersections operate at LOS C or better during the a.m. peak hour. Table 15 displays the future 2020 p.m. LOS and delay for the study intersections.

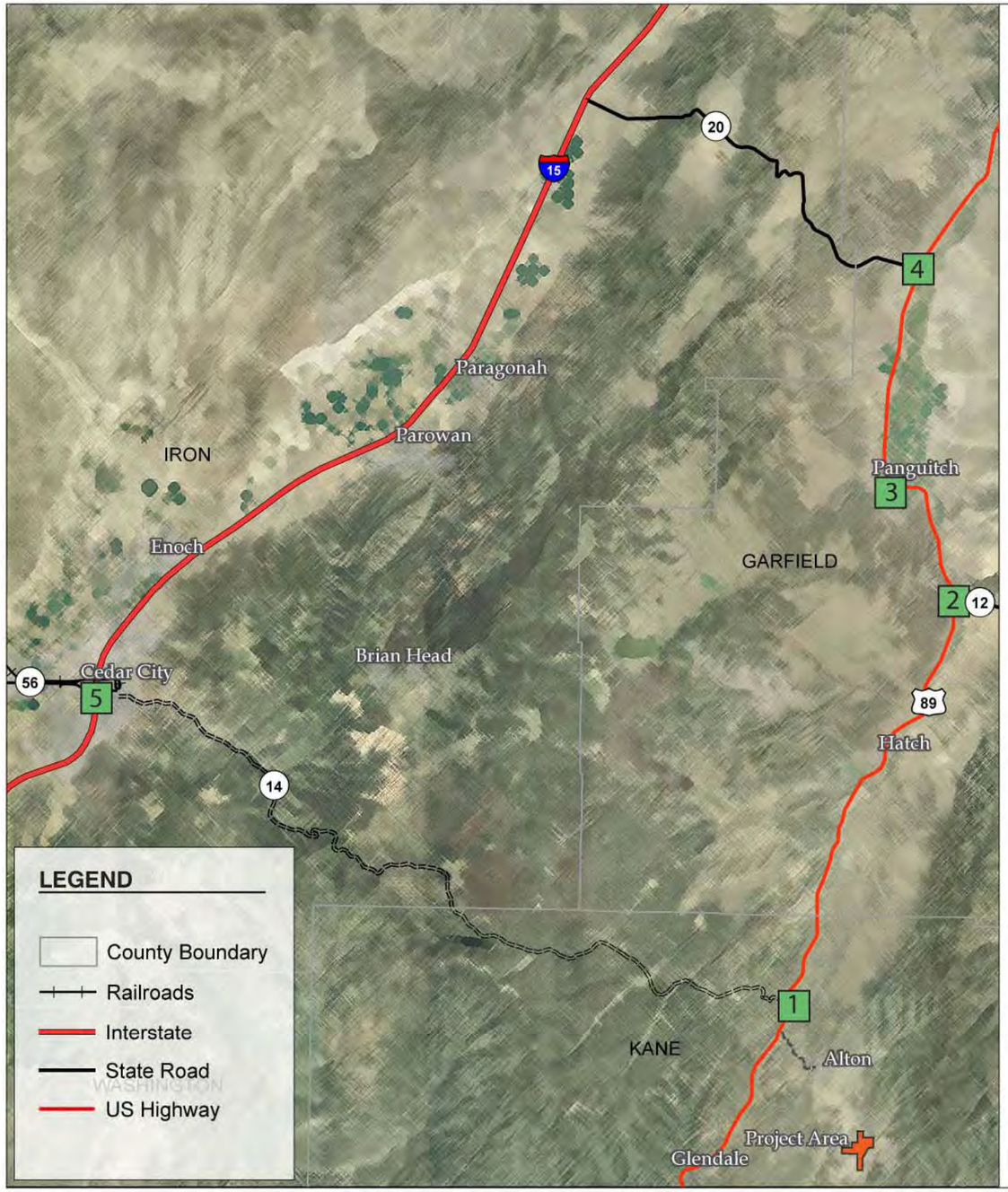
Table 15
Future 2020 p.m. Peak Hour LOS and Delay

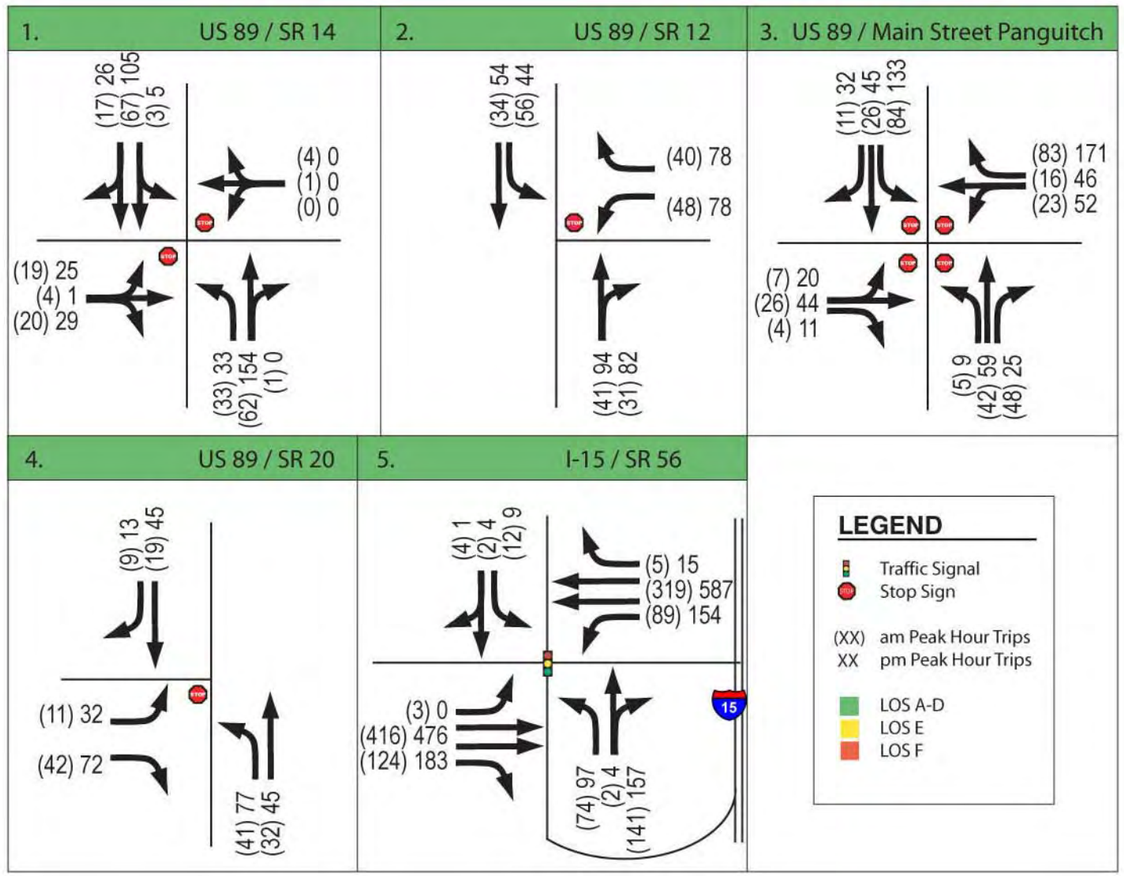
Intersection	Worst Approach[1]			Overall Intersection[2]	
	Approach	LOS	Delay	LOS	Delay
US-89 / SR-14	EB	B	10.7	A	2.5
US-89 / SR-12	WB	B	10.1	A	5.0
US-89 / SR-143 (Main St.)	SB	B	10.5	A	9.8
US-89 / SR-20	NB	B	10.1	A	7.7
I-15 SB Off-ramp / SR-56				C	19.5

Notes:
1. This represents the worst approach LOS and delay (seconds / vehicle) and is only reported for unsignalized intersections.
2. This represents the overall intersection LOS and delay (seconds / vehicle).

Source: Fehr & Peers, 2008

As shown in Table 15, all intersections operate at LOS C or better during the p.m. peak hour.





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FUTURE 2020 A.M. & P.M. TRAFFIC CONDITIONS
COAL HOLLOW DEVELOPMENT TRAFFIC TECHNICAL REPORT
FIGURE 10

4.3.2. Directional Segment Conditions

Future 2020 background conditions MOEs for the two-lane highway directional segment analysis are reported in LOS and Percent Time-Spent-Following. Table 16 displays the future 2020 weekday and weekend LOS and Percent Time-Spent-Following for the study roadway segments. Figures 11 and 12 show the results of the weekday and weekend directional segment LOS analysis.

Table 16
Future 2020 Directional Segment
Peak Hour LOS and Percent Time-Spent-Following

Intersection	Weekday			Weekend		
	Direction	LOS	% Time-Spent-Following	Direction	LOS	% Time-Spent-Following
US-89: Alton to SR-14	NB	B	45.8	NB	C	51.4
US-89: SR-14 to Hatch	NB	B	49.4	NB	C	54.8
US-89: Center of Hatch[1]	NB	C	95.0	NB	C	99.0
US-89: Hatch to SR-12	NB	B	47.5	NB	B	49.0
US-89: SR-12 to Panguitch	NB	A	33.0	NB	A	34.8
US-89: Panguitch to SR-20	NB	A	32.0	NB	B	39.9
SR-20: US-89 to Upslope	WB	D	35.7	WB	D	49.5
SR-20: Upslope to Summit[2]	WB	A	14.2	WB	A	18.5
SR-20: Summit to Downslope	WB	C	48.8	WB	D	63.0
SR-20: Downslope to I-15	WB	C	40.9	WB	C	55.2

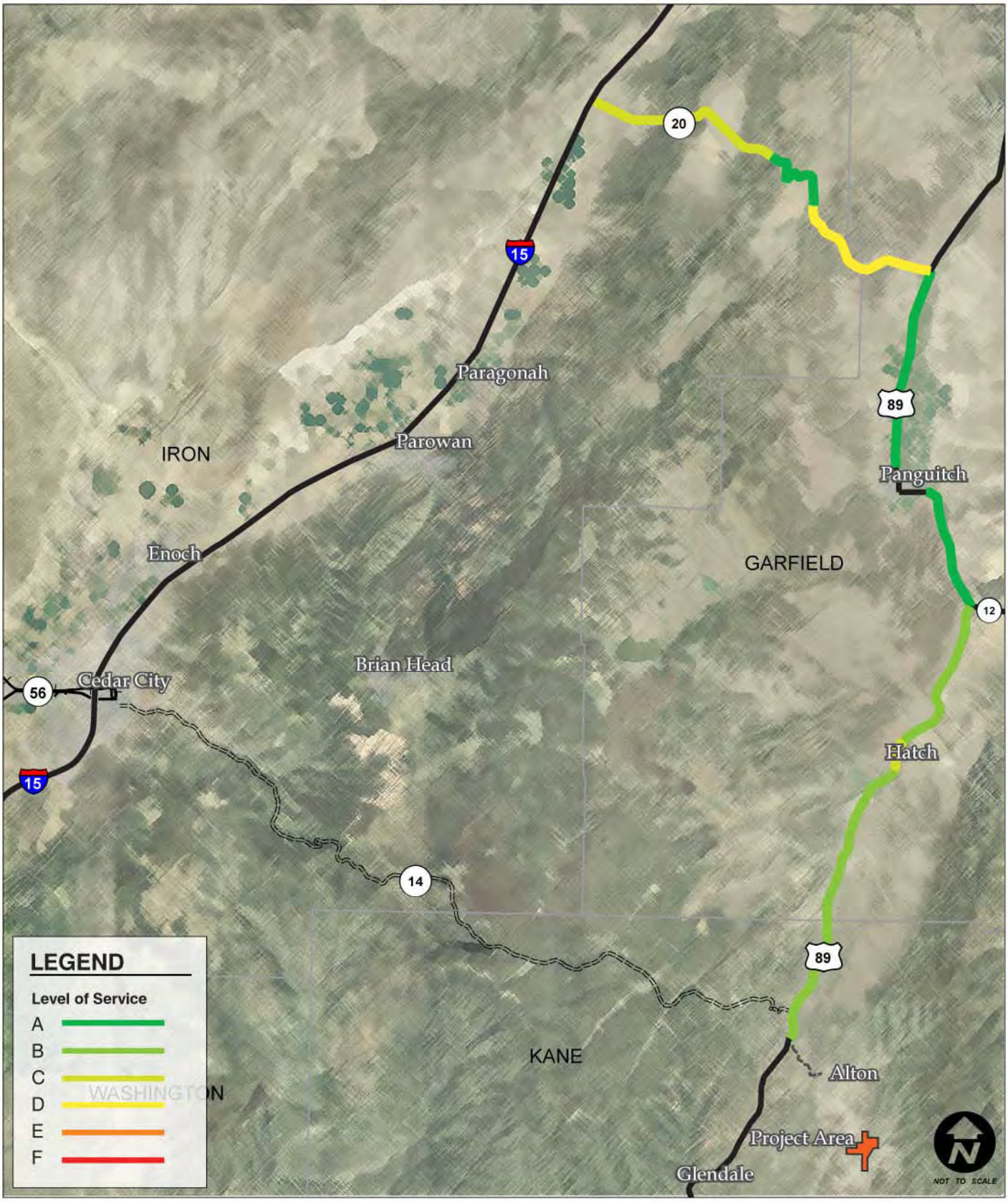
Notes:
1. The analysis for the center of Hatch was done using HCS HIGHPLAN software due to the reduced highway speeds through town.
2. This segment of roadway was analyzed with a passing lane and as a Class II highway due to the low posted speed limit of 25 mph.

Source: Fehr & Peers, 2008

As shown in Table 16, all roadway segments operate at an LOS D or better.

4.4. Future 2020 Background Conditions Summary

Future 2020 background conditions at the study intersections continue to have low delays per vehicle and little to no congestion. Future 2020 conditions on the study roadways continue to have relatively low traffic volumes and traffic is expected to travel at free flow speeds.



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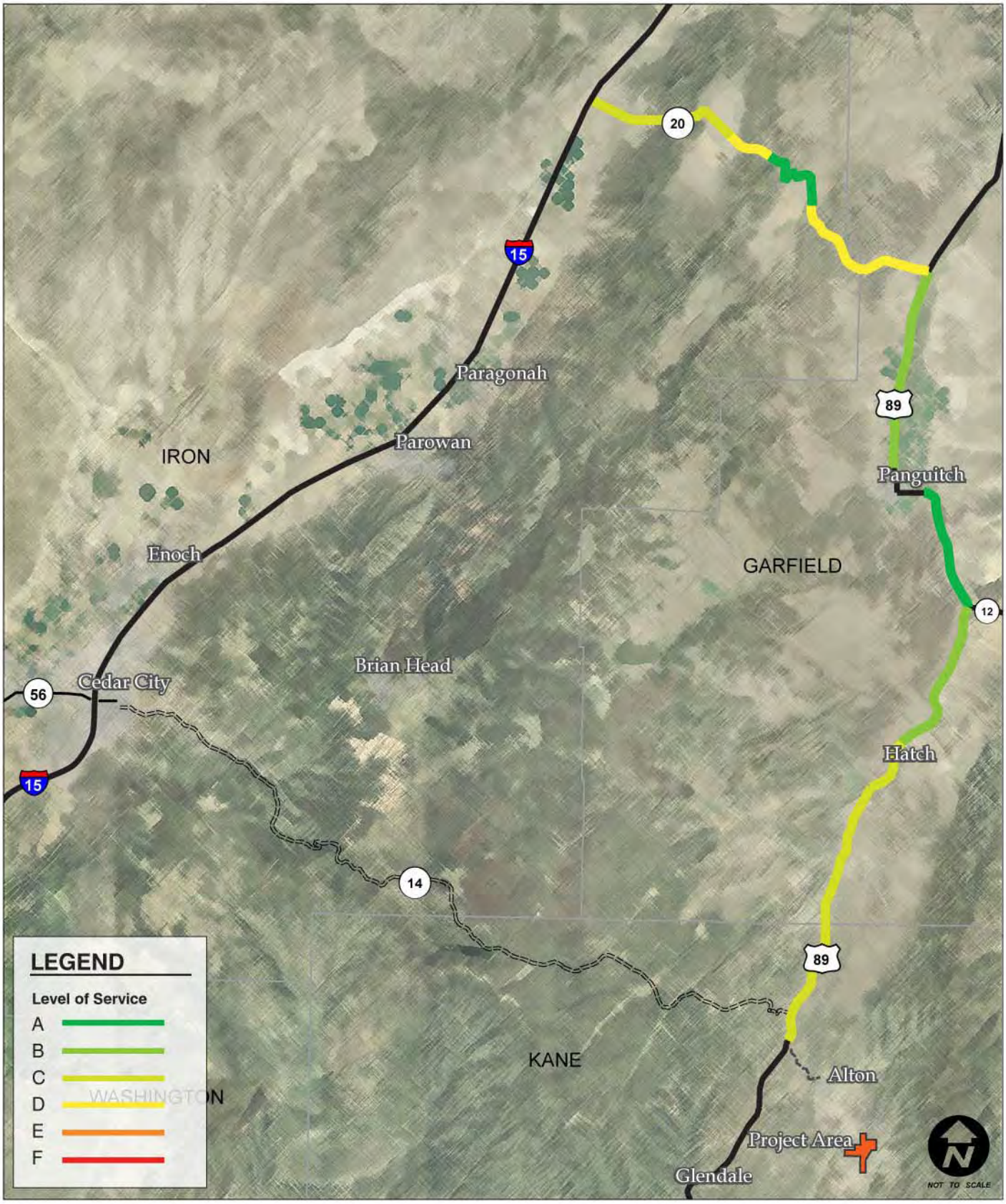
FUTURE 2020 BACKGROUND
WEEKDAY DIRECTIONAL LEVELS OF SERVICE
COAL HOLLOW TRAFFIC TECHNICAL REPORT

FIGURE 11



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FUTURE 2020 BACKGROUND
WEEKEND DIRECTIONAL LEVELS OF SERVICE
COAL HOLLOW DEVELOPMENT TRAFFIC TECHNICAL REPORT
FIGURE 12

5. Future 2020 Plus Trucks Conditions

This section of the report describes the future 2020 plus trucks study area characteristics. The purpose of the future 2020 plus trucks analysis is to evaluate the intersections and roadways during the peak travel periods of the day under future 2020 traffic and geometric conditions plus the additional coal trucks that are proposed with the project coal mine. Technical data supporting these findings are included in the appendix.

5.1. Roadway Characteristics

The study roadways for the future 2020 plus trucks conditions consists of the same geometry as the existing plus trucks conditions.

5.2. Future 2020 Plus Trucks Traffic Conditions Results

The future 2020 plus trucks conditions analysis was done using HCS software for the unsignalized intersections and Synchro 6.0 software was used for the signalized intersection. HCS was also used for the roadway segment LOS analysis. As a conservative measure seven trucks an hour was used in the analysis.

5.2.1. Intersection Conditions

Future plus trucks conditions MOEs are reported in LOS and delay. Table 17 displays the future 2020 plus trucks a.m. LOS and delay for the study intersections. Figure 13 shows the a.m. and p.m. intersection volumes and LOS results.

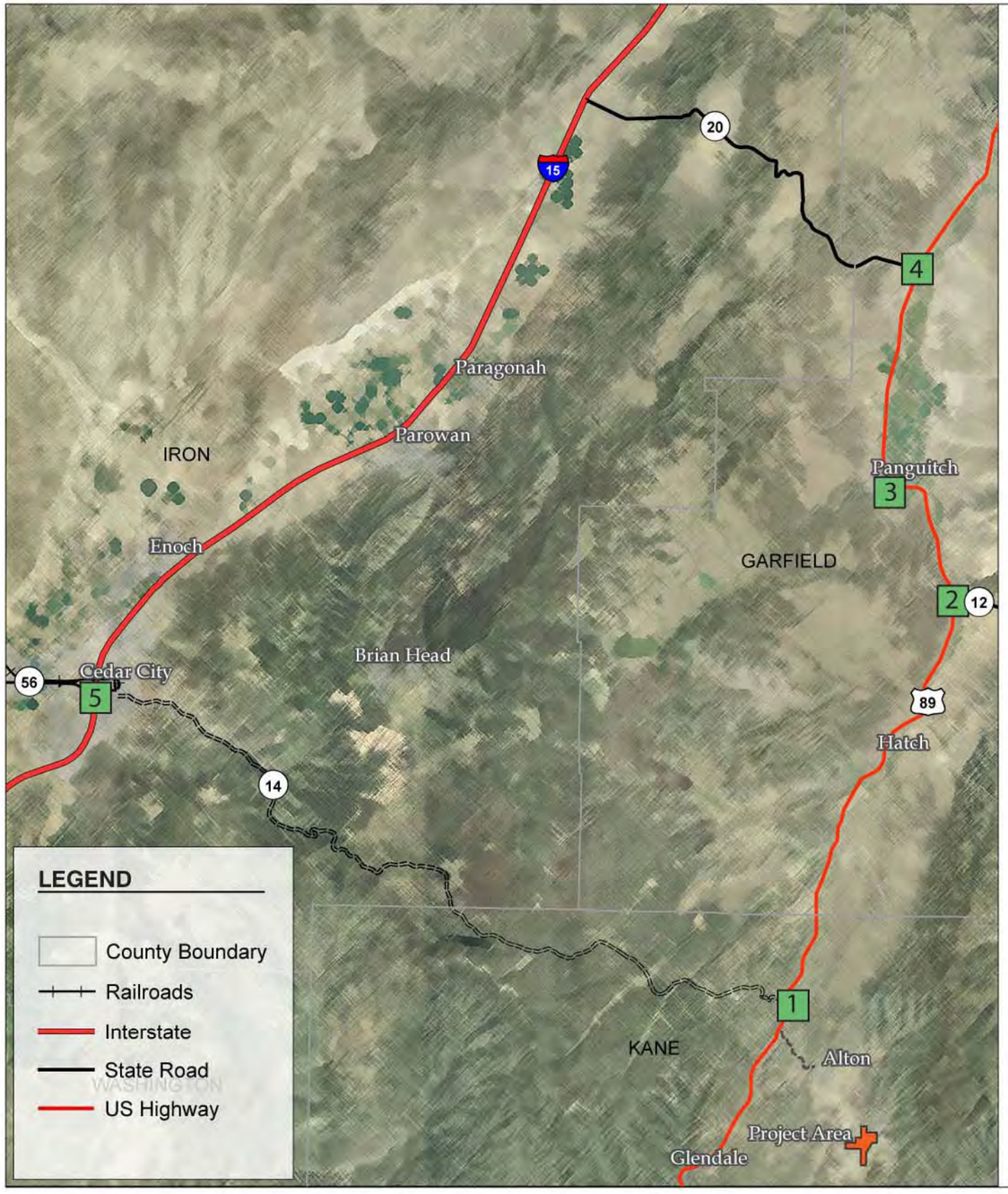
Table 17
Future 2020 Plus Trucks a.m. Peak Hour LOS and Delay

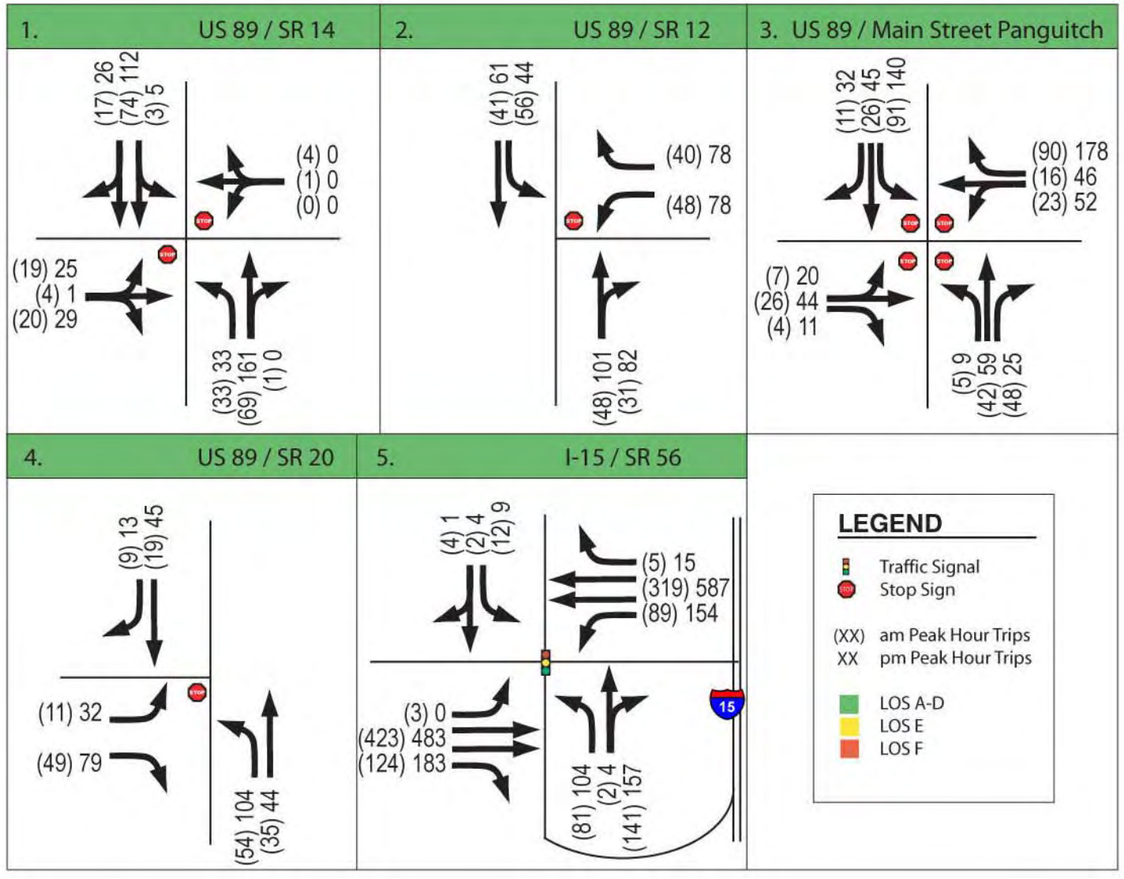
Intersection	Worst Approach[1]			Overall Intersection[2]	
	Approach	LOS	Delay	LOS	Delay
US-89 / SR-14	EB	B	10.0	A	3.4
US-89 / SR-12	WB	A	9.9	A	5.2
US-89 / SR-143 (Main St.)	SB	A	9.3	A	8.6
US-89 / SR-20	NB	A	9.6	A	7.9
I-15 SB Off-ramp / SR-56				C	20.2

Notes:
1. This represents the worst approach LOS and delay (seconds / vehicle) and is only reported for unsignalized intersections.
2. This represents the overall intersection LOS and delay (seconds / vehicle).

Source: Fehr & Peers, 2008

As shown in Table 17, all intersections operate at LOS C or better during the a.m. peak hour.





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FUTURE 2020 PLUS TRUCKS A.M. & P.M. TRAFFIC CONDITIONS
COAL HOLLOW DEVELOPMENT TRAFFIC TECHNICAL REPORT
FIGURE 13

Table 18 displays the future 2020 plus trucks p.m. LOS and delay for the study intersections.

Table 18
Future 2020 Plus Trucks p.m. Peak Hour LOS and Delay

Intersection	Worst Approach[1]			Overall Intersection[2]	
	Approach	LOS	Delay	LOS	Delay
US-89 / SR-14	EB	B	10.8	A	2.4
US-89 / SR-12	WB	B	10.2	A	4.9
US-89 / SR-143 (Main St.)	SB	B	10.8	B	10.0
US-89 / SR-20	NB	B	10.2	A	7.7
I-15 SB Off-ramp / SR-56				B	19.4

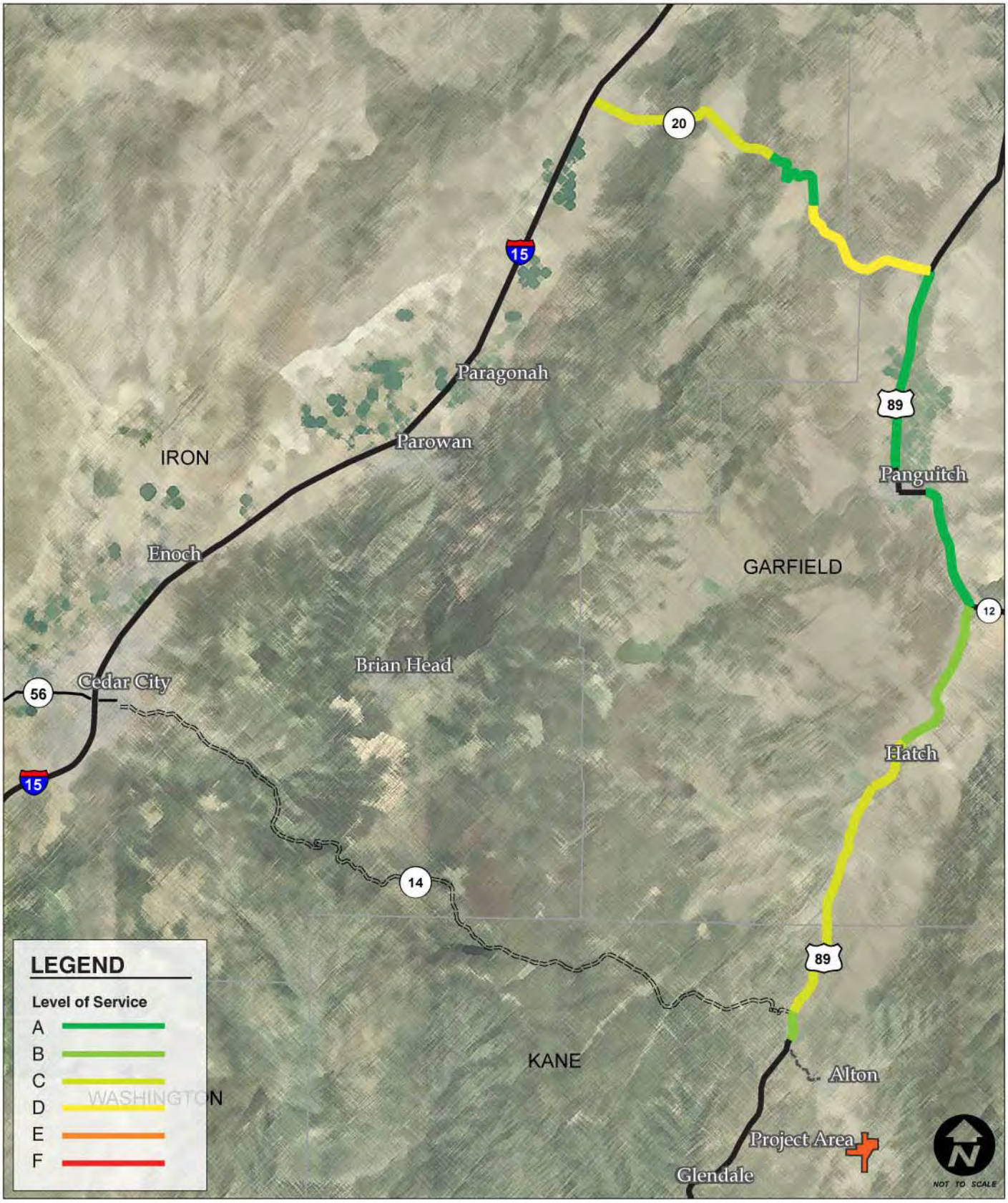
Notes:
1. This represents the worst approach LOS and delay (seconds / vehicle) and is only reported for unsignalized intersections.
2. This represents the overall intersection LOS and delay (seconds / vehicle).

Source: Fehr & Peers, 2008

As shown in Table 18, all intersections operate at LOS B or better during the p.m. peak hour.

5.2.2. Directional Segment Conditions

Future 2020 plus trucks conditions MOEs for the two-lane highway directional segment analysis are reported in LOS and Percent Time-Spent-Following. Table 19 displays the existing plus trucks weekday and weekend LOS and Percent Time-Spent-Following for the study roadway segments. Figures 14 and 15 show the results of the weekday and weekend directional segment LOS analysis.



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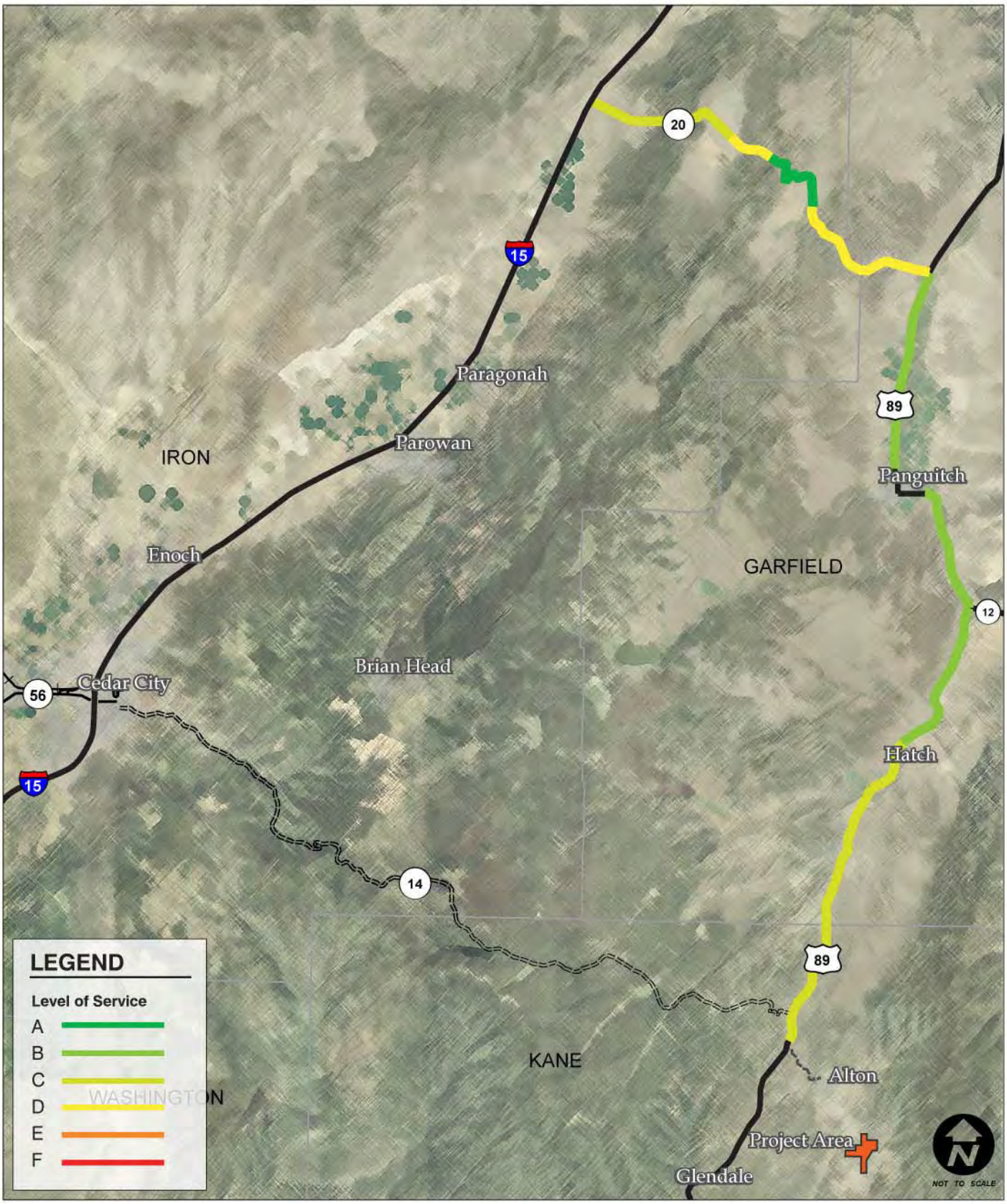
FUTURE 2020 PLUS TRUCKS
WEEKDAY DIRECTIONAL LEVELS OF SERVICE
COAL HOLLOW DEVELPMENT TRAFFIC TECHNICAL REPORT
FIGURE 14



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FUTURE 2020 PLUS TRUCKS
WEEKEND DIRECTIONAL LEVELS OF SERVICE
COAL HOLLOW TRAFFIC TECHNICAL REPORT
FIGURE 15

Table 19
Future 2020 Plus Trucks Directional Segment
Peak Hour LOS and Percent Time-Spent-Following

Intersection	Weekday			Weekend		
	Direction	LOS	% Time-Spent-Following	Direction	LOS	% Time-Spent-Following
US-89: Alton to SR-14	NB	B	47.0	NB	C	52.4
US-89: SR-14 to Hatch	NB	C	50.3	NB	C	55.6
US-89: Center of Hatch[1]	NB	C	96.0	NB	C	99.0
US-89: Hatch to SR-12	NB	B	48.7	NB	B	49.8
US-89: SR-12 to Panguitch	NB	A	34.1	NB	B	35.7
US-89: Panguitch to SR-20	NB	A	33.8	NB	B	41.0
SR-20: US-89 to Upslope	WB	D	36.8	WB	D	50.9
SR-20: Upslope to Summit[2]	WB	A	15.4	WB	A	19.7
SR-20: Summit to Downslope	WB	C	50.3	WB	D	65.8
SR-20: Downslope to I-15	WB	C	42.5	WB	C	56.6

Notes:
1. The analysis for the center of Hatch was done using HCS HIGHPLAN software due to the reduced highway speeds through town.
2. This segment of roadway was analyzed with a passing lane and as a Class II highway due to the low posted speed limit of 35 mph.

Source: Fehr & Peers, 2008

As shown in Table 19, all roadway segments operate at an LOS D or better.

5.3. Future 2020 Plus Trucks Conditions Summary

Future 2020 plus trucks conditions at the study intersections continue to have low delays per vehicle and little to no congestion. Future 2020 plus trucks conditions on the study roadways continue to have relatively low traffic volumes and traffic is expected to travel at free flow speeds. Based upon the accident history, there are not a lot of accidents involving truck traffic.

6. Commonly Used Acronyms

Table 20
Commonly Used Acronyms

Acronym	Definition
ADT	Average Daily Traffic
GPS	Global Positioning System
HCM 2000	Highway Capacity Manual 2000
HCS	Highway Capacity Software
LOS	Level of Service
MOE	Measures of Effectiveness
MP	Mile Post
OSR	Operational Safety Report
UDOT	Utah Department of Transportation

7. References

Transportation Research Board. Highway Capacity Manual 2000. Washington, D. C.: National Research Council, 2000.

Utah Department of Transportation. Operational Safety Report #07-037; US-89, MP 90.04 to MP 156.36 (Glendale to Jct. SR-20). Safety Evaluation. UDOT, 2007.

Utah Department of Transportation. Operational Safety Report #07-038; SR-20, MP 0.00 to MP 20.61. (I-15 to Jct. US-89). Safety Evaluation. UDOT, 2007.

Utah Department of Transportation. Operational Safety Report #07-039; I-15, MP 59.05 to MP 100.02 (Cedar City to SR-20). Safety Evaluation. UDOT, 2007.

Utah Department of Transportation. Operational Safety Report #07-040; SR-56, MP 9.80 to MP 61.39. Safety Evaluation. UDOT, 2007.

Utah Department of Transportation, Division of Traffic and Safety. CARS Codes. UDOT, 2001.

APPENDIX

APPENDIX A
Traffic Counts

L2 Data Collection

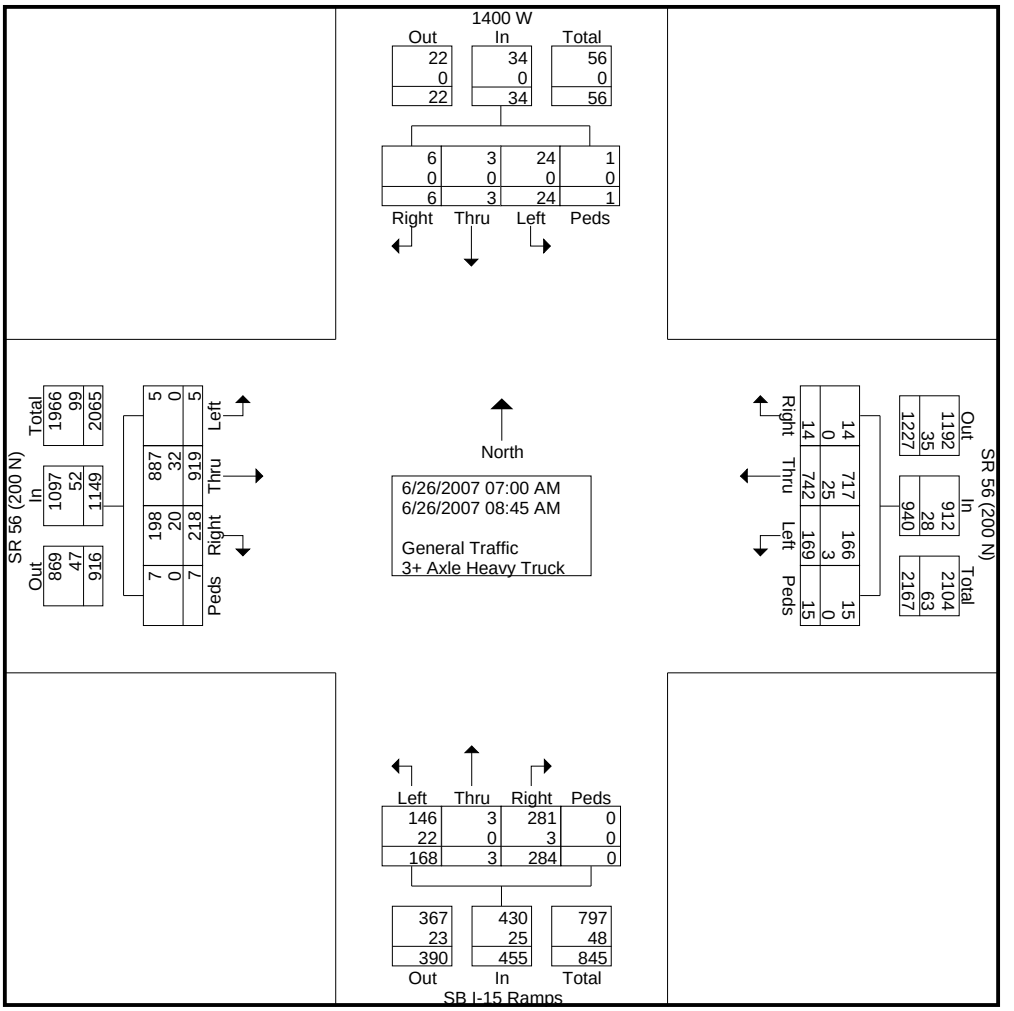
1770 State Street #204
Boise, Idaho
(208) 860-7554

Tech: Judd
Intersection: I-15 SB Ramps / SR 56
City, State: Cedar City, Utah
Control: Signalized

File Name : 56 SB Ramps AM
Site Code : 1
Start Date : 6/26/2007
Page No : 1

Groups Printed- General Traffic - 3+ Axle Heavy Truck

	1400 W From North					SR 56 (200 N) From East					SB I-15 Ramps From South					SR 56 (200 N) From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	1	0	4	0	5	1	101	16	0	118	25	1	27	0	53	36	76	0	1	113	289
07:15 AM	0	2	1	0	3	2	76	12	2	92	24	1	28	0	53	23	89	0	1	113	261
07:30 AM	2	0	3	1	6	1	76	19	2	98	34	0	23	0	57	16	101	1	2	120	281
07:45 AM	0	0	4	0	4	3	91	38	4	136	66	0	24	0	90	27	127	1	2	157	387
Total	3	2	12	1	18	7	344	85	8	444	149	2	102	0	253	102	393	2	6	503	1218
08:00 AM	1	0	2	0	3	0	103	16	0	119	35	0	21	0	56	29	124	2	0	155	333
08:15 AM	0	0	1	0	1	2	94	17	3	116	27	0	12	0	39	32	111	0	0	143	299
08:30 AM	1	0	4	0	5	3	95	30	4	132	35	0	17	0	52	22	121	1	0	144	333
08:45 AM	1	1	5	0	7	2	106	21	0	129	38	1	16	0	55	33	170	0	1	204	395
Total	3	1	12	0	16	7	398	84	7	496	135	1	66	0	202	116	526	3	1	646	1360
Grand Total	6	3	24	1	34	14	742	169	15	940	284	3	168	0	455	218	919	5	7	1149	2578
Apprch %	17.6	8.8	70.6	2.9		1.5	78.9	18	1.6		62.4	0.7	36.9	0		19	80	0.4	0.6		
Total %	0.2	0.1	0.9	0	1.3	0.5	28.8	6.6	0.6	36.5	11	0.1	6.5	0	17.6	8.5	35.6	0.2	0.3	44.6	
General Traffic	6	3	24	1	34	14	717	166	15	912	281	3	146	0	430	198	887	5	7	1097	2473
% General Traffic	100	100	100	100	100	100	96.6	98.2	100	97	98.9	100	86.9	0	94.5	90.8	96.5	100	100	95.5	95.9
3+ Axle Heavy Truck	0	0	0	0	0	0	25	3	0	28	3	0	22	0	25	20	32	0	0	52	105
% 3+ Axle Heavy Truck	0	0	0	0	0	0	3.4	1.8	0	3	1.1	0	13.1	0	5.5	9.2	3.5	0	0	4.5	4.1



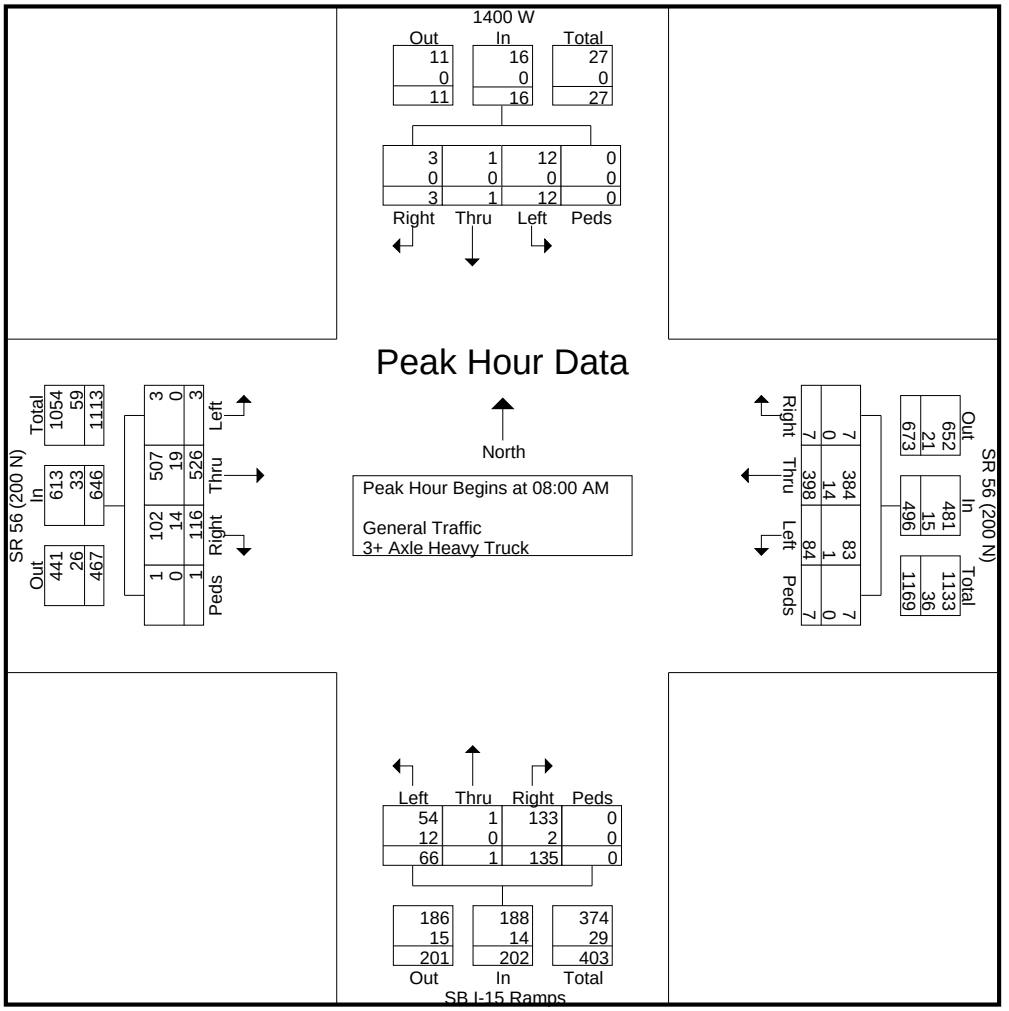
L2 Data Collection

1770 State Street #204
Boise, Idaho
(208) 860-7554

Tech: Judd
Intersection: I-15 SB Ramps / SR 56
City, State: Cedar City, Utah
Control: Signalized

File Name : 56 SB Ramps AM
Site Code : 1
Start Date : 6/26/2007
Page No : 2

	1400 W From North					SR 56 (200 N) From East					SB I-15 Ramps From South					SR 56 (200 N) From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 08:00 AM																					
08:00 AM	**1**	0	2	0	3	0	103	16	0	119	35	0	**21**	0	**56**	29	124	**2**	0	155	333
08:15 AM	0	0	1	0	1	2	94	17	3	116	27	0	12	0	39	32	111	0	0	143	299
08:30 AM	1	0	4	0	5	**3**	95	**30**	**4**	**132**	35	0	17	0	52	22	121	1	0	144	333
08:45 AM	1	**1**	**5**	0	**7**	2	**106**	21	0	129	**38**	**1**	16	0	55	**33**	**170**	0	**1**	**204**	**395**
Total Volume	3	1	12	0	16	7	398	84	7	496	135	1	66	0	202	116	526	3	1	646	1360
% App. Total	18.8	6.2	75	0		1.4	80.2	16.9	1.4		66.8	0.5	32.7	0		18	81.4	0.5	0.2		
PHF	.750	.250	.600	.000	.571	.583	.939	.700	.438	.939	.888	.250	.786	.000	.902	.879	.774	.375	.250	.792	.861
General Traffic	3	1	12	0	16	7	384	83	7	481	133	1	54	0	188	102	507	3	1	613	1298
% General Traffic	100	100	100	0	100	100	96.5	98.8	100	97.0	98.5	100	81.8	0	93.1	87.9	96.4	100	100	94.9	95.4
3+ Axle Heavy Truck	0	0	0	0	0	0	14	1	0	15	2	0	12	0	14	14	19	0	0	33	62
% 3+ Axle Heavy Truck	0	0	0	0	0	0	3.5	1.2	0	3.0	1.5	0	18.2	0	6.9	12.1	3.6	0	0	5.1	4.6



L2 Data Collection

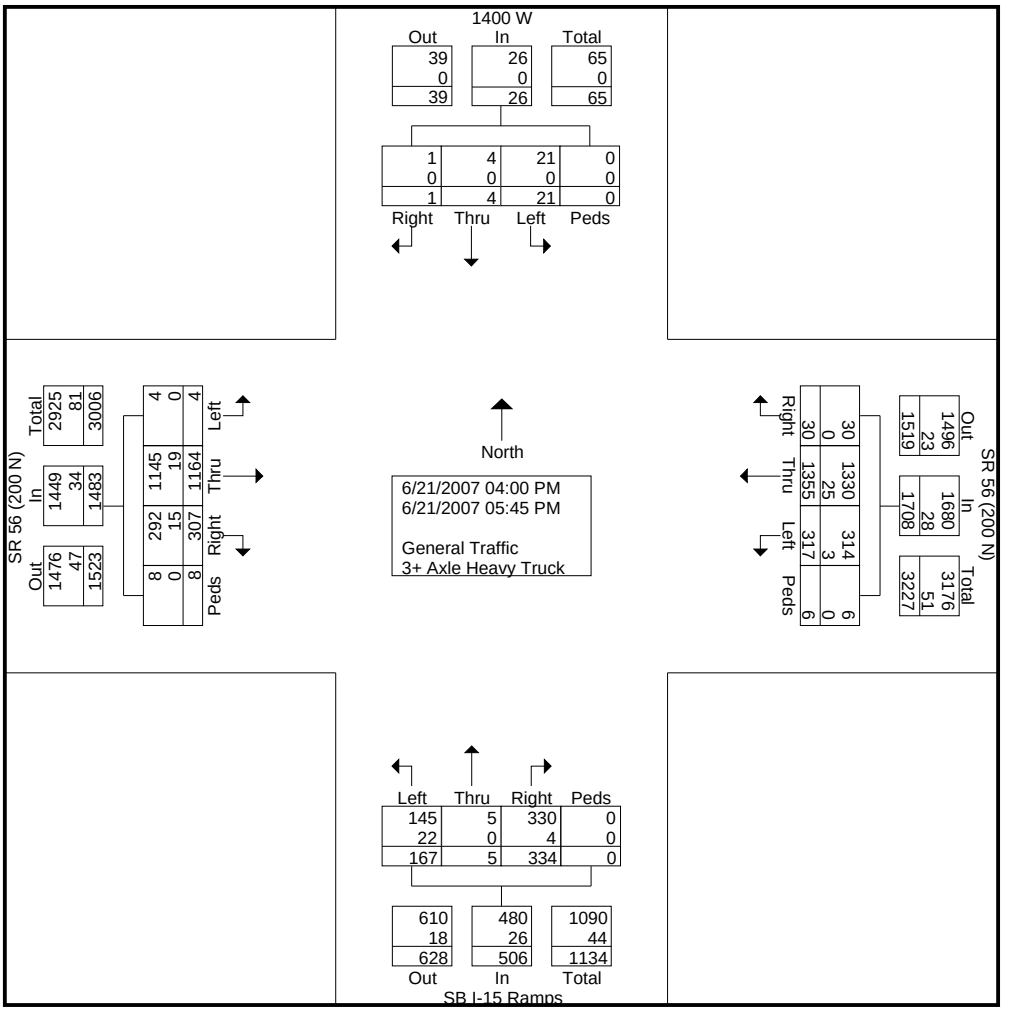
1770 State Street #204
Boise, Idaho
(208) 860-7554

Tech: Judd
Intersection: I-15 SB Ramps / SR 56
City, State: Cedar City, Utah
Control: Signalized

File Name : 56 SB Ramps PM
Site Code : 1
Start Date : 6/21/2007
Page No : 1

Groups Printed- General Traffic - 3+ Axle Heavy Truck

	1400 W From North					SR 56 (200 N) From East					SB I-15 Ramps From South					SR 56 (200 N) From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
04:00 PM	0	1	4	0	5	3	134	57	2	196	41	0	20	0	61	30	122	3	1	156	418
04:15 PM	0	1	0	0	1	3	150	28	2	183	47	2	20	0	69	40	132	1	2	175	428
04:30 PM	0	0	1	0	1	3	171	43	0	217	39	1	15	0	55	31	153	0	0	184	457
04:45 PM	0	0	3	0	3	2	168	45	1	216	42	1	24	0	67	47	155	0	1	203	489
Total	0	2	8	0	10	11	623	173	5	812	169	4	79	0	252	148	562	4	4	718	1792
05:00 PM	0	0	3	0	3	6	206	35	0	247	30	0	22	0	52	39	153	0	0	192	494
05:15 PM	1	1	2	0	4	3	193	40	0	236	34	1	17	0	52	38	146	0	4	188	480
05:30 PM	0	1	3	0	4	5	173	31	0	209	44	0	24	0	68	47	152	0	0	199	480
05:45 PM	0	0	5	0	5	5	160	38	1	204	57	0	25	0	82	35	151	0	0	186	477
Total	1	2	13	0	16	19	732	144	1	896	165	1	88	0	254	159	602	0	4	765	1931
Grand Total	1	4	21	0	26	30	1355	317	6	1708	334	5	167	0	506	307	1164	4	8	1483	3723
Apprch %	3.8	15.4	80.8	0		1.8	79.3	18.6	0.4		66	1	33	0		20.7	78.5	0.3	0.5		
Total %	0	0.1	0.6	0	0.7	0.8	36.4	8.5	0.2	45.9	9	0.1	4.5	0	13.6	8.2	31.3	0.1	0.2	39.8	
General Traffic	1	4	21	0	26	30	1330	314	6	1680	330	5	145	0	480	292	1145	4	8	1449	3635
% General Traffic	100	100	100	0	100	100	98.2	99.1	100	98.4	98.8	100	86.8	0	94.9	95.1	98.4	100	100	97.7	97.6
3+ Axle Heavy Truck	0	0	0	0	0	0	25	3	0	28	4	0	22	0	26	15	19	0	0	34	88
% 3+ Axle Heavy Truck	0	0	0	0	0	0	1.8	0.9	0	1.6	1.2	0	13.2	0	5.1	4.9	1.6	0	0	2.3	2.4



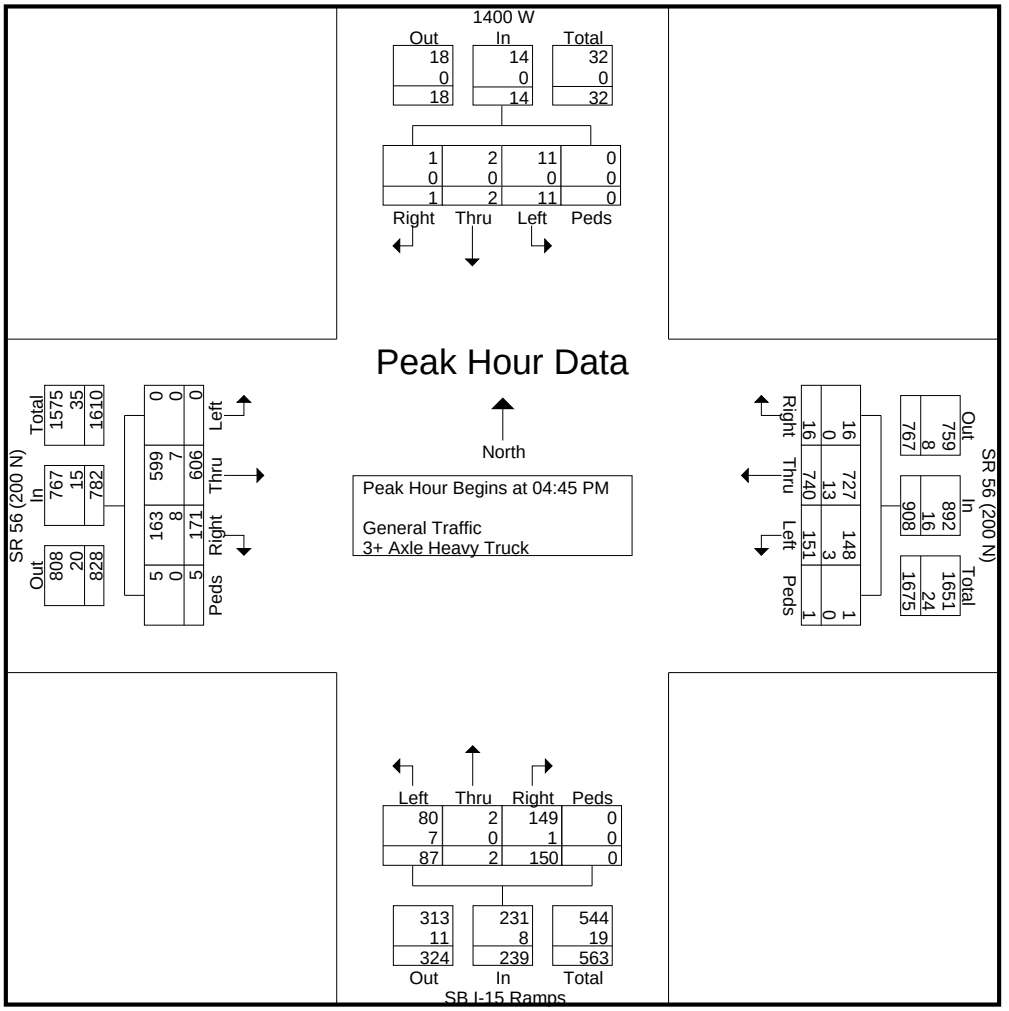
L2 Data Collection

1770 State Street #204
Boise, Idaho
(208) 860-7554

Tech: Judd
Intersection: I-15 SB Ramps / SR 56
City, State: Cedar City, Utah
Control: Signalized

File Name : 56 SB Ramps PM
Site Code : 1
Start Date : 6/21/2007
Page No : 2

	1400 W From North					SR 56 (200 N) From East					SB I-15 Ramps From South					SR 56 (200 N) From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:45 PM																					
04:45 PM	0	0	**3**	0	3	2	168	**45**	**1**	216	42	**1**	**24**	0	67	**47**	**155**	0	1	**203**	489
05:00 PM	0	0	3	0	3	**6**	**206**	35	0	**247**	30	0	22	0	52	39	153	0	0	192	**494**
05:15 PM	**1**	**1**	2	0	**4**	3	193	40	0	236	34	1	17	0	52	38	146	0	**4**	188	480
05:30 PM	0	1	3	0	4	5	173	31	0	209	**44**	0	24	0	**68**	47	152	0	0	199	480
Total Volume	1	2	11	0	14	16	740	151	1	908	150	2	87	0	239	171	606	0	5	782	1943
% App. Total	7.1	14.3	78.6	0		1.8	81.5	16.6	0.1		62.8	0.8	36.4	0		21.9	77.5	0	0.6		
PHF	.250	.500	.917	.000	.875	.667	.898	.839	.250	.919	.852	.500	.906	.000	.879	.910	.977	.000	.313	.963	.983
General Traffic	1	2	11	0	14	16	727	148	1	892	149	2	80	0	231	163	599	0	5	767	1904
% General Traffic	100	100	100	0	100	100	98.2	98.0	100	98.2	99.3	100	92.0	0	96.7	95.3	98.8	0	100	98.1	98.0
3+ Axle Heavy Truck	0	0	0	0	0	0	13	3	0	16	1	0	7	0	8	8	7	0	0	15	39
% 3+ Axle Heavy Truck	0	0	0	0	0	0	1.8	2.0	0	1.8	0.7	0	8.0	0	3.3	4.7	1.2	0	0	1.9	2.0



L2 Data Collection

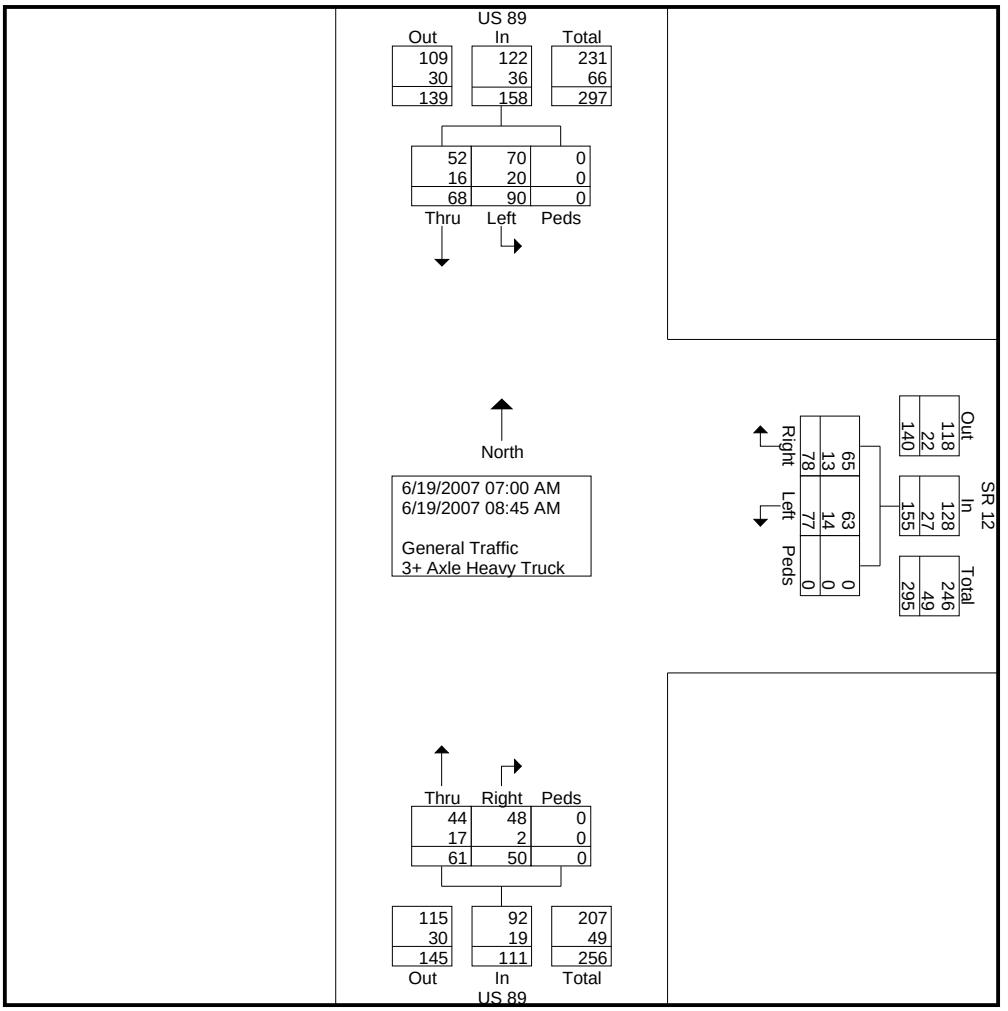
1770 State Street #204
Boise, Idaho
(208) 860-7554

Tech: Larsen
Intersection: US 89 / SR 12
City, State: Panguitch, Utah
Control: Stop, Yield Signs

File Name : 89 12 AM
Site Code : 4
Start Date : 6/19/2007
Page No : 1

Groups Printed- General Traffic - 3+ Axle Heavy Truck

	US 89 From North				SR 12 From East				US 89 From South				
Start Time	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	Int. Total
07:00 AM	9	7	0	16	7	5	0	12	4	3	0	7	35
07:15 AM	8	4	0	12	5	7	0	12	1	6	0	7	31
07:30 AM	5	12	0	17	12	11	0	23	8	7	0	15	55
07:45 AM	11	11	0	22	13	7	0	20	6	4	0	10	52
Total	33	34	0	67	37	30	0	67	19	20	0	39	173
08:00 AM	4	9	0	13	8	5	0	13	8	4	0	12	38
08:15 AM	10	16	0	26	11	10	0	21	9	15	0	24	71
08:30 AM	14	11	0	25	8	15	0	23	10	16	0	26	74
08:45 AM	7	20	0	27	14	17	0	31	4	6	0	10	68
Total	35	56	0	91	41	47	0	88	31	41	0	72	251
Grand Total	68	90	0	158	78	77	0	155	50	61	0	111	424
Apprch %	43	57	0		50.3	49.7	0		45	55	0		
Total %	16	21.2	0	37.3	18.4	18.2	0	36.6	11.8	14.4	0	26.2	
General Traffic	52	70	0	122	65	63	0	128	48	44	0	92	342
% General Traffic	76.5	77.8	0	77.2	83.3	81.8	0	82.6	96	72.1	0	82.9	80.7
3+ Axle Heavy Truck													
% 3+ Axle Heavy Truck	23.5	22.2	0	22.8	16.7	18.2	0	17.4	4	27.9	0	17.1	19.3



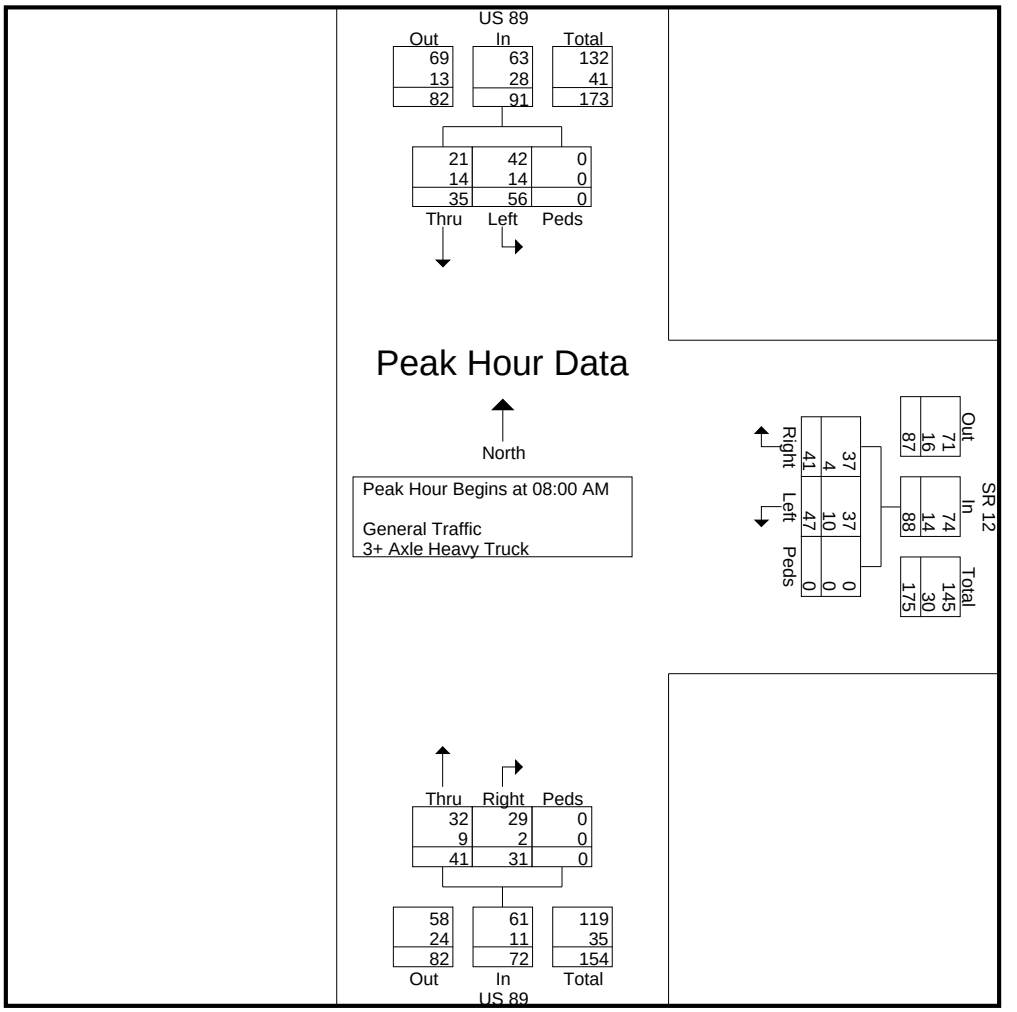
L2 Data Collection

1770 State Street #204
Boise, Idaho
(208) 860-7554

Tech: Larsen
Intersection: US 89 / SR 12
City, State: Panguitch, Utah
Control: Stop, Yield Signs

File Name : 89 12 AM
Site Code : 4
Start Date : 6/19/2007
Page No : 2

	US 89 From North				SR 12 From East				US 89 From South				
Start Time	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 08:00 AM													
08:00 AM	4	9	0	13	8	5	0	13	8	4	0	12	38
08:15 AM	10	16	0	26	11	10	0	21	9	15	0	24	71
08:30 AM	**14**	11	0	25	8	15	0	23	**10**	**16**	0	**26**	**74**
08:45 AM	7	**20**	0	**27**	**14**	**17**	0	**31**	4	6	0	10	68
Total Volume	35	56	0	91	41	47	0	88	31	41	0	72	251
% App. Total	38.5	61.5	0		46.6	53.4	0		43.1	56.9	0		
PHF	.625	.700	.000	.843	.732	.691	.000	.710	.775	.641	.000	.692	.848
General Traffic	21	42	0	63	37	37	0	74	29	32	0	61	198
% General Traffic	60.0	75.0	0	69.2	90.2	78.7	0	84.1	93.5	78.0	0	84.7	78.9
3+ Axle Heavy Truck													
% 3+ Axle Heavy Truck	40.0	25.0	0	30.8	9.8	21.3	0	15.9	6.5	22.0	0	15.3	21.1



L2 Data Collection

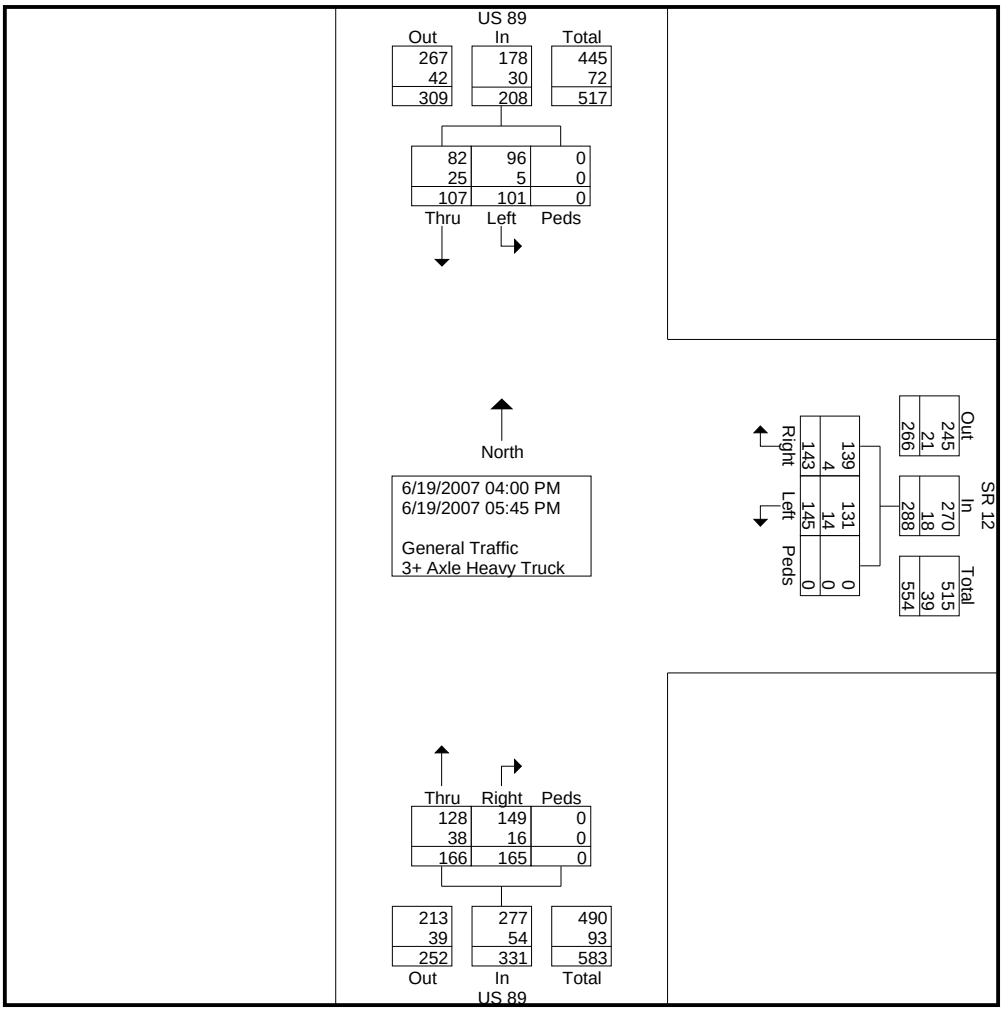
1770 State Street #204
Boise, Idaho
(208) 860-7554

Tech: Larsen
Intersection: US 89 / SR 12
City, State: Panguitch, Utah
Control: Stop, Yield Signs

File Name : 89 12 PM
Site Code : 4
Start Date : 6/19/2007
Page No : 1

Groups Printed- General Traffic - 3+ Axle Heavy Truck

	US 89 From North				SR 12 From East				US 89 From South				
Start Time	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	Int. Total
04:00 PM	10	9	0	19	18	22	0	40	22	21	0	43	102
04:15 PM	16	13	0	29	26	21	0	47	24	22	0	46	122
04:30 PM	17	13	0	30	19	20	0	39	23	26	0	49	118
04:45 PM	12	10	0	22	17	15	0	32	13	28	0	41	95
Total	55	45	0	100	80	78	0	158	82	97	0	179	437
05:00 PM	14	10	0	24	8	18	0	26	27	14	0	41	91
05:15 PM	17	14	0	31	18	12	0	30	15	18	0	33	94
05:30 PM	14	16	0	30	16	19	0	35	15	22	0	37	102
05:45 PM	7	16	0	23	21	18	0	39	26	15	0	41	103
Total	52	56	0	108	63	67	0	130	83	69	0	152	390
Grand Total	107	101	0	208	143	145	0	288	165	166	0	331	827
Apprch %	51.4	48.6	0		49.7	50.3	0		49.8	50.2	0		
Total %	12.9	12.2	0	25.2	17.3	17.5	0	34.8	20	20.1	0	40	
General Traffic	82	96	0	178	139	131	0	270	149	128	0	277	725
% General Traffic	76.6	95	0	85.6	97.2	90.3	0	93.8	90.3	77.1	0	83.7	87.7
3+ Axle Heavy Truck													
% 3+ Axle Heavy Truck	23.4	5	0	14.4	2.8	9.7	0	6.2	9.7	22.9	0	16.3	12.3



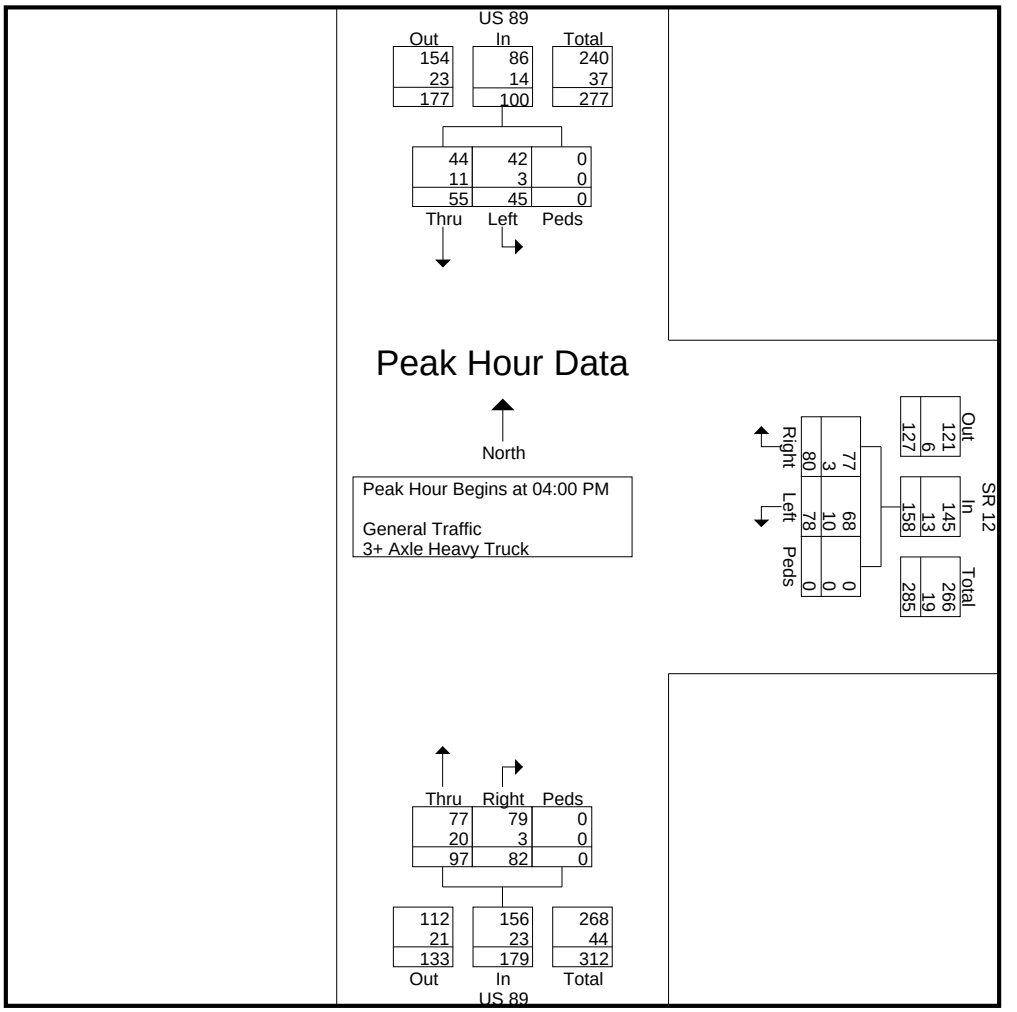
L2 Data Collection

1770 State Street #204
Boise, Idaho
(208) 860-7554

Tech: Larsen
Intersection: US 89 / SR 12
City, State: Panguitch, Utah
Control: Stop, Yield Signs

File Name : 89 12 PM
Site Code : 4
Start Date : 6/19/2007
Page No : 2

	US 89 From North				SR 12 From East				US 89 From South				
Start Time	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 04:00 PM													
04:00 PM	10	9	0	19	18	**22**	0	40	22	21	0	43	102
04:15 PM	16	**13**	0	29	**26**	21	0	**47**	**24**	22	0	46	**122**
04:30 PM	**17**	13	0	**30**	19	20	0	39	23	26	0	**49**	118
04:45 PM	12	10	0	22	17	15	0	32	13	**28**	0	41	95
Total Volume	55	45	0	100	80	78	0	158	82	97	0	179	437
% App. Total	55	45	0		50.6	49.4	0		45.8	54.2	0		
PHF	.809	.865	.000	.833	.769	.886	.000	.840	.854	.866	.000	.913	.895
General Traffic	44	42	0	86	77	68	0	145	79	77	0	156	387
% General Traffic	80.0	93.3	0	86.0	96.3	87.2	0	91.8	96.3	79.4	0	87.2	88.6
3+ Axle Heavy Truck													
% 3+ Axle Heavy Truck	20.0	6.7	0	14.0	3.8	12.8	0	8.2	3.7	20.6	0	12.8	11.4



L2 Data Collection

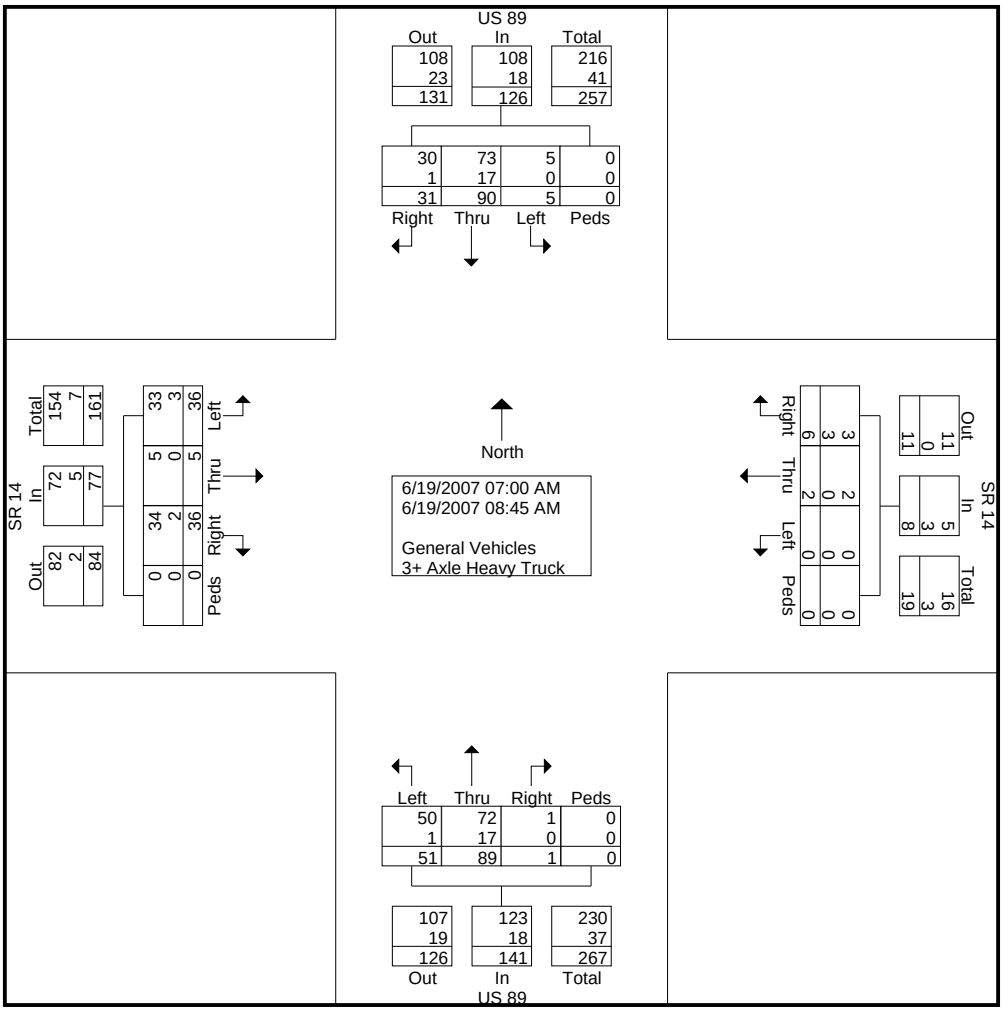
1770 State Street #204
Boise, Idaho
(208) 860-7554

Tech: Judd
Intersection: US 89 / SR 14
City, State: Alton, Utah
Control: Stop Sign

File Name : 89 14 AM
Site Code : 5
Start Date : 6/19/2007
Page No : 1

Groups Printed- General Vehicles - 3+ Axle Heavy Truck

	US 89 From North					SR 14 From East					US 89 From South					SR 14 From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	2	5	2	0	9	0	0	0	0	0	0	8	3	0	11	3	1	2	0	6	26
07:15 AM	1	8	0	0	9	3	1	0	0	4	0	9	8	0	17	7	0	8	0	15	45
07:30 AM	2	11	1	0	14	0	0	0	0	0	0	5	2	0	7	2	0	1	0	3	24
07:45 AM	10	10	0	0	20	0	0	0	0	0	0	16	7	0	23	4	1	6	0	11	54
Total	15	34	3	0	52	3	1	0	0	4	0	38	20	0	58	16	2	17	0	35	149
08:00 AM	5	11	0	0	16	0	0	0	0	0	0	14	11	0	25	3	1	4	0	8	49
08:15 AM	4	9	1	0	14	1	0	0	0	1	0	8	6	0	14	4	0	2	0	6	35
08:30 AM	5	14	1	0	20	1	0	0	0	1	1	16	5	0	22	10	1	5	0	16	59
08:45 AM	2	22	0	0	24	1	1	0	0	2	0	13	9	0	22	3	1	8	0	12	60
Total	16	56	2	0	74	3	1	0	0	4	1	51	31	0	83	20	3	19	0	42	203
Grand Total	31	90	5	0	126	6	2	0	0	8	1	89	51	0	141	36	5	36	0	77	352
Apprch %	24.6	71.4	4	0		75	25	0	0		0.7	63.1	36.2	0		46.8	6.5	46.8	0		
Total %	8.8	25.6	1.4	0	35.8	1.7	0.6	0	0	2.3	0.3	25.3	14.5	0	40.1	10.2	1.4	10.2	0	21.9	
General Vehicles	30	73	5	0	108	3	2	0	0	5	1	72	50	0	123	34	5	33	0	72	308
% General Vehicles	96.8	81.1	100	0	85.7	50	100	0	0	62.5	100	80.9	98	0	87.2	94.4	100	91.7	0	93.5	87.5
3+ Axle Heavy Truck	1	17	0	0	18	3	0	0	0	3	0	17	1	0	18	2	0	3	0	5	44
% 3+ Axle Heavy Truck	3.2	18.9	0	0	14.3	50	0	0	0	37.5	0	19.1	2	0	12.8	5.6	0	8.3	0	6.5	12.5



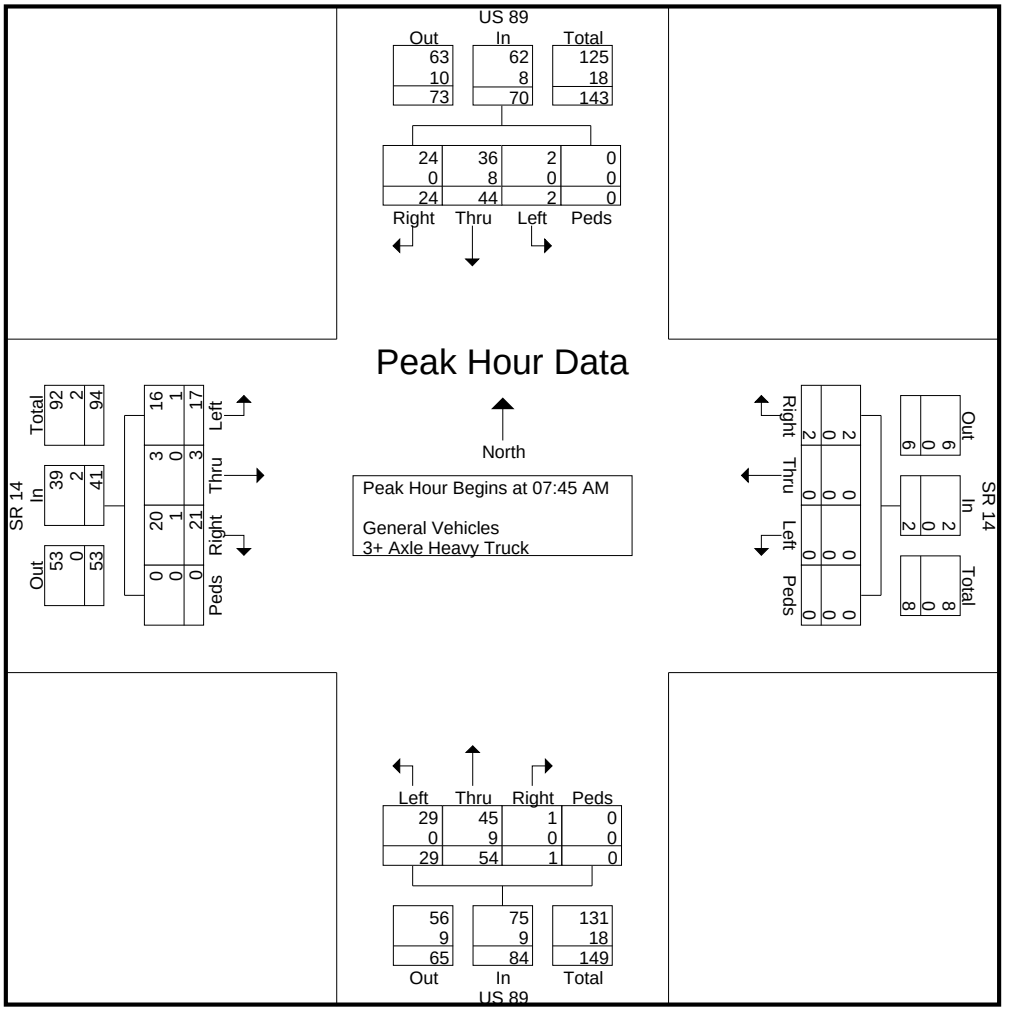
L2 Data Collection

1770 State Street #204
Boise, Idaho
(208) 860-7554

Tech: Judd
Intersection: US 89 / SR 14
City, State: Alton, Utah
Control: Stop Sign

File Name : 89 14 AM
Site Code : 5
Start Date : 6/19/2007
Page No : 2

	US 89 From North					SR 14 From East					US 89 From South					SR 14 From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:30 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:45 AM																					
07:45 AM	**10**	10	0	0	**20**	0	0	0	0	0	0	**16**	7	0	23	4	**1**	**6**	0	11	54
08:00 AM	5	11	0	0	16	0	0	0	0	0	0	14	**11**	0	**25**	3	1	4	0	8	49
08:15 AM	4	9	**1**	0	14	**1**	0	0	0	**1**	0	8	6	0	14	4	0	2	0	6	35
08:30 AM	5	**14**	1	0	20	1	0	0	0	1	**1**	16	5	0	22	**10**	1	5	0	**16**	**59**
Total Volume	24	44	2	0	70	2	0	0	0	2	1	54	29	0	84	21	3	17	0	41	197
% App. Total	34.3	62.9	2.9	0		100	0	0	0		1.2	64.3	34.5	0		51.2	7.3	41.5	0		
PHF	.600	.786	.500	.000	.875	.500	.000	.000	.000	.500	.250	.844	.659	.000	.840	.525	.750	.708	.000	.641	.835
General Vehicles	24	36	2	0	62	2	0	0	0	2	1	45	29	0	75	20	3	16	0	39	178
% General Vehicles	100	81.8	100	0	88.6	100	0	0	0	100	100	83.3	100	0	89.3	95.2	100	94.1	0	95.1	90.4
3+ Axle Heavy Truck	0	8	0	0	8	0	0	0	0	0	0	9	0	0	9	1	0	1	0	2	19
% 3+ Axle Heavy Truck	0	18.2	0	0	11.4	0	0	0	0	0	0	16.7	0	0	10.7	4.8	0	5.9	0	4.9	9.6



L2 Data Collection

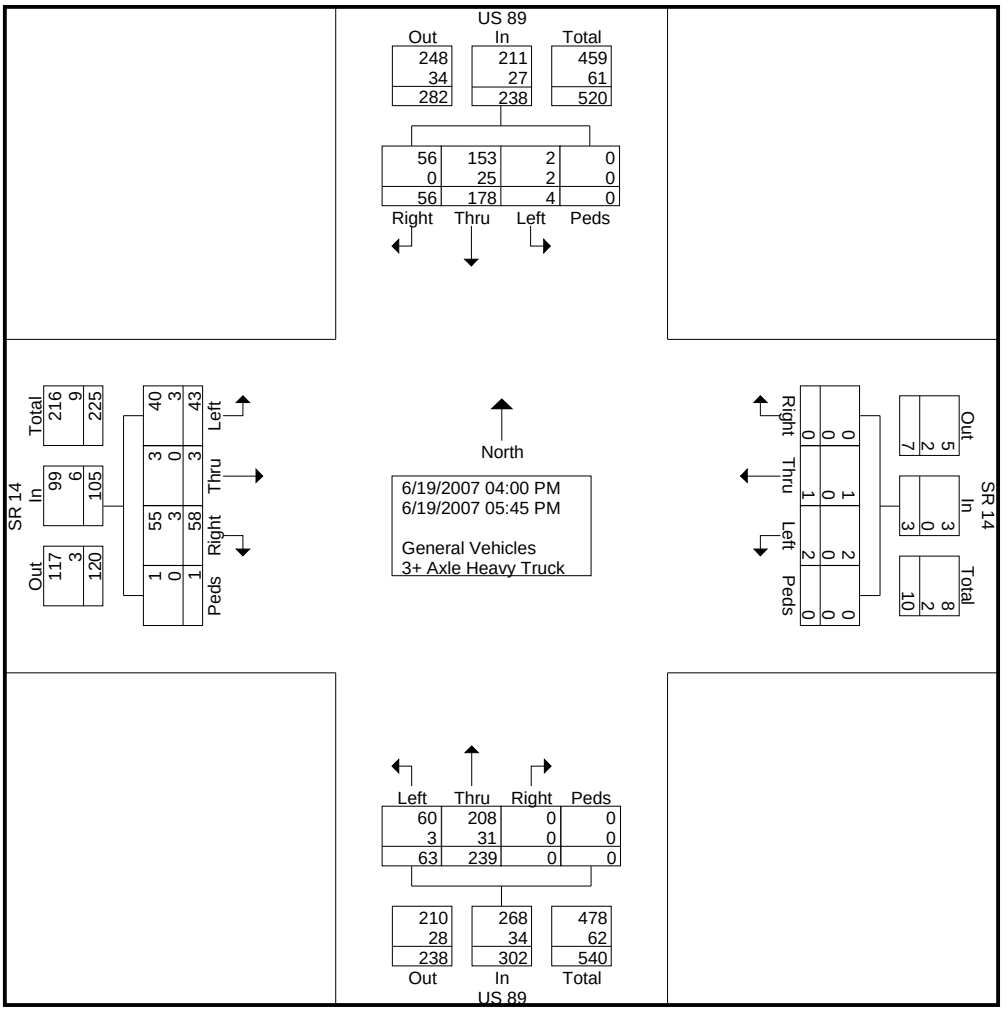
1770 State Street #204
Boise, Idaho
(208) 860-7554

Tech: Judd
Intersection: US 89 / SR 14
City, State: Alton, Utah
Control: Stop Sign

File Name : 89 14 PM
Site Code : 5
Start Date : 6/19/2007
Page No : 1

Groups Printed- General Vehicles - 3+ Axle Heavy Truck

	US 89 From North					SR 14 From East					US 89 From South					SR 14 From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
04:00 PM	7	17	1	0	25	0	0	0	0	0	0	37	17	0	54	8	0	5	0	13	92
04:15 PM	8	21	1	0	30	0	0	0	0	0	0	34	4	0	38	4	0	6	0	10	78
04:30 PM	8	26	1	0	35	0	0	0	0	0	0	35	5	0	40	10	0	6	1	17	92
04:45 PM	4	25	1	0	30	0	0	0	0	0	0	23	7	0	30	6	1	6	0	13	73
Total	27	89	4	0	120	0	0	0	0	0	0	129	33	0	162	28	1	23	1	53	335
05:00 PM	9	23	0	0	32	0	1	0	0	1	0	21	6	0	27	9	0	5	0	14	74
05:15 PM	7	16	0	0	23	0	0	2	0	2	0	33	8	0	41	7	0	3	0	10	76
05:30 PM	8	24	0	0	32	0	0	0	0	0	0	40	7	0	47	4	0	6	0	10	89
05:45 PM	5	26	0	0	31	0	0	0	0	0	0	16	9	0	25	10	2	6	0	18	74
Total	29	89	0	0	118	0	1	2	0	3	0	110	30	0	140	30	2	20	0	52	313
Grand Total	56	178	4	0	238	0	1	2	0	3	0	239	63	0	302	58	3	43	1	105	648
Apprch %	23.5	74.8	1.7	0		0	33.3	66.7	0		0	79.1	20.9	0		55.2	2.9	41	1		
Total %	8.6	27.5	0.6	0	36.7	0	0.2	0.3	0	0.5	0	36.9	9.7	0	46.6	9	0.5	6.6	0.2	16.2	
General Vehicles	56	153	2	0	211	0	1	2	0	3	0	208	60	0	268	55	3	40	1	99	581
% General Vehicles	100	86	50	0	88.7	0	100	100	0	100	0	87	95.2	0	88.7	94.8	100	93	100	94.3	89.7
3+ Axle Heavy Truck	0	25	2	0	27	0	0	0	0	0	0	31	3	0	34	3	0	3	0	6	67
% 3+ Axle Heavy Truck	0	14	50	0	11.3	0	0	0	0	0	0	13	4.8	0	11.3	5.2	0	7	0	5.7	10.3



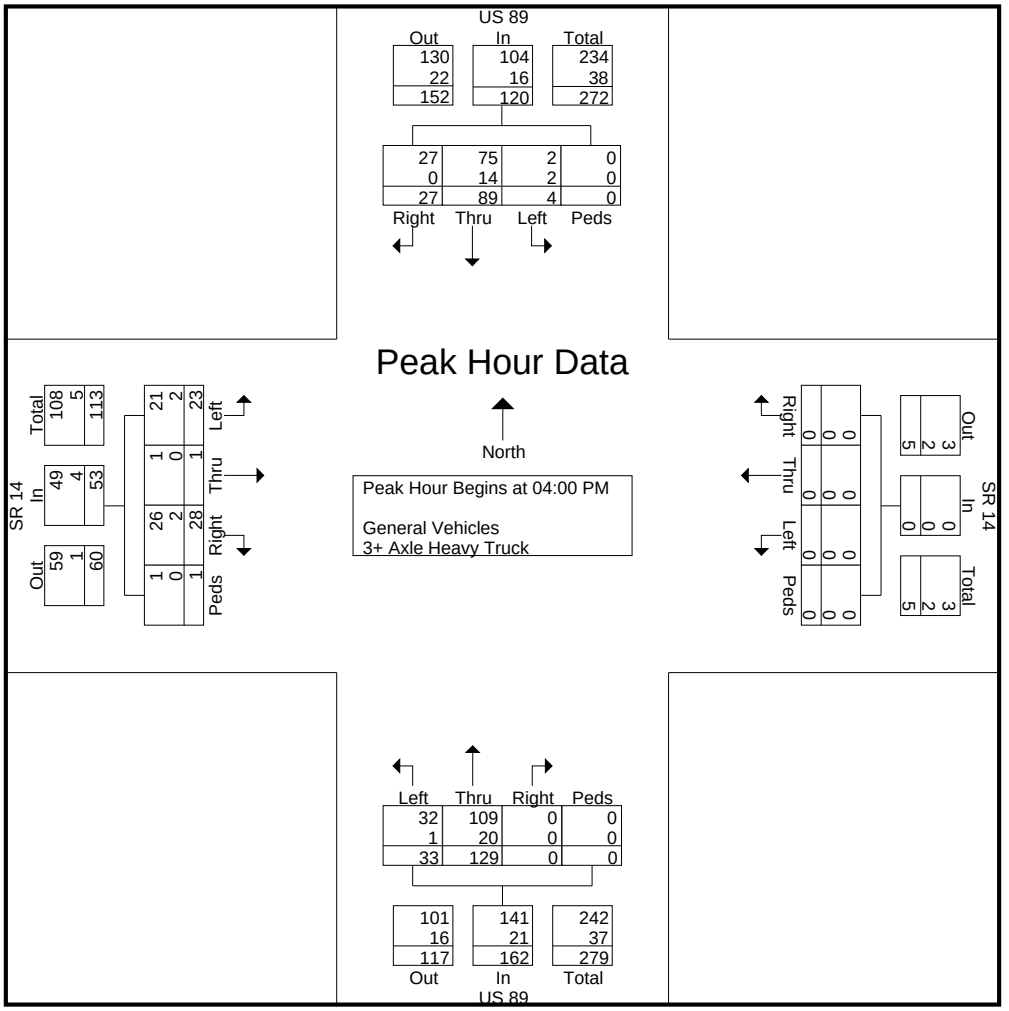
L2 Data Collection

1770 State Street #204
Boise, Idaho
(208) 860-7554

Tech: Judd
Intersection: US 89 / SR 14
City, State: Alton, Utah
Control: Stop Sign

File Name : 89 14 PM
Site Code : 5
Start Date : 6/19/2007
Page No : 2

	US 89 From North					SR 14 From East					US 89 From South					SR 14 From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:30 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:00 PM																					
04:00 PM	7	17	**1**	0	25	0	0	0	0	0	0	**37**	**17**	0	**54**	8	0	5	0	13	**92**
04:15 PM	**8**	21	1	0	30	0	0	0	0	0	0	34	4	0	38	4	0	**6**	0	10	78
04:30 PM	8	**26**	1	0	**35**	0	0	0	0	0	0	35	5	0	40	**10**	0	6	**1**	**17**	92
04:45 PM	4	25	1	0	30	0	0	0	0	0	0	23	7	0	30	6	**1**	6	0	13	73
Total Volume	27	89	4	0	120	0	0	0	0	0	0	129	33	0	162	28	1	23	1	53	335
% App. Total	22.5	74.2	3.3	0		0	0	0	0		0	79.6	20.4	0		52.8	1.9	43.4	1.9		
PHF	.844	.856	1.000	.000	.857	.000	.000	.000	.000	.000	.000	.872	.485	.000	.750	.700	.250	.958	.250	.779	.910
General Vehicles	27	75	2	0	104	0	0	0	0	0	0	109	32	0	141	26	1	21	1	49	294
% General Vehicles	100	84.3	50.0	0	86.7	0	0	0	0	0	0	84.5	97.0	0	87.0	92.9	100	91.3	100	92.5	87.8
3+ Axle Heavy Truck	0	14	2	0	16	0	0	0	0	0	0	20	1	0	21	2	0	2	0	4	41
% 3+ Axle Heavy Truck	0	15.7	50.0	0	13.3	0	0	0	0	0	0	15.5	3.0	0	13.0	7.1	0	8.7	0	7.5	12.2



L2 Data Collection

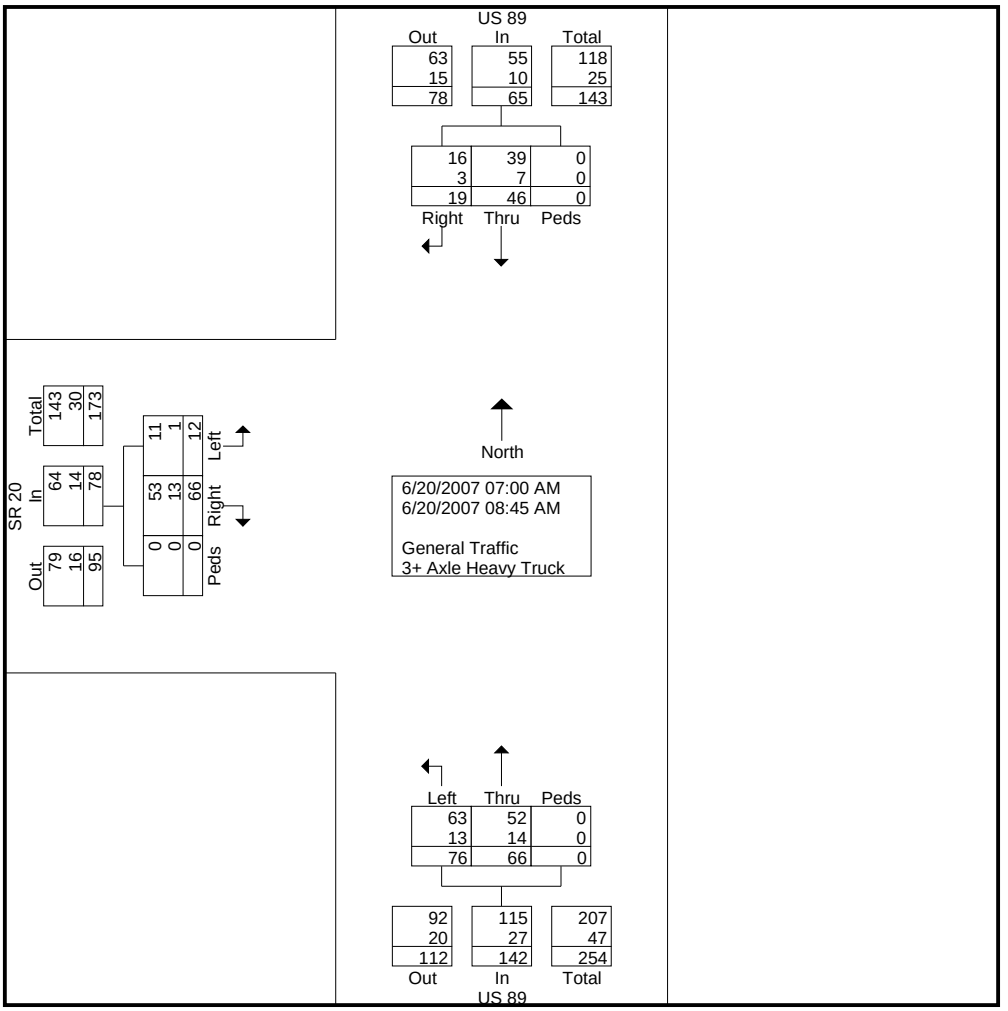
1770 State Street #204
Boise, Idaho
(208) 860-7554

Tech: Judd
Intersection: US 89 / SR 20
City, State: Panguitch, Utah
Control: Stop Sign

File Name : 89 20 AM
Site Code : 2
Start Date : 6/20/2007
Page No : 1

Groups Printed- General Traffic - 3+ Axle Heavy Truck

	US 89 From North				US 89 From South				SR 20 From West				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
07:00 AM	3	1	0	4	5	3	0	8	4	1	0	5	17
07:15 AM	2	5	0	7	4	9	0	13	5	0	0	5	25
07:30 AM	6	5	0	11	6	8	0	14	2	2	0	4	29
07:45 AM	2	10	0	12	7	9	0	16	11	2	0	13	41
Total	13	21	0	34	22	29	0	51	22	5	0	27	112
08:00 AM	3	8	0	11	19	10	0	29	10	2	0	12	52
08:15 AM	1	4	0	5	10	15	0	25	13	4	0	17	47
08:30 AM	2	6	0	8	7	9	0	16	6	0	0	6	30
08:45 AM	0	7	0	7	8	13	0	21	15	1	0	16	44
Total	6	25	0	31	44	47	0	91	44	7	0	51	173
Grand Total	19	46	0	65	66	76	0	142	66	12	0	78	285
Apprch %	29.2	70.8	0		46.5	53.5	0		84.6	15.4	0		
Total %	6.7	16.1	0	22.8	23.2	26.7	0	49.8	23.2	4.2	0	27.4	
General Traffic	16	39	0	55	52	63	0	115	53	11	0	64	234
% General Traffic	84.2	84.8	0	84.6	78.8	82.9	0	81	80.3	91.7	0	82.1	82.1
3+ Axle Heavy Truck													
% 3+ Axle Heavy Truck	15.8	15.2	0	15.4	21.2	17.1	0	19	19.7	8.3	0	17.9	17.9



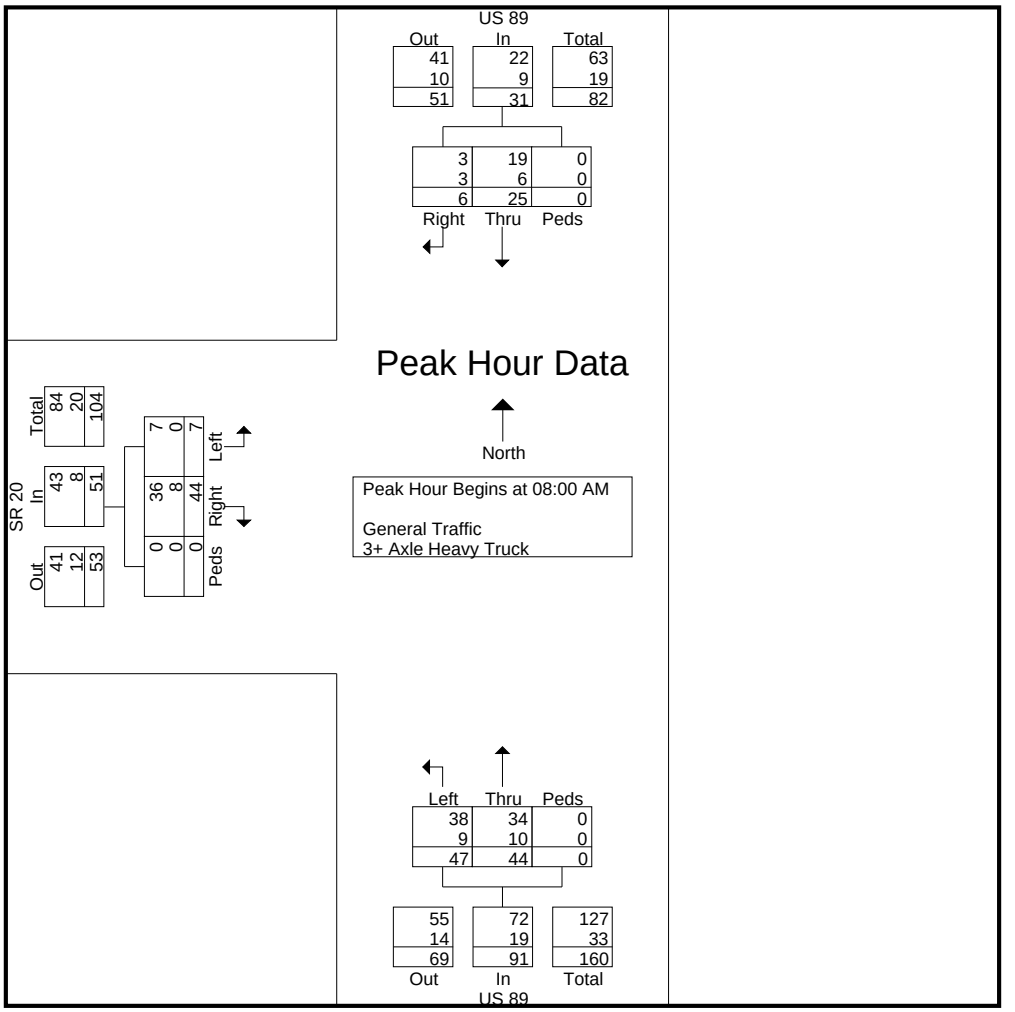
L2 Data Collection

1770 State Street #204
Boise, Idaho
(208) 860-7554

Tech: Judd
Intersection: US 89 / SR 20
City, State: Panguitch, Utah
Control: Stop Sign

File Name : 89 20 AM
Site Code : 2
Start Date : 6/20/2007
Page No : 2

	US 89 From North				US 89 From South				SR 20 From West				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 08:00 AM													
08:00 AM	**3**	**8**	0	**11**	**19**	10	0	**29**	10	2	0	12	**52**
08:15 AM	1	4	0	5	10	**15**	0	25	13	**4**	0	**17**	47
08:30 AM	2	6	0	8	7	9	0	16	6	0	0	6	30
08:45 AM	0	7	0	7	8	13	0	21	**15**	1	0	16	44
Total Volume	6	25	0	31	44	47	0	91	44	7	0	51	173
% App. Total	19.4	80.6	0		48.4	51.6	0		86.3	13.7	0		
PHF	.500	.781	.000	.705	.579	.783	.000	.784	.733	.438	.000	.750	.832
General Traffic	3	19	0	22	34	38	0	72	36	7	0	43	137
% General Traffic	50.0	76.0	0	71.0	77.3	80.9	0	79.1	81.8	100	0	84.3	79.2
3+ Axle Heavy Truck													
% 3+ Axle Heavy Truck	50.0	24.0	0	29.0	22.7	19.1	0	20.9	18.2	0	0	15.7	20.8



L2 Data Collection

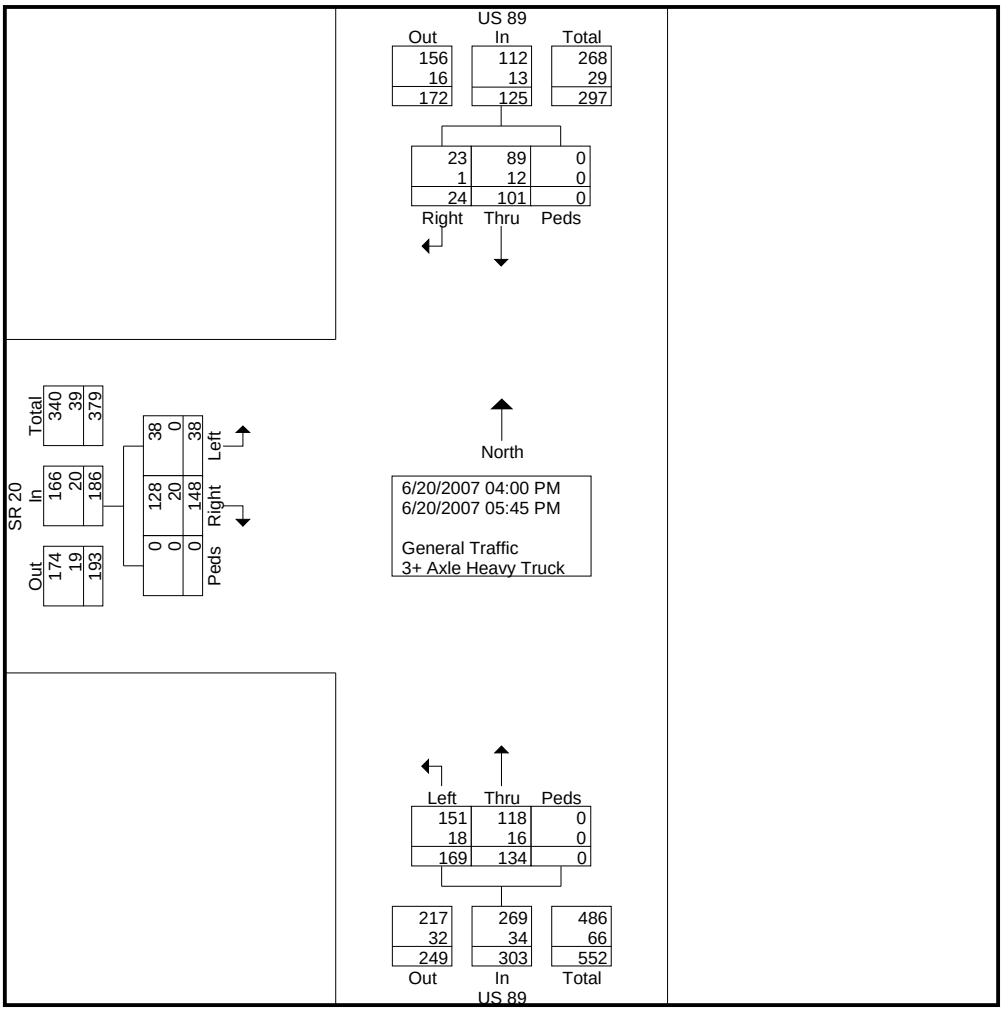
1770 State Street #204
Boise, Idaho
(208) 860-7554

Tech: Judd
Intersection: US 89 / SR 20
City, State: Panguitch, Utah
Control: Stop Sign

File Name : 89 20 PM
Site Code : 2
Start Date : 6/20/2007
Page No : 1

Groups Printed- General Traffic - 3+ Axle Heavy Truck

	US 89 From North				US 89 From South				SR 20 From West				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
04:00 PM	2	18	0	20	14	26	0	40	15	9	0	24	84
04:15 PM	6	10	0	16	15	24	0	39	23	2	0	25	80
04:30 PM	0	14	0	14	16	22	0	38	19	7	0	26	78
04:45 PM	1	15	0	16	17	25	0	42	16	5	0	21	79
Total	9	57	0	66	62	97	0	159	73	23	0	96	321
05:00 PM	4	8	0	12	20	26	0	46	22	2	0	24	82
05:15 PM	3	8	0	11	26	15	0	41	20	5	0	25	77
05:30 PM	5	15	0	20	11	15	0	26	18	5	0	23	69
05:45 PM	3	13	0	16	15	16	0	31	15	3	0	18	65
Total	15	44	0	59	72	72	0	144	75	15	0	90	293
Grand Total	24	101	0	125	134	169	0	303	148	38	0	186	614
Apprch %	19.2	80.8	0		44.2	55.8	0		79.6	20.4	0		
Total %	3.9	16.4	0	20.4	21.8	27.5	0	49.3	24.1	6.2	0	30.3	
General Traffic	23	89	0	112	118	151	0	269	128	38	0	166	547
% General Traffic	95.8	88.1	0	89.6	88.1	89.3	0	88.8	86.5	100	0	89.2	89.1
3+ Axle Heavy Truck													
% 3+ Axle Heavy Truck	4.2	11.9	0	10.4	11.9	10.7	0	11.2	13.5	0	0	10.8	10.9



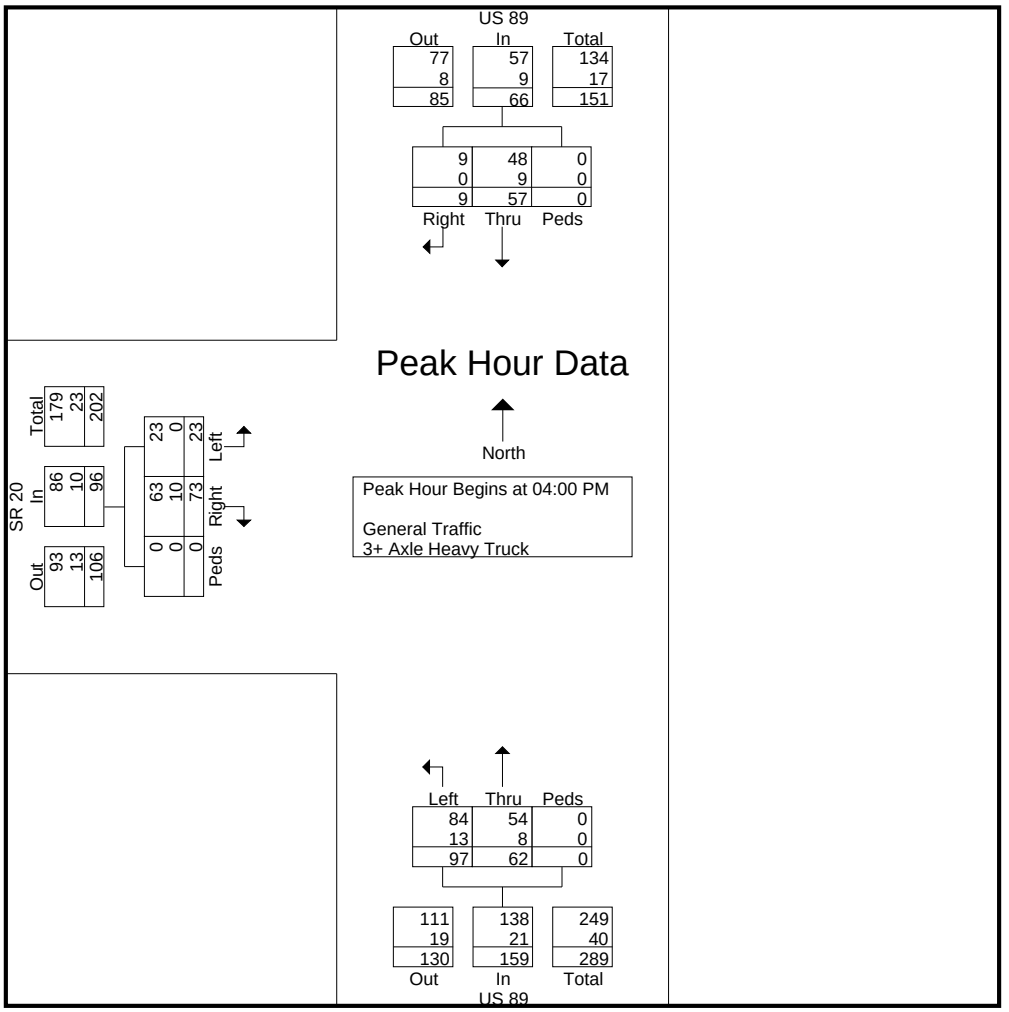
L2 Data Collection

1770 State Street #204
Boise, Idaho
(208) 860-7554

Tech: Judd
Intersection: US 89 / SR 20
City, State: Panguitch, Utah
Control: Stop Sign

File Name : 89 20 PM
Site Code : 2
Start Date : 6/20/2007
Page No : 2

	US 89 From North				US 89 From South				SR 20 From West				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 04:00 PM													
04:00 PM	2	**18**	0	**20**	14	**26**	0	40	15	**9**	0	24	**84**
04:15 PM	**6**	10	0	16	15	24	0	39	**23**	2	0	25	80
04:30 PM	0	14	0	14	16	22	0	38	19	7	0	**26**	78
04:45 PM	1	15	0	16	**17**	25	0	**42**	16	5	0	21	79
Total Volume	9	57	0	66	62	97	0	159	73	23	0	96	321
% App. Total	13.6	86.4	0		39	61	0		76	24	0		
PHF	.375	.792	.000	.825	.912	.933	.000	.946	.793	.639	.000	.923	.955
General Traffic	9	48	0	57	54	84	0	138	63	23	0	86	281
% General Traffic	100	84.2	0	86.4	87.1	86.6	0	86.8	86.3	100	0	89.6	87.5
3+ Axle Heavy Truck													
% 3+ Axle Heavy Truck	0	15.8	0	13.6	12.9	13.4	0	13.2	13.7	0	0	10.4	12.5



L2 Data Collection

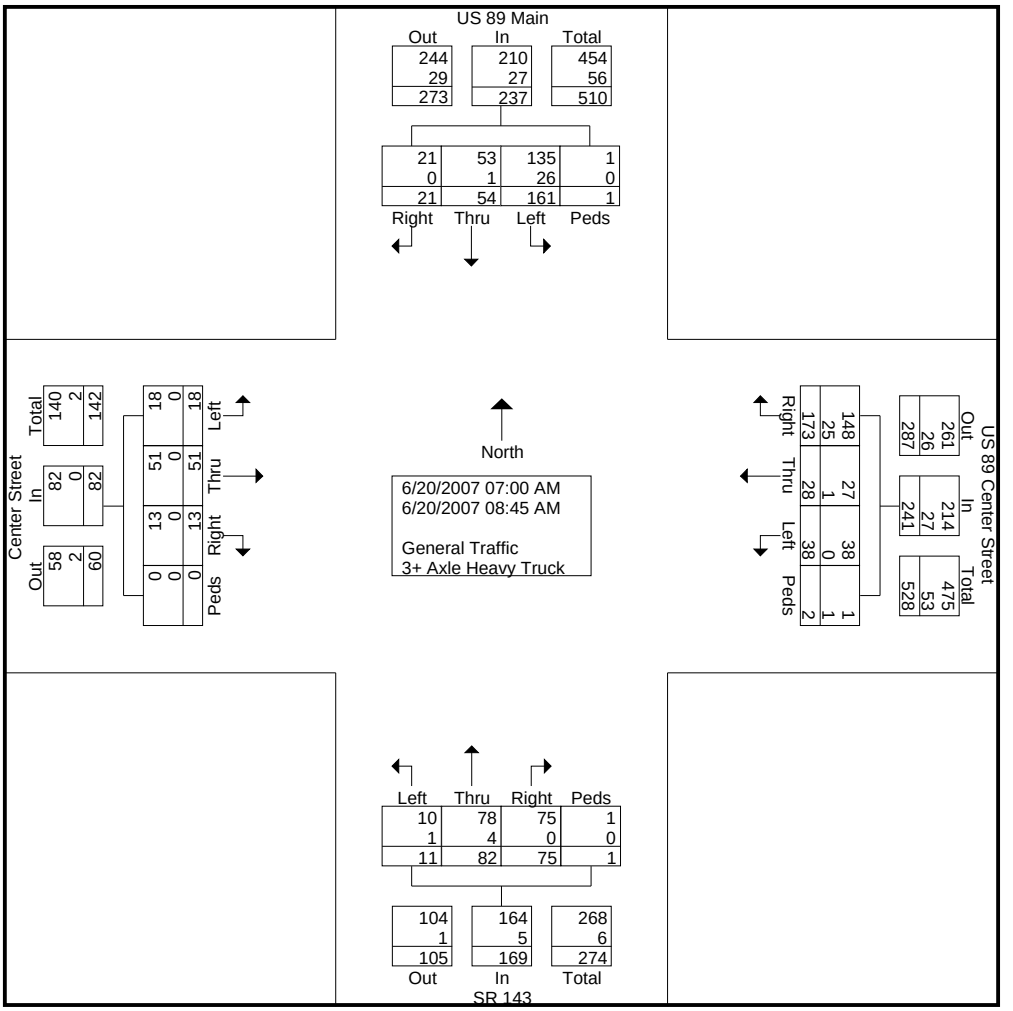
1770 State Street #204
Boise, Idaho
(208) 860-7554

Tech: Larsen
Intersection: US 89 / Main / Center
City, State: Panguitch, Utah
Control: 4 Way Stop

File Name : 89 Main AM
Site Code : 3
Start Date : 6/20/2007
Page No : 1

Groups Printed- General Traffic - 3+ Axle Heavy Truck

	US 89 Main From North					US 89 Center Street From East					SR 143 From South					Center Street From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	1	4	12	1	18	19	6	1	1	27	6	4	3	0	13	3	4	1	0	8	66
07:15 AM	3	4	16	0	23	12	3	3	0	18	7	7	0	1	15	1	9	2	0	12	68
07:30 AM	1	9	21	0	31	24	2	1	0	27	4	4	1	0	9	1	5	3	0	9	76
07:45 AM	3	6	18	0	27	27	1	9	1	38	4	15	0	0	19	4	4	3	0	11	95
Total	8	23	67	1	99	82	12	14	2	110	21	30	4	1	56	9	22	9	0	40	305
08:00 AM	1	9	25	0	35	30	4	8	0	42	21	10	3	0	34	2	6	2	0	10	121
08:15 AM	2	7	22	0	31	20	5	5	0	30	6	8	2	0	16	1	11	3	0	15	92
08:30 AM	6	10	26	0	42	22	4	6	0	32	14	17	0	0	31	0	6	0	0	6	111
08:45 AM	4	5	21	0	30	19	3	5	0	27	13	17	2	0	32	1	6	4	0	11	100
Total	13	31	94	0	138	91	16	24	0	131	54	52	7	0	113	4	29	9	0	42	424
Grand Total	21	54	161	1	237	173	28	38	2	241	75	82	11	1	169	13	51	18	0	82	729
Apprch %	8.9	22.8	67.9	0.4		71.8	11.6	15.8	0.8		44.4	48.5	6.5	0.6		15.9	62.2	22	0		
Total %	2.9	7.4	22.1	0.1	32.5	23.7	3.8	5.2	0.3	33.1	10.3	11.2	1.5	0.1	23.2	1.8	7	2.5	0	11.2	
General Traffic	21	53	135	1	210	148	27	38	1	214	75	78	10	1	164	13	51	18	0	82	670
% General Traffic	100	98.1	83.9	100	88.6	85.5	96.4	100	50	88.8	100	95.1	90.9	100	97	100	100	100	0	100	91.9
3+ Axle Heavy Truck	0	1	26	0	27	25	1	0	1	27	0	4	1	0	5	0	0	0	0	0	59
% 3+ Axle Heavy Truck	0	1.9	16.1	0	11.4	14.5	3.6	0	50	11.2	0	4.9	9.1	0	3	0	0	0	0	0	8.1



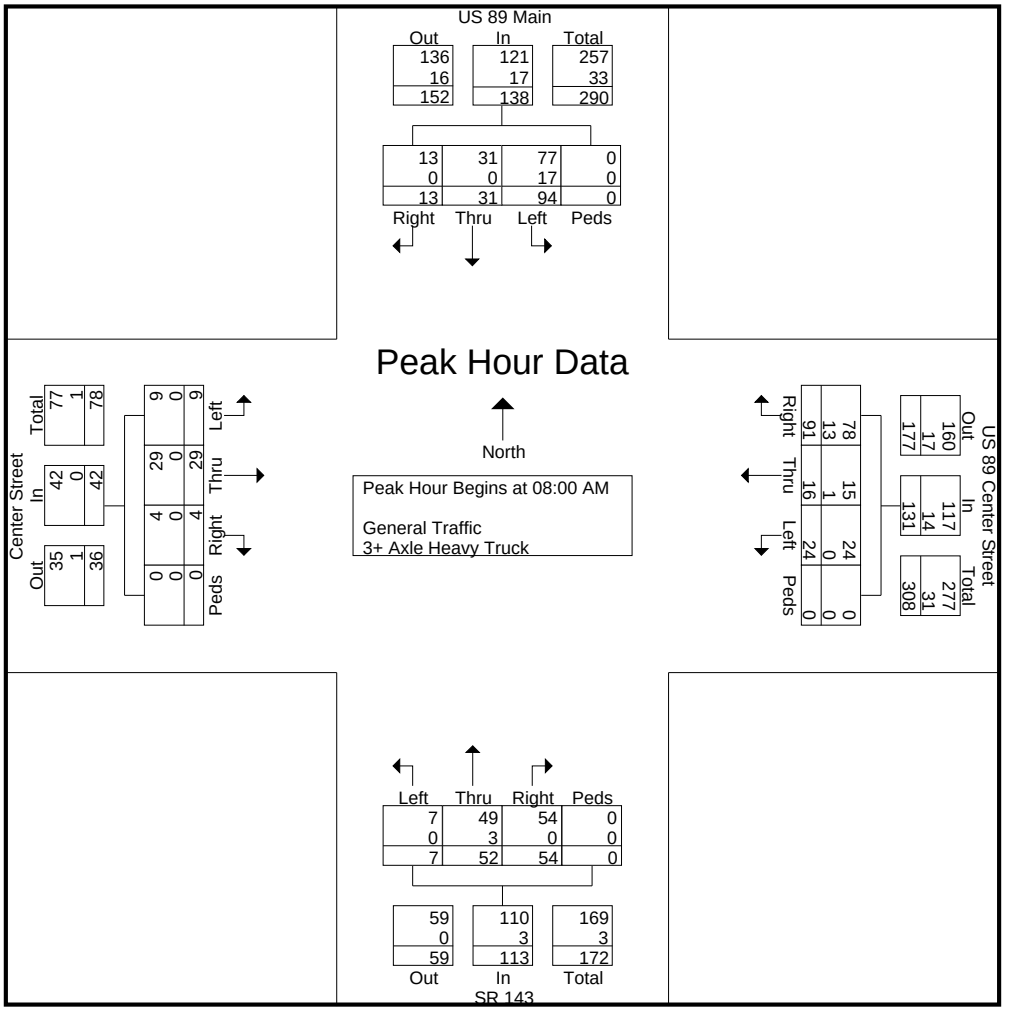
L2 Data Collection

1770 State Street #204
Boise, Idaho
(208) 860-7554

Tech: Larsen
Intersection: US 89 / Main / Center
City, State: Panguitch, Utah
Control: 4 Way Stop

File Name : 89 Main AM
Site Code : 3
Start Date : 6/20/2007
Page No : 2

	US 89 Main From North					US 89 Center Street From East					SR 143 From South					Center Street From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 08:00 AM																					
08:00 AM	1	9	25	0	35	**30**	4	**8**	0	**42**	**21**	10	**3**	0	**34**	**2**	6	2	0	10	**121**
08:15 AM	2	7	22	0	31	20	**5**	5	0	30	6	8	2	0	16	1	**11**	3	0	**15**	92
08:30 AM	**6**	**10**	**26**	0	**42**	22	4	6	0	32	14	**17**	0	0	31	0	6	0	0	6	111
08:45 AM	4	5	21	0	30	19	3	5	0	27	13	17	2	0	32	1	6	**4**	0	11	100
Total Volume	13	31	94	0	138	91	16	24	0	131	54	52	7	0	113	4	29	9	0	42	424
% App. Total	9.4	22.5	68.1	0		69.5	12.2	18.3	0		47.8	46	6.2	0		9.5	69	21.4	0		
PHF	.542	.775	.904	.000	.821	.758	.800	.750	.000	.780	.643	.765	.583	.000	.831	.500	.659	.563	.000	.700	.876
General Traffic	13	31	77	0	121	78	15	24	0	117	54	49	7	0	110	4	29	9	0	42	390
% General Traffic	100	100	81.9	0	87.7	85.7	93.8	100	0	89.3	100	94.2	100	0	97.3	100	100	100	0	100	92.0
3+ Axle Heavy Truck	0	0	17	0	17	13	1	0	0	14	0	3	0	0	3	0	0	0	0	0	34
% 3+ Axle Heavy Truck	0	0	18.1	0	12.3	14.3	6.3	0	0	10.7	0	5.8	0	0	2.7	0	0	0	0	0	8.0



L2 Data Collection

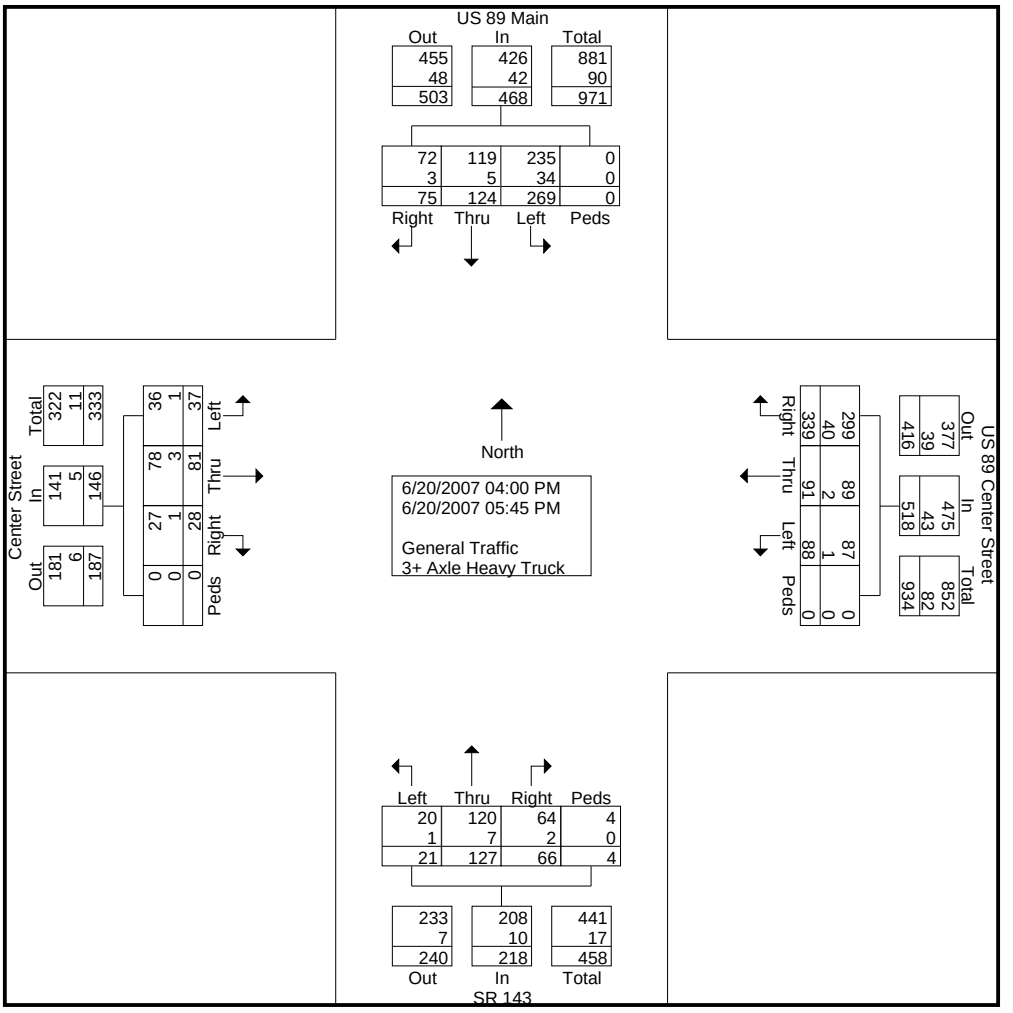
1770 State Street #204
Boise, Idaho
(208) 860-7554

Tech: Larsen
Intersection: US 89 / Main / Center
City, State: Panguitch, Utah
Control: 4 Way Stop

File Name : 89 Main PM
Site Code : 3
Start Date : 6/20/2007
Page No : 1

Groups Printed- General Traffic - 3+ Axle Heavy Truck

	US 89 Main From North					US 89 Center Street From East					SR 143 From South					Center Street From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
04:00 PM	8	16	28	0	52	31	9	11	0	51	11	16	3	0	30	3	5	5	0	13	146
04:15 PM	10	11	33	0	54	45	13	12	0	70	6	23	2	0	31	4	7	1	0	12	167
04:30 PM	10	10	41	0	61	38	8	8	0	54	7	18	1	0	26	2	8	5	0	15	156
04:45 PM	7	13	44	0	64	46	10	15	0	71	6	17	2	0	25	2	15	8	0	25	185
Total	35	50	146	0	231	160	40	46	0	246	30	74	8	0	112	11	35	19	0	65	654
05:00 PM	11	22	30	0	63	63	18	20	0	101	8	13	5	0	26	5	16	8	0	29	219
05:15 PM	7	20	30	0	57	36	8	10	0	54	12	17	2	4	35	4	13	3	0	20	166
05:30 PM	13	17	31	0	61	45	11	3	0	59	9	14	3	0	26	4	7	3	0	14	160
05:45 PM	9	15	32	0	56	35	14	9	0	58	7	9	3	0	19	4	10	4	0	18	151
Total	40	74	123	0	237	179	51	42	0	272	36	53	13	4	106	17	46	18	0	81	696
Grand Total	75	124	269	0	468	339	91	88	0	518	66	127	21	4	218	28	81	37	0	146	1350
Apprch %	16	26.5	57.5	0		65.4	17.6	17	0		30.3	58.3	9.6	1.8		19.2	55.5	25.3	0		
Total %	5.6	9.2	19.9	0	34.7	25.1	6.7	6.5	0	38.4	4.9	9.4	1.6	0.3	16.1	2.1	6	2.7	0	10.8	
General Traffic	72	119	235	0	426	299	89	87	0	475	64	120	20	4	208	27	78	36	0	141	1250
% General Traffic	96	96	87.4	0	91	88.2	97.8	98.9	0	91.7	97	94.5	95.2	100	95.4	96.4	96.3	97.3	0	96.6	92.6
3+ Axle Heavy Truck	3	5	34	0	42	40	2	1	0	43	2	7	1	0	10	1	3	1	0	5	100
% 3+ Axle Heavy Truck	4	4	12.6	0	9	11.8	2.2	1.1	0	8.3	3	5.5	4.8	0	4.6	3.6	3.7	2.7	0	3.4	7.4



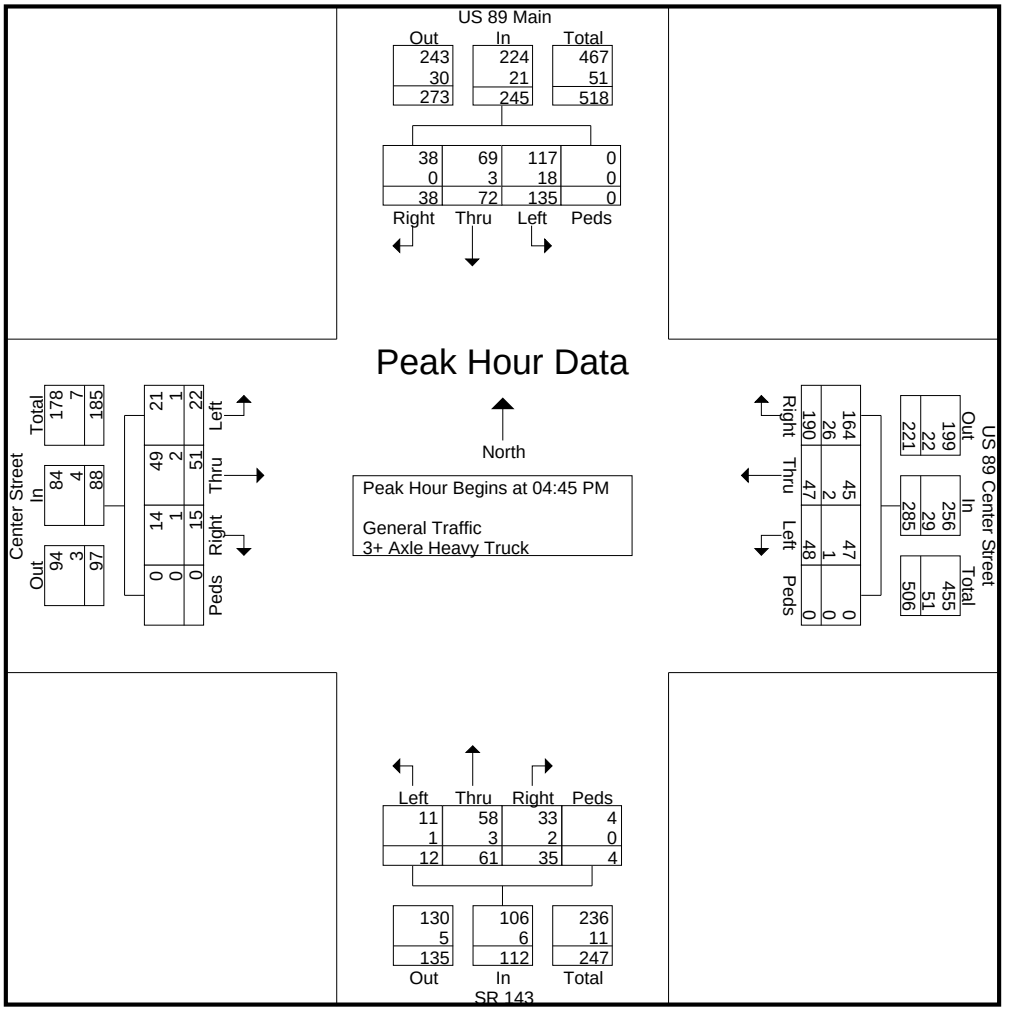
L2 Data Collection

1770 State Street #204
Boise, Idaho
(208) 860-7554

Tech: Larsen
Intersection: US 89 / Main / Center
City, State: Panguitch, Utah
Control: 4 Way Stop

File Name : 89 Main PM
Site Code : 3
Start Date : 6/20/2007
Page No : 2

	US 89 Main From North					US 89 Center Street From East					SR 143 From South					Center Street From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:45 PM																					
04:45 PM	7	13	**44**	0	**64**	46	10	15	0	71	6	**17**	2	0	25	2	15	**8**	0	25	185
05:00 PM	11	**22**	30	0	63	**63**	**18**	**20**	0	**101**	8	13	**5**	0	26	**5**	**16**	8	0	**29**	**219**
05:15 PM	7	20	30	0	57	36	8	10	0	54	**12**	17	2	**4**	**35**	4	13	3	0	20	166
05:30 PM	**13**	17	31	0	61	45	11	3	0	59	9	14	3	0	26	4	7	3	0	14	160
Total Volume	38	72	135	0	245	190	47	48	0	285	35	61	12	4	112	15	51	22	0	88	730
% App. Total	15.5	29.4	55.1	0		66.7	16.5	16.8	0		31.2	54.5	10.7	3.6		17	58	25	0		
PHF	.731	.818	.767	.000	.957	.754	.653	.600	.000	.705	.729	.897	.600	.250	.800	.750	.797	.688	.000	.759	.833
General Traffic	38	69	117	0	224	164	45	47	0	256	33	58	11	4	106	14	49	21	0	84	670
% General Traffic	100	95.8	86.7	0	91.4	86.3	95.7	97.9	0	89.8	94.3	95.1	91.7	100	94.6	93.3	96.1	95.5	0	95.5	91.8
3+ Axle Heavy Truck	0	3	18	0	21	26	2	1	0	29	2	3	1	0	6	1	2	1	0	4	60
% 3+ Axle Heavy Truck	0	4.2	13.3	0	8.6	13.7	4.3	2.1	0	10.2	5.7	4.9	8.3	0	5.4	6.7	3.9	4.5	0	4.5	8.2



L2 Data Collection

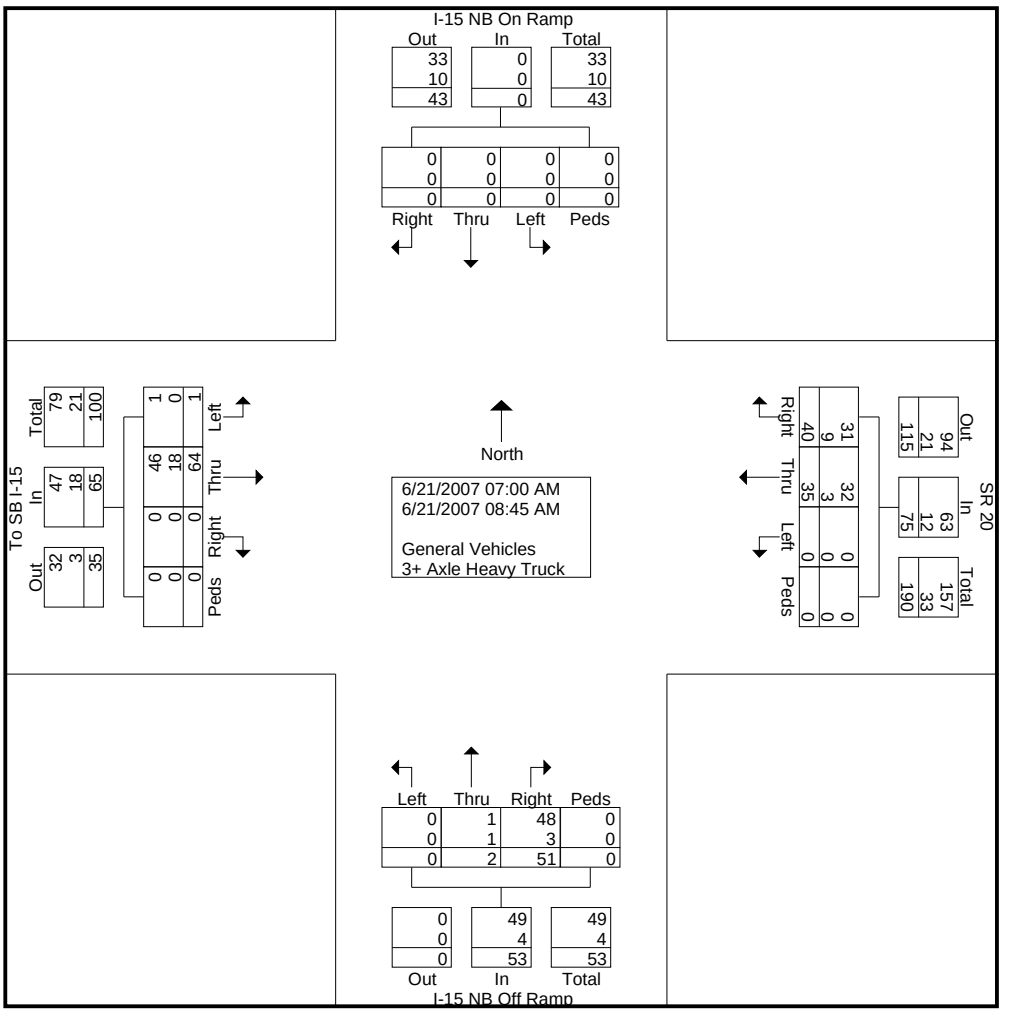
1770 W. State St. #204
Boise, Idaho
(208) 860-7554

Tech: Judd
Intersection: I-15 NB Ramps / SR 20
City, State: Iron County, Utah
Control: Stop Sign

File Name : I 15 SR 20 AM NB
Site Code : 00000000
Start Date : 6/21/2007
Page No : 1

Groups Printed- General Vehicles - 3+ Axle Heavy Truck

	I-15 NB On Ramp From North					SR 20 From East					I-15 NB Off Ramp From South					To SB I-15 From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	0	0	0	0	0	2	1	0	0	3	6	1	0	0	7	0	7	0	0	7	17
07:15 AM	0	0	0	0	0	4	5	0	0	9	8	0	0	0	8	0	7	0	0	7	24
07:30 AM	0	0	0	0	0	6	5	0	0	11	3	0	0	0	3	0	5	0	0	5	19
07:45 AM	0	0	0	0	0	5	2	0	0	7	6	0	0	0	6	0	4	0	0	4	17
Total	0	0	0	0	0	17	13	0	0	30	23	1	0	0	24	0	23	0	0	23	77
08:00 AM	0	0	0	0	0	1	7	0	0	8	8	0	0	0	8	0	9	1	0	10	26
08:15 AM	0	0	0	0	0	5	4	0	0	9	9	0	0	0	9	0	6	0	0	6	24
08:30 AM	0	0	0	0	0	9	6	0	0	15	7	1	0	0	8	0	15	0	0	15	38
08:45 AM	0	0	0	0	0	8	5	0	0	13	4	0	0	0	4	0	11	0	0	11	28
Total	0	0	0	0	0	23	22	0	0	45	28	1	0	0	29	0	41	1	0	42	116
Grand Total	0	0	0	0	0	40	35	0	0	75	51	2	0	0	53	0	64	1	0	65	193
Apprch %	0	0	0	0		53.3	46.7	0	0		96.2	3.8	0	0		0	98.5	1.5	0		
Total %	0	0	0	0	0	20.7	18.1	0	0	38.9	26.4	1	0	0	27.5	0	33.2	0.5	0	33.7	
General Vehicles																					
% General Vehicles	0	0	0	0	0	77.5	91.4	0	0	84	94.1	50	0	0	92.5	0	71.9	100	0	72.3	82.4
3+ Axle Heavy Truck																					
% 3+ Axle Heavy Truck	0	0	0	0	0	22.5	8.6	0	0	16	5.9	50	0	0	7.5	0	28.1	0	0	27.7	17.6



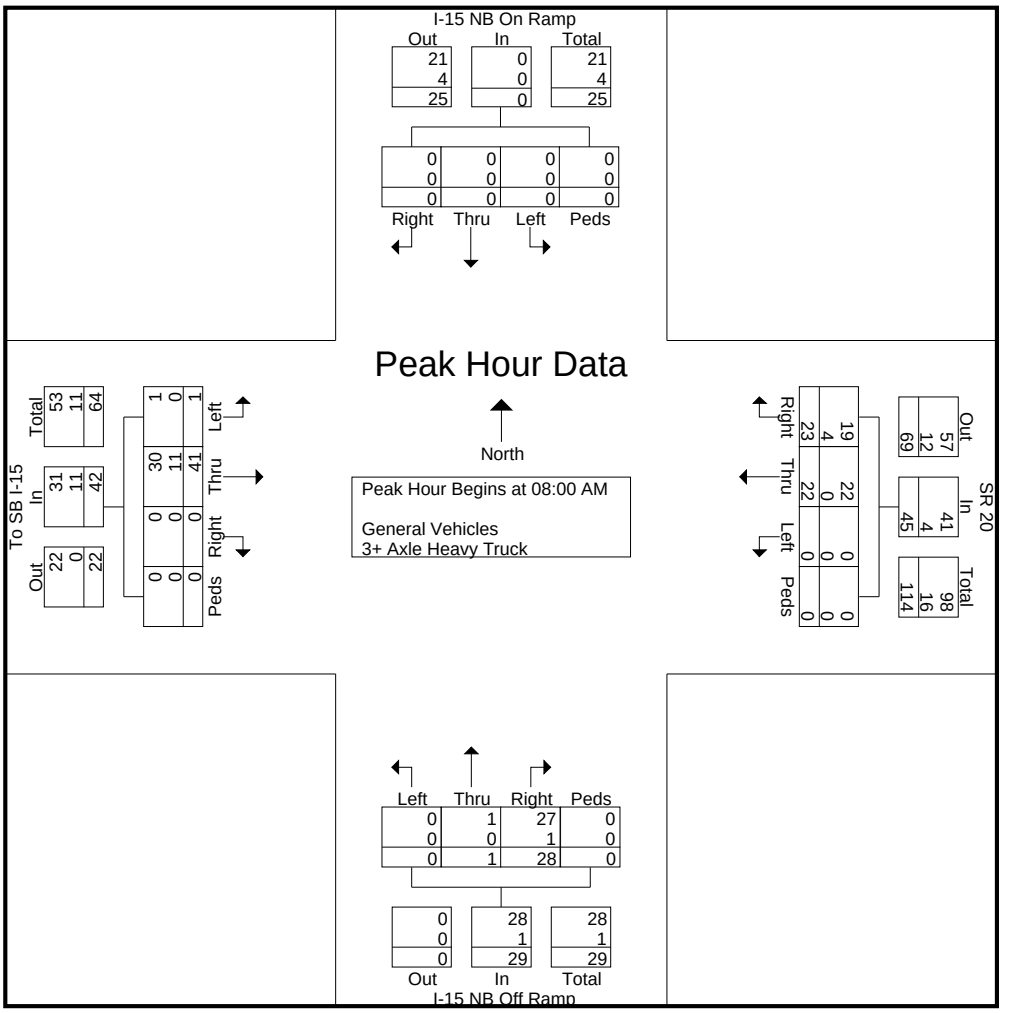
L2 Data Collection

1770 W. State St. #204
Boise, Idaho
(208) 860-7554

Tech: Judd
Intersection: I-15 NB Ramps / SR 20
City, State: Iron County, Utah
Control: Stop Sign

File Name : I 15 SR 20 AM NB
Site Code : 00000000
Start Date : 6/21/2007
Page No : 2

	I-15 NB On Ramp From North					SR 20 From East					I-15 NB Off Ramp From South					To SB I-15 From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 08:00 AM																					
08:00 AM	0	0	0	0	0	1	**7**	0	0	8	8	0	0	0	8	0	9	**1**	0	10	26
08:15 AM	0	0	0	0	0	5	4	0	0	9	**9**	0	0	0	**9**	0	6	0	0	6	24
08:30 AM	0	0	0	0	0	**9**	6	0	0	**15**	7	**1**	0	0	8	0	**15**	0	0	**15**	**38**
08:45 AM	0	0	0	0	0	8	5	0	0	13	4	0	0	0	4	0	11	0	0	11	28
Total Volume	0	0	0	0	0	23	22	0	0	45	28	1	0	0	29	0	41	1	0	42	116
% App. Total	0	0	0	0		51.1	48.9	0	0		96.6	3.4	0	0		0	97.6	2.4	0		
PHF	.000	.000	.000	.000	.000	.639	.786	.000	.000	.750	.778	.250	.000	.000	.806	.000	.683	.250	.000	.700	.763
General Vehicles % General Vehicles	0	0	0	0	0	82.6	100	0	0	91.1	96.4	100	0	0	96.6	0	73.2	100	0	73.8	86.2
3+ Axle Heavy Truck % 3+ Axle Heavy Truck	0	0	0	0	0	17.4	0	0	0	8.9	3.6	0	0	0	3.4	0	26.8	0	0	26.2	13.8



L2 Data Collection

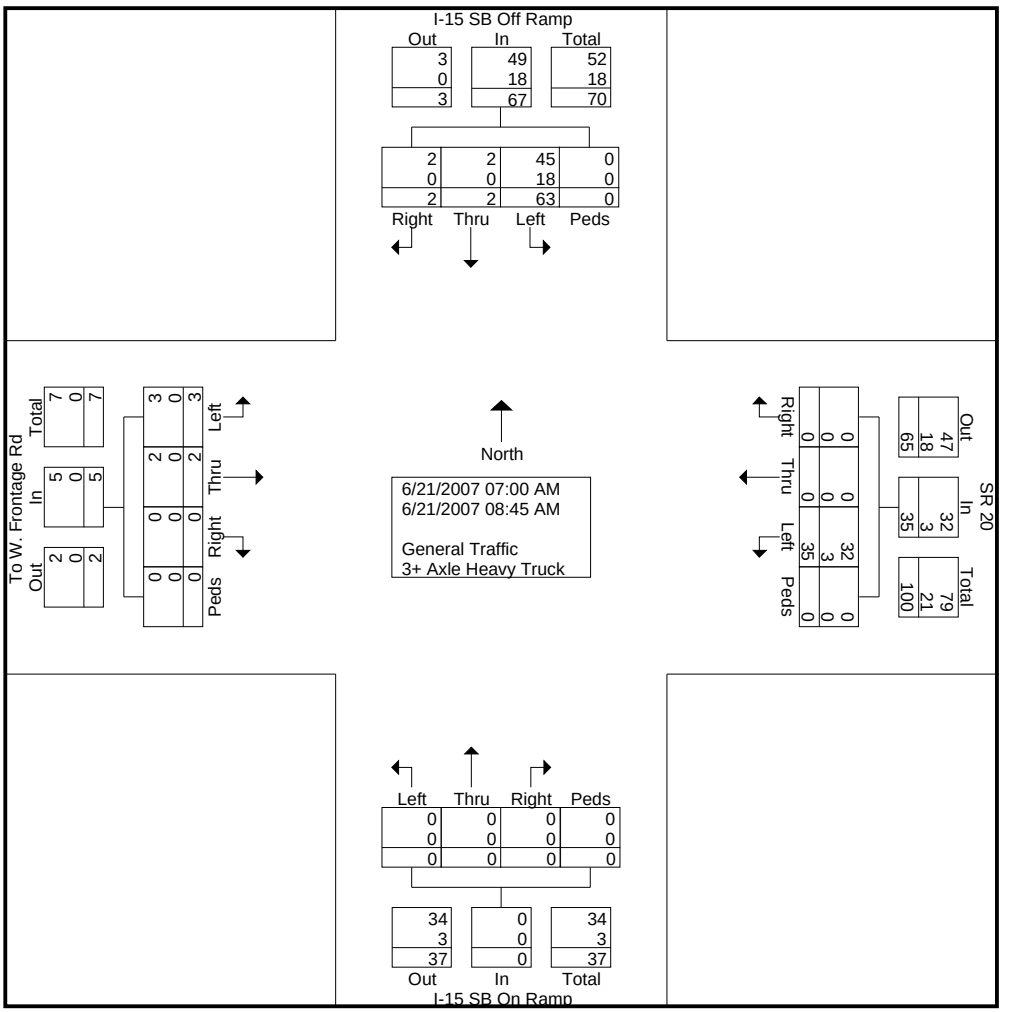
1770 W. State St. #204
Boise, Idaho
(208) 860-7554

Tech: Judd
Intersection: I-15 SB Ramps / SR 20
City, State: Iron County, Utah
Control: Stop Sign

File Name : I 15 SR 20 AM SB
Site Code : 00000000
Start Date : 6/21/2007
Page No : 1

Groups Printed- General Traffic - 3+ Axle Heavy Truck

	I-15 SB Off Ramp From North					SR 20 From East					I-15 SB On Ramp From South					To W. Frontage Rd From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	0	0	6	0	6	0	0	1	0	1	0	0	0	0	0	0	1	3	0	4	11
07:15 AM	0	0	7	0	7	0	0	5	0	5	0	0	0	0	0	0	0	0	0	0	12
07:30 AM	0	0	5	0	5	0	0	5	0	5	0	0	0	0	0	0	0	0	0	0	10
07:45 AM	0	0	4	0	4	0	0	2	0	2	0	0	0	0	0	0	0	0	0	0	6
Total	0	0	22	0	22	0	0	13	0	13	0	0	0	0	0	0	1	3	0	4	39
08:00 AM	0	1	9	0	10	0	0	7	0	7	0	0	0	0	0	0	1	0	0	1	18
08:15 AM	0	0	6	0	6	0	0	4	0	4	0	0	0	0	0	0	0	0	0	0	10
08:30 AM	1	1	15	0	17	0	0	6	0	6	0	0	0	0	0	0	0	0	0	0	23
08:45 AM	1	0	11	0	12	0	0	5	0	5	0	0	0	0	0	0	0	0	0	0	17
Total	2	2	41	0	45	0	0	22	0	22	0	0	0	0	0	0	1	0	0	1	68
Grand Total	2	2	63	0	67	0	0	35	0	35	0	0	0	0	0	0	2	3	0	5	107
Apprch %	3	3	94	0		0	0	100	0		0	0	0	0		0	40	60	0		
Total %	1.9	1.9	58.9	0	62.6	0	0	32.7	0	32.7	0	0	0	0	0	0	1.9	2.8	0	4.7	
General Traffic																					
% General Traffic	100	100	71.4	0	73.1	0	0	91.4	0	91.4	0	0	0	0	0	0	100	100	0	100	80.4
3+ Axle Heavy Truck																					
% 3+ Axle Heavy Truck	0	0	28.6	0	26.9	0	0	8.6	0	8.6	0	0	0	0	0	0	0	0	0	0	19.6



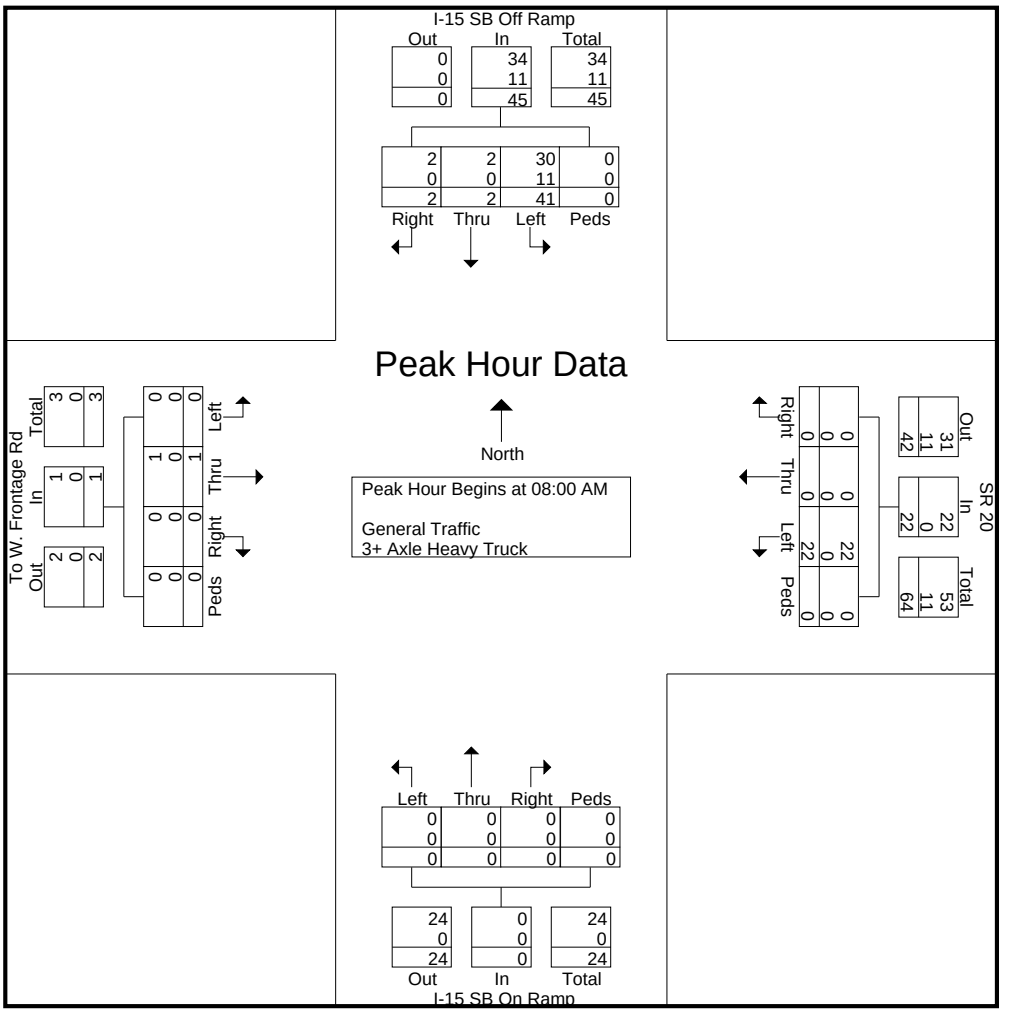
L2 Data Collection

1770 W. State St. #204
Boise, Idaho
(208) 860-7554

Tech: Judd
Intersection: I-15 SB Ramps / SR 20
City, State: Iron County, Utah
Control: Stop Sign

File Name : I 15 SR 20 AM SB
Site Code : 00000000
Start Date : 6/21/2007
Page No : 2

	I-15 SB Off Ramp From North					SR 20 From East					I-15 SB On Ramp From South					To W. Frontage Rd From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 08:00 AM																					
08:00 AM	0	**1**	9	0	10	0	0	**7**	0	**7**	0	0	0	0	0	0	**1**	0	0	**1**	18
08:15 AM	0	0	6	0	6	0	0	4	0	4	0	0	0	0	0	0	0	0	0	0	10
08:30 AM	**1**	1	**15**	0	**17**	0	0	6	0	6	0	0	0	0	0	0	0	0	0	0	**23**
08:45 AM	1	0	11	0	12	0	0	5	0	5	0	0	0	0	0	0	0	0	0	0	17
Total Volume	2	2	41	0	45	0	0	22	0	22	0	0	0	0	0	0	1	0	0	1	68
% App. Total	4.4	4.4	91.1	0		0	0	100	0		0	0	0	0		0	100	0	0		
PHF	.500	.500	.683	.000	.662	.000	.000	.786	.000	.786	.000	.000	.000	.000	.000	.000	.250	.000	.000	.250	.739
General Traffic % General Traffic	100	100	73.2	0	75.6	0	0	100	0	100	0	0	0	0	0	0	100	0	0	100	83.8
3+ Axle Heavy Truck % 3+ Axle Heavy Truck	0	0	26.8	0	24.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16.2



L2 Data Collection

1770 West State Street #204
Boise, Idaho 83702
(208) 860-7554

Project #: FEHR0021
Type: Volume / Direction
Tech: Vawdrey / Judd
Counter: 13350 / 13131

Tube Da
Date Start: 19-Jun-07
Date End: 25-Jun-07
SR20 E of Summit
Iron County, Utah

Start Time	19-Jun-07 Tue	WB	EB	Total
12:00 AM		2	3	5
12:15		4	6	10
12:30		0	4	4
12:45		0	3	3
01:00		2	0	2
01:15		3	1	4
01:30		1	1	2
01:45		2	1	3
02:00		0	3	3
02:15		1	1	2
02:30		0	0	0
02:45		1	1	2
03:00		1	0	1
03:15		1	0	1
03:30		2	2	4
03:45		1	0	1
04:00		3	3	6
04:15		1	1	2
04:30		1	0	1
04:45		3	2	5
05:00		2	2	4
05:15		0	0	0
05:30		1	2	3
05:45		1	5	6
06:00		6	6	12
06:15		5	2	7
06:30		6	10	16
06:45		5	6	11
07:00		4	4	8
07:15		12	6	18
07:30		6	5	11
07:45		7	14	21
08:00		12	13	25
08:15		6	8	14
08:30		8	12	20
08:45		14	12	26
09:00		16	12	28
09:15		16	9	25
09:30		18	10	28
09:45		14	13	27
10:00		15	14	29
10:15		**16**	28	**44**
10:30		**25**	15	**40**
10:45		**11**	**29**	**40**
11:00		**21**	**22**	**43**
11:15		13	**25**	38
11:30		12	**23**	35
11:45		15	14	29
Total		316	353	669
Percent		47.2%	52.8%	
Peak		10:15	10:45	10:15
Vol.		73	99	167
P.H.F.		0.730	0.853	0.949

L2 Data Collection

1770 West State Street #204
Boise, Idaho 83702
(208) 860-7554

Project #: FEHR0021
Type: Volume / Direction
Tech: Vawdrey / Judd
Counter: 13350 / 13131

Tube Da
Date Start: 19-Jun-07
Date End: 25-Jun-07
SR20 E of Summit
Iron County, Utah

Start Time	19-Jun-07 Tue	WB	EB	Total
12:00 PM		13	30	43
12:15		20	14	34
12:30		19	22	41
12:45		23	14	37
01:00		23	19	42
01:15		17	**19**	36
01:30		22	**24**	46
01:45		22	**18**	40
02:00		16	**25**	41
02:15		19	17	36
02:30		20	13	33
02:45		18	15	33
03:00		**21**	18	**39**
03:15		**17**	25	**42**
03:30		**22**	16	**38**
03:45		**35**	15	**50**
04:00		17	12	29
04:15		19	16	35
04:30		16	11	27
04:45		18	18	36
05:00		14	21	35
05:15		17	12	29
05:30		12	15	27
05:45		21	19	40
06:00		14	19	33
06:15		19	13	32
06:30		16	14	30
06:45		16	20	36
07:00		15	15	30
07:15		9	13	22
07:30		12	10	22
07:45		8	9	17
08:00		12	10	22
08:15		10	11	21
08:30		5	7	12
08:45		12	8	20
09:00		1	7	8
09:15		12	11	23
09:30		8	8	16
09:45		4	7	11
10:00		1	11	12
10:15		3	6	9
10:30		7	5	12
10:45		7	5	12
11:00		3	5	8
11:15		4	5	9
11:30		9	11	20
11:45		4	6	10
Total		672	664	1336
Percent		50.3%	49.7%	
Peak		15:00	13:15	15:00
Vol.		95	86	169
P.H.F.		0.679	0.717	0.845

L2 Data Collection

1770 West State Street #204
Boise, Idaho 83702
(208) 860-7554

Project #: FEHR0021
Type: Volume / Direction
Tech: Vawdrey / Judd
Counter: 13350 / 13131

Tube Da
Date Start: 19-Jun-07
Date End: 25-Jun-07
SR20 E of Summit
Iron County, Utah

Start Time	20-Jun-07 Wed	WB	EB	Total
12:00 AM		2	3	5
12:15		1	2	3
12:30		1	0	1
12:45		2	6	8
01:00		2	1	3
01:15		0	1	1
01:30		0	0	0
01:45		1	0	1
02:00		0	2	2
02:15		4	1	5
02:30		3	1	4
02:45		1	2	3
03:00		3	2	5
03:15		1	1	2
03:30		0	2	2
03:45		3	2	5
04:00		1	2	3
04:15		1	0	1
04:30		2	1	3
04:45		2	1	3
05:00		3	2	5
05:15		2	2	4
05:30		1	0	1
05:45		2	4	6
06:00		3	4	7
06:15		5	5	10
06:30		7	6	13
06:45		2	8	10
07:00		5	7	12
07:15		6	3	9
07:30		11	14	25
07:45		12	8	20
08:00		12	15	27
08:15		11	8	19
08:30		18	13	31
08:45		12	10	22
09:00		12	**18**	30
09:15		12	**28**	**40**
09:30		**22**	**13**	**35**
09:45		**23**	**18**	**41**
10:00		**19**	15	**34**
10:15		**18**	19	37
10:30		18	17	35
10:45		11	17	28
11:00		14	17	31
11:15		18	17	35
11:30		19	20	39
11:45		13	15	28
Total		341	353	694
Percent		49.1%	50.9%	
Peak		09:30	09:00	09:15
Vol.		82	77	150
P.H.F.		0.891	0.688	0.915

L2 Data Collection

1770 West State Street #204
Boise, Idaho 83702
(208) 860-7554

Project #: FEHR0021
Type: Volume / Direction
Tech: Vawdrey / Judd
Counter: 13350 / 13131

Tube Da
Date Start: 19-Jun-07
Date End: 25-Jun-07
SR20 E of Summit
Iron County, Utah

Start Time	20-Jun-07 Wed	WB	EB	Total
12:00 PM		10	20	30
12:15		19	12	31
12:30		24	16	40
12:45		18	18	36
01:00		19	18	37
01:15		18	26	44
01:30		12	14	26
01:45		17	20	37
02:00		30	16	46
02:15		23	21	44
02:30		19	16	35
02:45		21	23	44
03:00		19	14	33
03:15		22	27	49
03:30		23	18	41
03:45		**22**	24	46
04:00		**26**	25	51
04:15		**24**	**27**	**51**
04:30		**32**	**18**	**50**
04:45		19	**26**	**45**
05:00		28	**27**	**55**
05:15		22	19	41
05:30		22	21	43
05:45		12	22	34
06:00		17	9	26
06:15		28	26	54
06:30		20	29	49
06:45		11	16	27
07:00		17	21	38
07:15		14	21	35
07:30		9	18	27
07:45		17	14	31
08:00		10	12	22
08:15		14	12	26
08:30		11	18	29
08:45		11	6	17
09:00		10	15	25
09:15		9	12	21
09:30		10	12	22
09:45		4	16	20
10:00		5	7	12
10:15		7	5	12
10:30		10	9	19
10:45		7	8	15
11:00		4	8	12
11:15		7	6	13
11:30		3	4	7
11:45		2	2	4
Total		758	794	1552
Percent		48.8%	51.2%	
Peak		15:45	16:15	16:15
Vol.		104	98	201
P.H.F.		0.813	0.845	0.914

L2 Data Collection

1770 West State Street #204
Boise, Idaho 83702
(208) 860-7554

Project #: FEHR0021
Type: Volume / Direction
Tech: Vawdrey / Judd
Counter: 13350 / 13131

Tube Da
Date Start: 19-Jun-07
Date End: 25-Jun-07
SR20 E of Summit
Iron County, Utah

Start Time	21-Jun-07 Thu	WB	EB	Total
12:00 AM		4	1	5
12:15		1	4	5
12:30		4	1	5
12:45		2	0	2
01:00		0	0	0
01:15		0	4	4
01:30		0	0	0
01:45		4	0	4
02:00		1	3	4
02:15		1	3	4
02:30		0	1	1
02:45		2	3	5
03:00		2	1	3
03:15		2	3	5
03:30		1	0	1
03:45		3	1	4
04:00		5	1	6
04:15		1	7	8
04:30		1	0	1
04:45		1	0	1
05:00		4	2	6
05:15		1	1	2
05:30		2	2	4
05:45		1	1	2
06:00		3	5	8
06:15		2	2	4
06:30		9	7	16
06:45		3	5	8
07:00		2	11	13
07:15		10	14	24
07:30		9	10	19
07:45		7	9	16
08:00		8	12	20
08:15		17	23	40
08:30		10	18	28
08:45		10	14	24
09:00		11	20	31
09:15		17	20	37
09:30		11	21	32
09:45		14	17	31
10:00		11	20	31
10:15		**15**	18	33
10:30		**26**	**32**	**58**
10:45		**17**	**28**	**45**
11:00		**18**	**31**	**49**
11:15		13	**25**	**38**
11:30		18	24	42
11:45		20	24	44
Total		324	449	773
Percent		41.9%	58.1%	
Peak		10:15	10:30	10:30
Vol.		76	116	190
P.H.F.		0.731	0.906	0.819

L2 Data Collection

1770 West State Street #204
Boise, Idaho 83702
(208) 860-7554

Project #: FEHR0021
Type: Volume / Direction
Tech: Vawdrey / Judd
Counter: 13350 / 13131

Tube Da
Date Start: 19-Jun-07
Date End: 25-Jun-07
SR20 E of Summit
Iron County, Utah

Start Time	21-Jun-07 Thu	WB	EB	Total
12:00 PM		21	30	51
12:15		8	18	26
12:30		34	32	66
12:45		26	24	50
01:00		23	12	35
01:15		12	26	38
01:30		24	**36**	60
01:45		19	**28**	47
02:00		13	**28**	**41**
02:15		22	**35**	**57**
02:30		27	31	**58**
02:45		30	30	**60**
03:00		12	27	39
03:15		19	31	50
03:30		12	23	35
03:45		29	25	54
04:00		20	20	40
04:15		21	31	52
04:30		14	20	34
04:45		27	25	52
05:00		17	31	48
05:15		**22**	29	51
05:30		**33**	30	63
05:45		**26**	24	50
06:00		**22**	22	44
06:15		22	23	45
06:30		27	23	50
06:45		16	16	32
07:00		21	32	53
07:15		16	17	33
07:30		14	20	34
07:45		17	9	26
08:00		11	13	24
08:15		15	8	23
08:30		13	21	34
08:45		11	15	26
09:00		7	12	19
09:15		8	5	13
09:30		8	16	24
09:45		14	17	31
10:00		11	13	24
10:15		6	13	19
10:30		11	7	18
10:45		8	18	26
11:00		5	13	18
11:15		8	7	15
11:30		4	4	8
11:45		7	7	14
Total		813	997	1810
Percent		44.9%	55.1%	
Peak		17:15	13:30	14:00
Vol.		103	127	216
P.H.F.		0.757	0.882	0.818

L2 Data Collection

1770 West State Street #204
Boise, Idaho 83702
(208) 860-7554

Project #: FEHR0021
Type: Volume / Direction
Tech: Vawdrey / Judd
Counter: 13350 / 13131

Tube Da
Date Start: 19-Jun-07
Date End: 25-Jun-07
SR20 E of Summit
Iron County, Utah

Start Time	22-Jun-07 Fri	WB	EB	Total
12:00 AM		3	4	7
12:15		5	7	12
12:30		4	4	8
12:45		7	1	8
01:00		2	4	6
01:15		3	6	9
01:30		5	3	8
01:45		5	3	8
02:00		1	2	3
02:15		1	3	4
02:30		3	2	5
02:45		3	1	4
03:00		4	0	4
03:15		2	3	5
03:30		2	0	2
03:45		4	1	5
04:00		1	0	1
04:15		2	0	2
04:30		2	2	4
04:45		0	2	2
05:00		2	2	4
05:15		0	3	3
05:30		3	5	8
05:45		3	3	6
06:00		3	6	9
06:15		6	7	13
06:30		2	5	7
06:45		7	11	18
07:00		5	3	8
07:15		9	12	21
07:30		11	16	27
07:45		18	16	34
08:00		6	13	19
08:15		13	10	23
08:30		17	17	34
08:45		12	17	29
09:00		8	16	24
09:15		8	18	26
09:30		**16**	23	39
09:45		**17**	14	31
10:00		**21**	16	37
10:15		**22**	23	**45**
10:30		14	28	**42**
10:45		18	16	**34**
11:00		16	**22**	**38**
11:15		18	**22**	40
11:30		14	**21**	35
11:45		14	**30**	44
Total		362	443	805
Percent		45.0%	55.0%	
Peak		09:30	11:00	10:15
Vol.		76	95	159
P.H.F.		0.864	0.792	0.883

L2 Data Collection

1770 West State Street #204
Boise, Idaho 83702
(208) 860-7554

Project #: FEHR0021
Type: Volume / Direction
Tech: Vawdrey / Judd
Counter: 13350 / 13131

Tube Da
Date Start: 19-Jun-07
Date End: 25-Jun-07
SR20 E of Summit
Iron County, Utah

Start Time	22-Jun-07 Fri	WB	EB	Total
12:00 PM		19	22	41
12:15		19	30	49
12:30		25	34	59
12:45		16	27	43
01:00		28	33	61
01:15		37	31	68
01:30		18	31	49
01:45		20	23	43
02:00		25	29	54
02:15		27	27	54
02:30		21	39	60
02:45		17	31	48
03:00		22	28	50
03:15		23	22	45
03:30		**28**	**38**	**66**
03:45		**30**	**33**	**63**
04:00		**35**	**41**	**76**
04:15		**25**	**37**	**62**
04:30		19	25	44
04:45		23	24	47
05:00		30	30	60
05:15		27	36	63
05:30		23	31	54
05:45		23	37	60
06:00		25	29	54
06:15		22	44	66
06:30		19	30	49
06:45		10	25	35
07:00		18	24	42
07:15		15	27	42
07:30		14	22	36
07:45		6	18	24
08:00		13	23	36
08:15		11	27	38
08:30		18	26	44
08:45		9	31	40
09:00		9	36	45
09:15		21	20	41
09:30		14	20	34
09:45		9	14	23
10:00		15	14	29
10:15		9	13	22
10:30		10	7	17
10:45		12	10	22
11:00		9	7	16
11:15		5	9	14
11:30		6	4	10
11:45		8	5	13
Total		887	1224	2111
Percent		42.0%	58.0%	
Peak		15:30	15:30	15:30
Vol.		118	149	267
P.H.F.		0.797	0.847	0.878

L2 Data Collection

1770 West State Street #204
Boise, Idaho 83702
(208) 860-7554

Project #: FEHR0021
Type: Volume / Direction
Tech: Vawdrey / Judd
Counter: 13350 / 13131

Tube Da
Date Start: 19-Jun-07
Date End: 25-Jun-07
SR20 E of Summit
Iron County, Utah

Start Time	23-Jun-07 Sat	WB	EB	Total
12:00 AM		7	18	25
12:15		3	7	10
12:30		5	4	9
12:45		5	10	15
01:00		4	2	6
01:15		1	8	9
01:30		5	2	7
01:45		0	3	3
02:00		5	4	9
02:15		4	5	9
02:30		1	4	5
02:45		1	2	3
03:00		2	2	4
03:15		1	0	1
03:30		3	1	4
03:45		2	0	2
04:00		0	1	1
04:15		1	3	4
04:30		3	3	6
04:45		2	2	4
05:00		3	2	5
05:15		3	3	6
05:30		3	4	7
05:45		0	7	7
06:00		4	8	12
06:15		2	8	10
06:30		9	7	16
06:45		7	5	12
07:00		4	7	11
07:15		2	9	11
07:30		4	16	20
07:45		9	15	24
08:00		6	12	18
08:15		15	6	21
08:30		17	15	32
08:45		17	11	28
09:00		13	24	37
09:15		9	21	30
09:30		21	20	41
09:45		12	17	29
10:00		18	29	47
10:15		15	17	32
10:30		26	18	44
10:45		21	**31**	52
11:00		**14**	**25**	**39**
11:15		**15**	**23**	**38**
11:30		**22**	**28**	**50**
11:45		**38**	27	**65**
Total		384	496	880
Percent		43.6%	56.4%	
Peak		11:00	10:45	11:00
Vol.		89	107	192
P.H.F.		0.586	0.863	0.738

L2 Data Collection

1770 West State Street #204
Boise, Idaho 83702
(208) 860-7554

Project #: FEHR0021
Type: Volume / Direction
Tech: Vawdrey / Judd
Counter: 13350 / 13131

Tube Da
Date Start: 19-Jun-07
Date End: 25-Jun-07
SR20 E of Summit
Iron County, Utah

Start Time	23-Jun-07 Sat	WB	EB	Total
12:00 PM		18	25	43
12:15		28	19	47
12:30		24	25	49
12:45		43	16	59
01:00		23	28	51
01:15		26	19	45
01:30		23	22	45
01:45		24	28	52
02:00		21	19	40
02:15		18	29	47
02:30		31	17	48
02:45		**39**	19	58
03:00		**24**	**27**	**51**
03:15		**38**	**31**	**69**
03:30		**34**	**22**	**56**
03:45		37	**25**	**62**
04:00		16	25	41
04:15		20	29	49
04:30		29	21	50
04:45		41	15	56
05:00		18	11	29
05:15		20	19	39
05:30		37	24	61
05:45		32	18	50
06:00		32	17	49
06:15		25	14	39
06:30		21	12	33
06:45		20	18	38
07:00		21	17	38
07:15		27	16	43
07:30		19	7	26
07:45		18	18	36
08:00		8	8	16
08:15		13	18	31
08:30		14	11	25
08:45		17	7	24
09:00		11	6	17
09:15		13	3	16
09:30		20	4	24
09:45		17	9	26
10:00		25	5	30
10:15		25	2	27
10:30		30	5	35
10:45		14	4	18
11:00		11	5	16
11:15		13	8	21
11:30		13	4	17
11:45		6	8	14
Total		1097	759	1856
Percent		59.1%	40.9%	
Peak		14:45	15:00	15:00
Vol.		135	105	238
P.H.F.		0.785	0.847	0.862

L2 Data Collection

1770 West State Street #204
Boise, Idaho 83702
(208) 860-7554

Project #: FEHR0021
Type: Volume / Direction
Tech: Vawdrey / Judd
Counter: 13350 / 13131

Tube Da
Date Start: 19-Jun-07
Date End: 25-Jun-07
SR20 E of Summit
Iron County, Utah

Start Time	24-Jun-07 Sun	WB	EB	Total
12:00 AM		3	3	6
12:15		6	1	7
12:30		2	5	7
12:45		2	1	3
01:00		1	1	2
01:15		3	2	5
01:30		1	2	3
01:45		3	1	4
02:00		0	1	1
02:15		2	1	3
02:30		1	1	2
02:45		2	0	2
03:00		3	0	3
03:15		2	3	5
03:30		1	3	4
03:45		2	0	2
04:00		1	0	1
04:15		1	1	2
04:30		3	1	4
04:45		1	0	1
05:00		3	1	4
05:15		2	0	2
05:30		1	1	2
05:45		0	4	4
06:00		3	3	6
06:15		5	2	7
06:30		2	8	10
06:45		3	3	6
07:00		5	3	8
07:15		7	4	11
07:30		10	6	16
07:45		11	6	17
08:00		7	10	17
08:15		23	9	32
08:30		19	12	31
08:45		10	12	22
09:00		24	24	48
09:15		37	11	48
09:30		26	24	50
09:45		26	8	34
10:00		30	18	48
10:15		19	23	42
10:30		33	**24**	**57**
10:45		36	**28**	**64**
11:00		**28**	**17**	**45**
11:15		**29**	**25**	**54**
11:30		**35**	15	50
11:45		**37**	18	55
Total		511	346	857
Percent		59.6%	40.4%	
Peak		11:00	10:30	10:30
Vol.		129	94	220
P.H.F.		0.872	0.839	0.859

L2 Data Collection

1770 West State Street #204
Boise, Idaho 83702
(208) 860-7554

Project #: FEHR0021
Type: Volume / Direction
Tech: Vawdrey / Judd
Counter: 13350 / 13131

Tube Da
Date Start: 19-Jun-07
Date End: 25-Jun-07
SR20 E of Summit
Iron County, Utah

Start Time	24-Jun-07 Sun	WB	EB	Total
12:00 PM		42	19	61
12:15		36	24	60
12:30		51	26	77
12:45		36	13	49
01:00		38	29	67
01:15		38	**27**	**65**
01:30		32	**35**	**67**
01:45		34	**25**	**59**
02:00		**53**	**34**	**87**
02:15		**43**	21	64
02:30		**30**	17	47
02:45		**42**	22	64
03:00		39	22	61
03:15		39	28	67
03:30		37	13	50
03:45		32	23	55
04:00		38	21	59
04:15		34	23	57
04:30		38	31	69
04:45		43	19	62
05:00		35	19	54
05:15		44	15	59
05:30		38	23	61
05:45		23	11	34
06:00		23	27	50
06:15		29	13	42
06:30		32	22	54
06:45		38	16	54
07:00		30	9	39
07:15		21	5	26
07:30		16	10	26
07:45		25	11	36
08:00		18	14	32
08:15		20	11	31
08:30		12	11	23
08:45		22	18	40
09:00		13	10	23
09:15		8	12	20
09:30		14	7	21
09:45		14	8	22
10:00		15	9	24
10:15		11	5	16
10:30		5	5	10
10:45		2	2	4
11:00		9	5	14
11:15		2	6	8
11:30		6	2	8
11:45		3	2	5
Total		1303	780	2083
Percent		62.6%	37.4%	
Peak		14:00	13:15	13:15
Vol.		168	121	278
P.H.F.		0.792	0.864	0.799

L2 Data Collection

1770 West State Street #204
Boise, Idaho 83702
(208) 860-7554

Project #: FEHR0021
Type: Volume / Direction
Tech: Vawdrey / Judd
Counter: 13350 / 13131

Tube Da
Date Start: 19-Jun-07
Date End: 25-Jun-07
SR20 E of Summit
Iron County, Utah

Start Time	25-Jun-07 Mon	WB	EB	Total
12:00 AM		7	2	9
12:15		1	3	4
12:30		2	3	5
12:45		3	2	5
01:00		0	3	3
01:15		3	1	4
01:30		3	2	5
01:45		3	4	7
02:00		1	2	3
02:15		1	1	2
02:30		3	0	3
02:45		2	1	3
03:00		4	0	4
03:15		5	1	6
03:30		8	2	10
03:45		2	0	2
04:00		4	1	5
04:15		1	0	1
04:30		0	0	0
04:45		2	1	3
05:00		4	1	5
05:15		0	1	1
05:30		4	1	5
05:45		6	4	10
06:00		6	4	10
06:15		7	5	12
06:30		1	9	10
06:45		14	8	22
07:00		3	3	6
07:15		9	2	11
07:30		11	8	19
07:45		12	14	26
08:00		11	11	22
08:15		11	15	26
08:30		8	15	23
08:45		6	11	17
09:00		17	15	32
09:15		9	7	16
09:30		**28**	13	41
09:45		**25**	19	44
10:00		**20**	16	36
10:15		**19**	**21**	**40**
10:30		28	**16**	**44**
10:45		10	**18**	**28**
11:00		26	**29**	**55**
11:15		24	16	40
11:30		19	17	36
11:45		20	15	35
Total		413	343	756
Percent		54.6%	45.4%	
Peak		09:30	10:15	10:15
Vol.		92	84	167
P.H.F.		0.821	0.724	0.759

L2 Data Collection

1770 West State Street #204
Boise, Idaho 83702
(208) 860-7554

Project #: FEHR0021
Type: Volume / Direction
Tech: Vawdrey / Judd
Counter: 13350 / 13131

Tube Da
Date Start: 19-Jun-07
Date End: 25-Jun-07
SR20 E of Summit
Iron County, Utah

Start Time	25-Jun-07 Mon	WB	EB	Total
12:00 PM		18	23	41
12:15		23	**28**	**51**
12:30		25	**22**	**47**
12:45		19	**21**	**40**
01:00		16	**31**	**47**
01:15		10	21	31
01:30		15	26	41
01:45		18	23	41
02:00		14	21	35
02:15		22	16	38
02:30		11	22	33
02:45		18	19	37
03:00		21	13	34
03:15		17	17	34
03:30		23	14	37
03:45		21	15	36
04:00		17	30	47
04:15		12	23	35
04:30		**25**	17	42
04:45		**15**	24	39
05:00		**28**	26	54
05:15		**22**	20	42
05:30		22	13	35
05:45		16	17	33
06:00		22	15	37
06:15		19	16	35
06:30		16	13	29
06:45		13	9	22
07:00		9	16	25
07:15		22	8	30
07:30		12	8	20
07:45		20	18	38
08:00		5	5	10
08:15		9	6	15
08:30		10	9	19
08:45		8	7	15
09:00		9	9	18
09:15		11	5	16
09:30		9	7	16
09:45		8	6	14
10:00		5	6	11
10:15		7	1	8
10:30		2	9	11
10:45		5	5	10
11:00		5	4	9
11:15		8	4	12
11:30		4	4	8
11:45		4	0	4
Total		690	692	1382
Percent		49.9%	50.1%	
Peak		16:30	12:15	12:15
Vol.		90	102	185
P.H.F.		0.804	0.823	0.856
Grand Total		8871	8693	17564
Percent		50.5%	49.5%	
ADT		ADT 2,509	AADT 2,509	

L2 Data Collection

1770 West State Street #204
Boise, Idaho 83702
(208) 860-7554

Project #: FEHR0021
Type: Volume / Direction
Tech: Vawdrey / Judd
Counter: 11011

Tube Da
Date Start: 19-Jun-07
Date End: 25-Jun-07
US89 S of SR20
Garfield County, Utah

Start Time	19-Jun-07 Tue	SB	NB	Total
12:00 AM		2	9	11
12:15		4	1	5
12:30		5	1	6
12:45		4	1	5
01:00		4	3	7
01:15		0	1	1
01:30		2	4	6
01:45		2	2	4
02:00		1	1	2
02:15		3	1	4
02:30		1	0	1
02:45		2	6	8
03:00		2	5	7
03:15		0	3	3
03:30		0	1	1
03:45		2	4	6
04:00		1	2	3
04:15		5	2	7
04:30		1	2	3
04:45		2	2	4
05:00		4	2	6
05:15		2	1	3
05:30		2	2	4
05:45		4	6	10
06:00		3	7	10
06:15		4	4	8
06:30		2	4	6
06:45		15	7	22
07:00		5	12	17
07:15		9	7	16
07:30		6	16	22
07:45		13	26	39
08:00		19	9	28
08:15		19	16	35
08:30		12	16	28
08:45		11	21	32
09:00		19	27	46
09:15		19	26	45
09:30		22	17	39
09:45		21	23	44
10:00		25	20	45
10:15		32	**31**	**63**
10:30		27	**22**	**49**
10:45		23	**24**	**47**
11:00		**32**	**24**	**56**
11:15		**32**	16	48
11:30		**33**	29	62
11:45		**28**	20	48
Total		486	486	972
Percent		50.0%	50.0%	
Peak		11:00	10:15	10:15
Vol.		125	101	215
P.H.F.		0.947	0.815	0.853

L2 Data Collection

1770 West State Street #204
Boise, Idaho 83702
(208) 860-7554

Project #: FEHR0021
Type: Volume / Direction
Tech: Vawdrey / Judd
Counter: 11011

Tube Da
Date Start: 19-Jun-07
Date End: 25-Jun-07
US89 S of SR20
Garfield County, Utah

Start Time	19-Jun-07 Tue	SB	NB	Total
12:00 PM		27	18	45
12:15		**37**	33	**70**
12:30		**23**	33	**56**
12:45		**35**	33	**68**
01:00		**29**	24	**53**
01:15		25	31	56
01:30		24	34	58
01:45		26	27	53
02:00		21	23	44
02:15		30	27	57
02:30		29	33	62
02:45		26	34	60
03:00		34	17	51
03:15		27	**30**	57
03:30		32	**39**	71
03:45		18	**37**	55
04:00		26	**18**	44
04:15		17	28	45
04:30		22	37	59
04:45		23	20	43
05:00		24	32	56
05:15		26	18	44
05:30		16	27	43
05:45		19	22	41
06:00		22	22	44
06:15		28	24	52
06:30		18	16	34
06:45		18	18	36
07:00		24	14	38
07:15		33	17	50
07:30		8	17	25
07:45		15	12	27
08:00		11	12	23
08:15		13	9	22
08:30		13	19	32
08:45		5	6	11
09:00		16	11	27
09:15		6	10	16
09:30		17	7	24
09:45		13	5	18
10:00		8	9	17
10:15		14	8	22
10:30		6	6	12
10:45		5	7	12
11:00		8	5	13
11:15		6	10	16
11:30		6	10	16
11:45		10	5	15
Total		939	954	1893
Percent		49.6%	50.4%	
Peak		12:15	15:15	12:15
Vol.		124	124	247
P.H.F.		0.838	0.795	0.870

L2 Data Collection

1770 West State Street #204
Boise, Idaho 83702
(208) 860-7554

Project #: FEHR0021
Type: Volume / Direction
Tech: Vawdrey / Judd
Counter: 11011

Tube Da
Date Start: 19-Jun-07
Date End: 25-Jun-07
US89 S of SR20
Garfield County, Utah

Start Time	20-Jun-07 Wed	SB	NB	Total
12:00 AM		6	2	8
12:15		2	3	5
12:30		2	2	4
12:45		1	3	4
01:00		5	2	7
01:15		4	0	4
01:30		2	2	4
01:45		1	1	2
02:00		1	3	4
02:15		3	0	3
02:30		1	2	3
02:45		1	3	4
03:00		2	1	3
03:15		1	3	4
03:30		3	1	4
03:45		2	1	3
04:00		4	0	4
04:15		2	6	8
04:30		1	2	3
04:45		2	6	8
05:00		2	5	7
05:15		4	1	5
05:30		2	2	4
05:45		5	8	13
06:00		6	2	8
06:15		3	13	16
06:30		9	6	15
06:45		4	12	16
07:00		10	8	18
07:15		10	14	24
07:30		7	11	18
07:45		22	16	38
08:00		15	29	44
08:15		16	23	39
08:30		13	15	28
08:45		15	20	35
09:00		20	17	37
09:15		23	30	53
09:30		28	28	56
09:45		36	28	64
10:00		19	19	38
10:15		20	23	43
10:30		26	**37**	**63**
10:45		23	**22**	**45**
11:00		**26**	**24**	**50**
11:15		**26**	**28**	**54**
11:30		**27**	19	46
11:45		**36**	18	54
Total		499	521	1020
Percent		48.9%	51.1%	
Peak		11:00	10:30	10:30
Vol.		115	111	212
P.H.F.		0.799	0.750	0.828

L2 Data Collection

1770 West State Street #204
Boise, Idaho 83702
(208) 860-7554

Project #: FEHR0021
Type: Volume / Direction
Tech: Vawdrey / Judd
Counter: 11011

Tube Da
Date Start: 19-Jun-07
Date End: 25-Jun-07
US89 S of SR20
Garfield County, Utah

Start Time	20-Jun-07 Wed	SB	NB	Total
12:00 PM		39	20	59
12:15		28	32	60
12:30		24	25	49
12:45		24	34	58
01:00		27	22	49
01:15		27	24	51
01:30		32	30	62
01:45		31	39	70
02:00		31	39	70
02:15		25	30	55
02:30		26	38	64
02:45		27	30	57
03:00		26	29	55
03:15		**33**	27	60
03:30		**35**	27	62
03:45		**28**	42	70
04:00		**37**	25	62
04:15		33	**45**	**78**
04:30		31	**37**	**68**
04:45		32	**41**	**73**
05:00		30	**42**	**72**
05:15		28	34	62
05:30		34	27	61
05:45		34	29	63
06:00		25	32	57
06:15		32	21	53
06:30		28	23	51
06:45		35	29	64
07:00		27	18	45
07:15		28	16	44
07:30		26	23	49
07:45		26	17	43
08:00		21	11	32
08:15		17	19	36
08:30		19	13	32
08:45		24	6	30
09:00		17	12	29
09:15		21	16	37
09:30		8	10	18
09:45		10	6	16
10:00		22	7	29
10:15		14	17	31
10:30		7	11	18
10:45		11	7	18
11:00		13	8	21
11:15		11	4	15
11:30		8	8	16
11:45		3	8	11
Total		1175	1110	2285
Percent		51.4%	48.6%	
Peak		15:15	16:15	16:15
Vol.		133	165	291
P.H.F.		0.853	0.917	0.933

L2 Data Collection

1770 West State Street #204
Boise, Idaho 83702
(208) 860-7554

Project #: FEHR0021
Type: Volume / Direction
Tech: Vawdrey / Judd
Counter: 11011

Tube Da
Date Start: 19-Jun-07
Date End: 25-Jun-07
US89 S of SR20
Garfield County, Utah

Start Time	21-Jun-07 Thu	SB	NB	Total
12:00 AM		7	3	10
12:15		1	2	3
12:30		5	5	10
12:45		1	0	1
01:00		1	0	1
01:15		7	0	7
01:30		2	4	6
01:45		0	1	1
02:00		0	4	4
02:15		4	0	4
02:30		1	3	4
02:45		3	2	5
03:00		3	3	6
03:15		3	3	6
03:30		2	4	6
03:45		2	4	6
04:00		1	5	6
04:15		4	0	4
04:30		8	2	10
04:45		1	4	5
05:00		1	4	5
05:15		5	3	8
05:30		2	1	3
05:45		6	7	13
06:00		3	6	9
06:15		2	11	13
06:30		3	9	12
06:45		9	1	10
07:00		7	16	23
07:15		12	13	25
07:30		18	12	30
07:45		16	20	36
08:00		9	18	27
08:15		26	17	43
08:30		22	16	38
08:45		22	21	43
09:00		23	19	42
09:15		17	25	42
09:30		26	18	44
09:45		25	19	44
10:00		24	**22**	46
10:15		35	**30**	65
10:30		24	**26**	50
10:45		**53**	**25**	**78**
11:00		**36**	21	**57**
11:15		**30**	17	**47**
11:30		**33**	36	**69**
11:45		29	29	58
Total		574	511	1085
Percent		52.9%	47.1%	
Peak		10:45	10:00	10:45
Vol.		152	103	251
P.H.F.		0.717	0.715	0.804

L2 Data Collection

1770 West State Street #204
Boise, Idaho 83702
(208) 860-7554

Project #: FEHR0021
Type: Volume / Direction
Tech: Vawdrey / Judd
Counter: 11011

Tube Da
Date Start: 19-Jun-07
Date End: 25-Jun-07
US89 S of SR20
Garfield County, Utah

Start Time	21-Jun-07 Thu	SB	NB	Total
12:00 PM		32	20	52
12:15		43	36	79
12:30		32	40	72
12:45		46	25	71
01:00		34	26	60
01:15		32	37	69
01:30		49	24	73
01:45		40	24	64
02:00		49	26	**75**
02:15		**42**	29	**71**
02:30		**59**	55	**114**
02:45		**55**	32	**87**
03:00		**51**	23	74
03:15		35	30	65
03:30		57	34	91
03:45		35	29	64
04:00		44	39	83
04:15		55	22	77
04:30		36	**42**	78
04:45		34	**30**	64
05:00		61	**34**	95
05:15		31	**41**	72
05:30		28	28	56
05:45		36	34	70
06:00		34	36	70
06:15		38	25	63
06:30		29	30	59
06:45		28	26	54
07:00		20	28	48
07:15		28	20	48
07:30		24	22	46
07:45		28	17	45
08:00		25	17	42
08:15		19	18	37
08:30		19	14	33
08:45		21	12	33
09:00		16	21	37
09:15		18	18	36
09:30		10	19	29
09:45		29	11	40
10:00		21	20	41
10:15		18	13	31
10:30		14	11	25
10:45		13	11	24
11:00		16	9	25
11:15		10	5	15
11:30		9	9	18
11:45		9	6	15
Total		1512	1178	2690
Percent		56.2%	43.8%	
Peak		14:15	16:30	14:00
Vol.		207	147	347
P.H.F.		0.848	0.668	0.761

L2 Data Collection

1770 West State Street #204
Boise, Idaho 83702
(208) 860-7554

Project #: FEHR0021
Type: Volume / Direction
Tech: Vawdrey / Judd
Counter: 11011

Tube Da
Date Start: 19-Jun-07
Date End: 25-Jun-07
US89 S of SR20
Garfield County, Utah

Start Time	22-Jun-07 Fri	SB	NB	Total
12:00 AM		7	6	13
12:15		6	5	11
12:30		4	11	15
12:45		6	2	8
01:00		2	4	6
01:15		4	10	14
01:30		7	8	15
01:45		3	1	4
02:00		4	1	5
02:15		2	3	5
02:30		2	3	5
02:45		3	11	14
03:00		2	1	3
03:15		1	6	7
03:30		2	6	8
03:45		0	2	2
04:00		1	0	1
04:15		2	4	6
04:30		0	5	5
04:45		4	4	8
05:00		6	1	7
05:15		4	5	9
05:30		6	6	12
05:45		3	8	11
06:00		6	4	10
06:15		5	10	15
06:30		6	8	14
06:45		5	4	9
07:00		16	12	28
07:15		12	13	25
07:30		21	19	40
07:45		20	18	38
08:00		19	18	37
08:15		23	21	44
08:30		17	17	34
08:45		25	16	41
09:00		21	26	47
09:15		26	22	48
09:30		**46**	**41**	**87**
09:45		**36**	**32**	**68**
10:00		**35**	**43**	**78**
10:15		**32**	**36**	**68**
10:30		27	26	53
10:45		30	30	60
11:00		33	36	69
11:15		39	26	65
11:30		33	20	53
11:45		37	33	70
Total		651	644	1295
Percent		50.3%	49.7%	
Peak		09:30	09:30	09:30
Vol.		149	152	301
P.H.F.		0.810	0.884	0.865

L2 Data Collection

1770 West State Street #204
Boise, Idaho 83702
(208) 860-7554

Project #: FEHR0021
Type: Volume / Direction
Tech: Vawdrey / Judd
Counter: 11011

Tube Da
Date Start: 19-Jun-07
Date End: 25-Jun-07
US89 S of SR20
Garfield County, Utah

Start Time	22-Jun-07 Fri	SB	NB	Total
12:00 PM		32	33	65
12:15		25	25	50
12:30		46	17	63
12:45		47	34	81
01:00		32	40	72
01:15		36	28	64
01:30		39	36	75
01:45		34	51	85
02:00		27	34	61
02:15		52	36	88
02:30		30	29	59
02:45		50	34	84
03:00		29	36	65
03:15		46	**50**	**96**
03:30		31	**39**	**70**
03:45		**45**	**46**	**91**
04:00		**51**	**50**	**101**
04:15		**40**	32	72
04:30		**39**	32	71
04:45		36	46	82
05:00		27	36	63
05:15		46	32	78
05:30		43	41	84
05:45		41	35	76
06:00		32	29	61
06:15		33	30	63
06:30		43	27	70
06:45		32	22	54
07:00		32	18	50
07:15		28	20	48
07:30		33	17	50
07:45		27	17	44
08:00		17	12	29
08:15		35	24	59
08:30		33	12	45
08:45		27	14	41
09:00		42	20	62
09:15		36	21	57
09:30		31	10	41
09:45		21	20	41
10:00		15	11	26
10:15		21	15	36
10:30		17	15	32
10:45		16	11	27
11:00		15	6	21
11:15		8	6	14
11:30		6	12	18
11:45		4	7	11
Total		1528	1268	2796
Percent		54.6%	45.4%	
Peak		15:45	15:15	15:15
Vol.		175	185	358
P.H.F.		0.841	0.907	0.886

L2 Data Collection

1770 West State Street #204
Boise, Idaho 83702
(208) 860-7554

Project #: FEHR0021
Type: Volume / Direction
Tech: Vawdrey / Judd
Counter: 11011

Tube Da
Date Start: 19-Jun-07
Date End: 25-Jun-07
US89 S of SR20
Garfield County, Utah

Start Time	23-Jun-07 Sat	SB	NB	Total
12:00 AM		9	6	15
12:15		14	6	20
12:30		8	4	12
12:45		6	6	12
01:00		4	2	6
01:15		4	7	11
01:30		11	2	13
01:45		6	7	13
02:00		11	2	13
02:15		5	3	8
02:30		6	5	11
02:45		6	3	9
03:00		4	1	5
03:15		2	6	8
03:30		1	2	3
03:45		2	0	2
04:00		4	1	5
04:15		5	3	8
04:30		2	3	5
04:45		1	5	6
05:00		3	3	6
05:15		2	3	5
05:30		5	3	8
05:45		6	6	12
06:00		10	5	15
06:15		10	13	23
06:30		10	7	17
06:45		4	11	15
07:00		10	7	17
07:15		8	10	18
07:30		14	7	21
07:45		13	15	28
08:00		18	11	29
08:15		11	33	44
08:30		17	24	41
08:45		22	21	43
09:00		34	12	46
09:15		40	31	71
09:30		28	22	50
09:45		32	29	61
10:00		24	22	46
10:15		44	26	70
10:30		18	30	48
10:45		31	**32**	**63**
11:00		**41**	**18**	**59**
11:15		**32**	**34**	**66**
11:30		**33**	**40**	**73**
11:45		**36**	25	61
Total		667	574	1241
Percent		53.7%	46.3%	
Peak		11:00	10:45	10:45
Vol.		142	124	261
P.H.F.		0.807	0.775	0.894

L2 Data Collection

1770 West State Street #204
Boise, Idaho 83702
(208) 860-7554

Project #: FEHR0021
Type: Volume / Direction
Tech: Vawdrey / Judd
Counter: 11011

Tube Da
Date Start: 19-Jun-07
Date End: 25-Jun-07
US89 S of SR20
Garfield County, Utah

Start Time	23-Jun-07 Sat	SB	NB	Total
12:00 PM		39	34	73
12:15		30	23	53
12:30		36	61	97
12:45		**41**	34	75
01:00		**32**	33	65
01:15		**38**	19	57
01:30		**41**	49	90
01:45		34	30	64
02:00		29	27	56
02:15		39	37	76
02:30		49	28	**77**
02:45		35	**42**	**77**
03:00		22	**50**	**72**
03:15		39	**39**	**78**
03:30		41	**34**	75
03:45		27	34	61
04:00		31	28	59
04:15		37	36	73
04:30		33	49	82
04:45		30	32	62
05:00		26	40	66
05:15		27	43	70
05:30		24	37	61
05:45		37	37	74
06:00		32	34	66
06:15		24	25	49
06:30		35	31	66
06:45		20	20	40
07:00		19	36	55
07:15		21	19	40
07:30		30	25	55
07:45		25	17	42
08:00		25	16	41
08:15		14	17	31
08:30		31	16	47
08:45		10	17	27
09:00		14	14	28
09:15		7	23	30
09:30		9	19	28
09:45		9	32	41
10:00		8	30	38
10:15		9	47	56
10:30		5	26	31
10:45		4	22	26
11:00		8	17	25
11:15		5	19	24
11:30		11	6	17
11:45		4	3	7
Total		1196	1407	2603
Percent		45.9%	54.1%	
Peak		12:45	14:45	14:30
Vol.		152	165	304
P.H.F.		0.776	0.676	0.784

L2 Data Collection

1770 West State Street #204
Boise, Idaho 83702
(208) 860-7554

Project #: FEHR0021
Type: Volume / Direction
Tech: Vawdrey / Judd
Counter: 11011

Tube Da
Date Start: 19-Jun-07
Date End: 25-Jun-07
US89 S of SR20
Garfield County, Utah

Start Time	24-Jun-07 Sun	SB	NB	Total
12:00 AM		5	7	12
12:15		3	7	10
12:30		3	2	5
12:45		3	2	5
01:00		1	3	4
01:15		2	1	3
01:30		3	2	5
01:45		1	1	2
02:00		1	3	4
02:15		2	1	3
02:30		2	4	6
02:45		1	2	3
03:00		0	3	3
03:15		1	1	2
03:30		5	3	8
03:45		8	2	10
04:00		0	1	1
04:15		0	2	2
04:30		0	1	1
04:45		2	3	5
05:00		1	4	5
05:15		2	0	2
05:30		0	0	0
05:45		3	4	7
06:00		5	6	11
06:15		6	5	11
06:30		4	2	6
06:45		8	3	11
07:00		4	10	14
07:15		7	8	15
07:30		5	10	15
07:45		10	7	17
08:00		17	30	47
08:15		22	29	51
08:30		23	27	50
08:45		24	33	57
09:00		38	42	80
09:15		31	34	65
09:30		17	35	52
09:45		38	55	93
10:00		21	28	49
10:15		**34**	44	78
10:30		**37**	46	83
10:45		**30**	41	71
11:00		**30**	**59**	**89**
11:15		24	**60**	**84**
11:30		36	**52**	**88**
11:45		33	**56**	**89**
Total		553	781	1334
Percent		41.5%	58.5%	
Peak		10:15	11:00	11:00
Vol.		131	227	350
P.H.F.		0.862	0.946	0.941

L2 Data Collection

1770 West State Street #204
Boise, Idaho 83702
(208) 860-7554

Project #: FEHR0021
Type: Volume / Direction
Tech: Vawdrey / Judd
Counter: 11011

Tube Da
Date Start: 19-Jun-07
Date End: 25-Jun-07
US89 S of SR20
Garfield County, Utah

Start Time	24-Jun-07 Sun	SB	NB	Total
12:00 PM		47	39	86
12:15		35	**48**	83
12:30		35	**62**	97
12:45		34	**47**	81
01:00		34	**51**	85
01:15		32	42	74
01:30		**36**	41	77
01:45		**48**	50	**98**
02:00		**41**	48	**89**
02:15		**41**	44	**85**
02:30		35	47	**82**
02:45		30	57	87
03:00		35	54	89
03:15		33	48	81
03:30		37	45	82
03:45		36	53	89
04:00		26	49	75
04:15		38	51	89
04:30		24	39	63
04:45		39	48	87
05:00		28	50	78
05:15		34	57	91
05:30		25	52	77
05:45		32	35	67
06:00		22	43	65
06:15		34	36	70
06:30		19	51	70
06:45		30	34	64
07:00		27	38	65
07:15		21	20	41
07:30		17	19	36
07:45		17	26	43
08:00		21	27	48
08:15		19	10	29
08:30		15	21	36
08:45		20	20	40
09:00		26	14	40
09:15		12	15	27
09:30		15	12	27
09:45		9	16	25
10:00		11	13	24
10:15		9	7	16
10:30		5	5	10
10:45		6	10	16
11:00		6	8	14
11:15		7	11	18
11:30		7	4	11
11:45		4	11	15
Total		1214	1628	2842
Percent		42.7%	57.3%	
Peak		13:30	12:15	13:45
Vol.		166	208	354
P.H.F.		0.865	0.839	0.903

L2 Data Collection

1770 West State Street #204
Boise, Idaho 83702
(208) 860-7554

Project #: FEHR0021
Type: Volume / Direction
Tech: Vawdrey / Judd
Counter: 11011

Tube Da
Date Start: 19-Jun-07
Date End: 25-Jun-07
US89 S of SR20
Garfield County, Utah

Start Time	25-Jun-07 Mon	SB	NB	Total
12:00 AM		1	4	5
12:15		1	0	1
12:30		2	5	7
12:45		5	4	9
01:00		1	5	6
01:15		3	4	7
01:30		1	6	7
01:45		2	1	3
02:00		3	0	3
02:15		3	4	7
02:30		1	0	1
02:45		0	6	6
03:00		1	5	6
03:15		0	9	9
03:30		4	5	9
03:45		1	3	4
04:00		0	4	4
04:15		1	1	2
04:30		1	3	4
04:45		3	6	9
05:00		4	0	4
05:15		3	4	7
05:30		2	5	7
05:45		3	9	12
06:00		7	6	13
06:15		5	5	10
06:30		7	13	20
06:45		13	10	23
07:00		6	9	15
07:15		8	16	24
07:30		5	13	18
07:45		12	18	30
08:00		19	20	39
08:15		14	15	29
08:30		19	17	36
08:45		17	21	38
09:00		25	23	48
09:15		21	28	49
09:30		16	**33**	49
09:45		18	**32**	50
10:00		26	**29**	55
10:15		19	**33**	52
10:30		26	21	47
10:45		22	30	52
11:00		**27**	29	**56**
11:15		**36**	32	**68**
11:30		**29**	25	**54**
11:45		**37**	34	**71**
Total		480	605	1085
Percent		44.2%	55.8%	
Peak		11:00	09:30	11:00
Vol.		129	127	249
P.H.F.		0.872	0.934	0.877

L2 Data Collection

1770 West State Street #204
Boise, Idaho 83702
(208) 860-7554

Project #: FEHR0021
Type: Volume / Direction
Tech: Vawdrey / Judd
Counter: 11011

Tube Da
Date Start: 19-Jun-07
Date End: 25-Jun-07
US89 S of SR20
Garfield County, Utah

Start Time	25-Jun-07 Mon	SB	NB	Total
12:00 PM		25	29	54
12:15		35	28	63
12:30		36	23	59
12:45		30	18	48
01:00		34	21	55
01:15		30	24	54
01:30		38	35	73
01:45		26	23	49
02:00		34	29	63
02:15		30	18	48
02:30		25	21	46
02:45		31	22	53
03:00		24	22	46
03:15		31	40	71
03:30		27	29	56
03:45		24	24	48
04:00		31	29	60
04:15		30	30	60
04:30		30	18	48
04:45		**29**	**32**	**61**
05:00		**41**	**43**	**84**
05:15		**41**	**31**	**72**
05:30		**31**	**22**	**53**
05:45		26	28	54
06:00		30	25	55
06:15		30	27	57
06:30		23	17	40
06:45		21	16	37
07:00		17	26	43
07:15		24	20	44
07:30		13	14	27
07:45		14	20	34
08:00		11	13	24
08:15		10	15	25
08:30		12	10	22
08:45		16	17	33
09:00		12	19	31
09:15		16	8	24
09:30		8	13	21
09:45		9	12	21
10:00		6	12	18
10:15		9	7	16
10:30		2	11	13
10:45		10	7	17
11:00		7	11	18
11:15		5	7	12
11:30		6	4	10
11:45		5	4	9
Total		1055	974	2029
Percent		52.0%	48.0%	
Peak		16:45	16:45	16:45
Vol.		142	128	270
P.H.F.		0.866	0.744	0.804
Grand Total		12529	12641	25170
Percent		49.8%	50.2%	
ADT		ADT 3,596	AADT 3,596	

L2 Data Collection

1770 West State Street #204
Boise, Idaho 83702
(208) 860-7554

Project #: FEHR0021
Type: Volume / Direction
Tech: Vawdrey / Judd
Counter: 12348

Tube Da
Date Start: 19-Jun-07
Date End: 25-Jun-07
US89 S of SR 14
Alton, Utah

Start Time	19-Jun-07 Tue	SB	NB	Total
12:00 AM		3	3	6
12:15		3	0	3
12:30		2	4	6
12:45		4	2	6
01:00		4	2	6
01:15		1	2	3
01:30		1	2	3
01:45		4	0	4
02:00		1	4	5
02:15		2	0	2
02:30		1	3	4
02:45		2	2	4
03:00		3	0	3
03:15		1	3	4
03:30		1	1	2
03:45		0	3	3
04:00		0	1	1
04:15		0	0	0
04:30		0	0	0
04:45		3	4	7
05:00		2	3	5
05:15		1	1	2
05:30		8	4	12
05:45		6	0	6
06:00		4	3	7
06:15		2	2	4
06:30		3	9	12
06:45		4	4	8
07:00		7	8	15
07:15		14	15	29
07:30		10	12	22
07:45		13	24	37
08:00		16	19	35
08:15		14	13	27
08:30		22	21	43
08:45		26	21	47
09:00		28	32	60
09:15		31	29	60
09:30		39	43	82
09:45		27	27	54
10:00		**34**	30	**64**
10:15		**34**	42	**76**
10:30		**36**	46	**82**
10:45		**38**	37	**75**
11:00		30	**27**	57
11:15		35	**35**	70
11:30		32	**56**	88
11:45		23	**40**	63
Total		575	639	1214
Percent		47.4%	52.6%	
Peak		10:00	11:00	10:00
Vol.		142	158	297
P.H.F.		0.910	0.705	0.844

L2 Data Collection

1770 West State Street #204
Boise, Idaho 83702
(208) 860-7554

Project #: FEHR0021
Type: Volume / Direction
Tech: Vawdrey / Judd
Counter: 12348

Tube Da
Date Start: 19-Jun-07
Date End: 25-Jun-07
US89 S of SR 14
Alton, Utah

Start Time	19-Jun-07 Tue	SB	NB	Total
12:00 PM		40	**46**	**86**
12:15		41	**39**	**80**
12:30		20	**37**	**57**
12:45		25	**53**	**78**
01:00		26	35	61
01:15		**43**	42	85
01:30		**30**	38	68
01:45		**34**	32	66
02:00		**33**	42	75
02:15		30	33	63
02:30		29	43	72
02:45		36	43	79
03:00		38	37	75
03:15		28	28	56
03:30		27	35	62
03:45		33	43	76
04:00		26	42	68
04:15		22	39	61
04:30		34	38	72
04:45		33	30	63
05:00		30	31	61
05:15		24	32	56
05:30		25	54	79
05:45		35	23	58
06:00		26	30	56
06:15		12	33	45
06:30		28	23	51
06:45		25	26	51
07:00		21	23	44
07:15		22	14	36
07:30		20	19	39
07:45		23	19	42
08:00		17	20	37
08:15		24	11	35
08:30		13	15	28
08:45		15	10	25
09:00		21	13	34
09:15		5	13	18
09:30		9	12	21
09:45		12	7	19
10:00		11	6	17
10:15		11	7	18
10:30		14	10	24
10:45		10	11	21
11:00		13	7	20
11:15		6	4	10
11:30		2	5	7
11:45		3	3	6
Total		1105	1256	2361
Percent		46.8%	53.2%	
Peak		13:15	12:00	12:00
Vol.		140	175	301
P.H.F.		0.814	0.810	0.875

L2 Data Collection

1770 West State Street #204
Boise, Idaho 83702
(208) 860-7554

Project #: FEHR0021
Type: Volume / Direction
Tech: Vawdrey / Judd
Counter: 12348

Tube Da
Date Start: 19-Jun-07
Date End: 25-Jun-07
US89 S of SR 14
Alton, Utah

Start Time	20-Jun-07 Wed	SB	NB	Total
12:00 AM		3	6	9
12:15		3	2	5
12:30		4	3	7
12:45		2	2	4
01:00		2	1	3
01:15		0	3	3
01:30		2	0	2
01:45		2	2	4
02:00		5	3	8
02:15		0	1	1
02:30		1	4	5
02:45		3	0	3
03:00		0	0	0
03:15		1	0	1
03:30		2	2	4
03:45		0	3	3
04:00		1	2	3
04:15		0	2	2
04:30		1	1	2
04:45		3	2	5
05:00		1	2	3
05:15		3	6	9
05:30		3	3	6
05:45		1	9	10
06:00		4	5	9
06:15		5	4	9
06:30		9	8	17
06:45		3	8	11
07:00		9	9	18
07:15		6	13	19
07:30		12	16	28
07:45		19	12	31
08:00		13	24	37
08:15		19	18	37
08:30		27	22	49
08:45		23	34	57
09:00		20	34	54
09:15		34	21	55
09:30		37	27	64
09:45		31	38	69
10:00		**28**	37	65
10:15		**38**	34	72
10:30		**43**	26	69
10:45		**41**	33	74
11:00		25	**29**	**54**
11:15		28	**62**	**90**
11:30		39	**40**	**79**
11:45		41	**40**	**81**
Total		597	653	1250
Percent		47.8%	52.2%	
Peak		10:00	11:00	11:00
Vol.		150	171	304
P.H.F.		0.872	0.690	0.844

L2 Data Collection

1770 West State Street #204
Boise, Idaho 83702
(208) 860-7554

Project #: FEHR0021
Type: Volume / Direction
Tech: Vawdrey / Judd
Counter: 12348

Tube Da
Date Start: 19-Jun-07
Date End: 25-Jun-07
US89 S of SR 14
Alton, Utah

Start Time	20-Jun-07 Wed	SB	NB	Total
12:00 PM		27	39	66
12:15		**47**	40	87
12:30		**35**	50	85
12:45		**34**	38	72
01:00		**35**	26	61
01:15		30	35	65
01:30		24	49	73
01:45		32	40	72
02:00		48	34	82
02:15		31	33	64
02:30		33	47	80
02:45		24	29	53
03:00		30	42	72
03:15		27	30	57
03:30		31	39	70
03:45		47	45	**92**
04:00		33	33	**66**
04:15		39	**46**	**85**
04:30		28	**49**	**77**
04:45		37	**38**	75
05:00		33	**46**	79
05:15		33	36	69
05:30		29	30	59
05:45		31	31	62
06:00		30	33	63
06:15		25	27	52
06:30		33	24	57
06:45		19	38	57
07:00		32	20	52
07:15		20	17	37
07:30		25	24	49
07:45		20	19	39
08:00		17	21	38
08:15		26	15	41
08:30		25	13	38
08:45		13	9	22
09:00		21	14	35
09:15		14	7	21
09:30		14	16	30
09:45		13	19	32
10:00		12	10	22
10:15		13	4	17
10:30		9	10	19
10:45		12	7	19
11:00		5	7	12
11:15		14	8	22
11:30		10	6	16
11:45		9	7	16
Total		1229	1300	2529
Percent		48.6%	51.4%	
Peak		12:15	16:15	15:45
Vol.		151	179	320
P.H.F.		0.786	0.895	0.870

L2 Data Collection

1770 West State Street #204
Boise, Idaho 83702
(208) 860-7554

Project #: FEHR0021
Type: Volume / Direction
Tech: Vawdrey / Judd
Counter: 12348

Tube Da
Date Start: 19-Jun-07
Date End: 25-Jun-07
US89 S of SR 14
Alton, Utah

Start Time	21-Jun-07 Thu	SB	NB	Total
12:00 AM		8	1	9
12:15		4	0	4
12:30		3	0	3
12:45		2	3	5
01:00		3	4	7
01:15		4	3	7
01:30		0	2	2
01:45		1	2	3
02:00		2	1	3
02:15		1	2	3
02:30		0	0	0
02:45		0	4	4
03:00		1	2	3
03:15		2	2	4
03:30		1	4	5
03:45		3	0	3
04:00		1	2	3
04:15		6	1	7
04:30		0	4	4
04:45		1	1	2
05:00		4	4	8
05:15		10	5	15
05:30		0	2	2
05:45		0	14	14
06:00		5	3	8
06:15		3	7	10
06:30		9	8	17
06:45		6	13	19
07:00		11	10	21
07:15		9	8	17
07:30		8	13	21
07:45		17	15	32
08:00		19	17	36
08:15		18	25	43
08:30		30	21	51
08:45		26	25	51
09:00		40	24	64
09:15		35	37	72
09:30		30	22	52
09:45		30	37	67
10:00		31	43	74
10:15		41	26	67
10:30		48	44	92
10:45		38	38	76
11:00		**35**	**63**	**98**
11:15		**36**	**37**	**73**
11:30		**53**	**61**	**114**
11:45		**40**	**52**	**92**
Total		675	712	1387
Percent		48.7%	51.3%	
Peak		11:00	11:00	11:00
Vol.		164	213	377
P.H.F.		0.774	0.845	0.827

L2 Data Collection

1770 West State Street #204
Boise, Idaho 83702
(208) 860-7554

Project #: FEHR0021
Type: Volume / Direction
Tech: Vawdrey / Judd
Counter: 12348

Tube Da
Date Start: 19-Jun-07
Date End: 25-Jun-07
US89 S of SR 14
Alton, Utah

Start Time	21-Jun-07 Thu	SB	NB	Total
12:00 PM		34	**62**	96
12:15		29	**47**	76
12:30		32	**47**	79
12:45		25	**46**	71
01:00		30	38	68
01:15		37	40	77
01:30		27	51	78
01:45		40	45	85
02:00		34	51	85
02:15		34	35	69
02:30		39	32	71
02:45		31	37	68
03:00		29	53	82
03:15		41	35	76
03:30		36	40	76
03:45		31	50	81
04:00		33	55	88
04:15		**40**	33	73
04:30		**45**	29	74
04:45		**37**	51	**88**
05:00		**54**	46	**100**
05:15		29	47	**76**
05:30		38	40	**78**
05:45		37	35	72
06:00		24	29	53
06:15		30	43	73
06:30		31	32	63
06:45		24	24	48
07:00		27	23	50
07:15		25	22	47
07:30		14	26	40
07:45		30	20	50
08:00		24	19	43
08:15		24	24	48
08:30		14	21	35
08:45		19	19	38
09:00		17	19	36
09:15		18	20	38
09:30		16	15	31
09:45		16	19	35
10:00		6	20	26
10:15		12	11	23
10:30		13	10	23
10:45		14	9	23
11:00		13	7	20
11:15		6	7	13
11:30		8	11	19
11:45		9	9	18
Total		1276	1504	2780
Percent		45.9%	54.1%	
Peak		16:15	12:00	16:45
Vol.		176	202	342
P.H.F.		0.815	0.815	0.855

L2 Data Collection

1770 West State Street #204
Boise, Idaho 83702
(208) 860-7554

Project #: FEHR0021
Type: Volume / Direction
Tech: Vawdrey / Judd
Counter: 12348

Tube Da
Date Start: 19-Jun-07
Date End: 25-Jun-07
US89 S of SR 14
Alton, Utah

Start Time	22-Jun-07 Fri	SB	NB	Total
12:00 AM		8	9	17
12:15		2	4	6
12:30		9	8	17
12:45		2	9	11
01:00		1	1	2
01:15		2	3	5
01:30		6	2	8
01:45		2	3	5
02:00		3	9	12
02:15		2	3	5
02:30		5	6	11
02:45		1	4	5
03:00		1	1	2
03:15		2	1	3
03:30		2	2	4
03:45		0	4	4
04:00		0	1	1
04:15		2	2	4
04:30		2	2	4
04:45		1	5	6
05:00		2	1	3
05:15		3	4	7
05:30		2	6	8
05:45		3	12	15
06:00		4	5	9
06:15		7	4	11
06:30		4	2	6
06:45		6	21	27
07:00		9	13	22
07:15		12	7	19
07:30		16	12	28
07:45		8	18	26
08:00		23	17	40
08:15		27	16	43
08:30		22	27	49
08:45		23	27	50
09:00		19	32	51
09:15		35	32	67
09:30		35	38	73
09:45		32	39	71
10:00		47	35	82
10:15		29	24	53
10:30		41	47	88
10:45		28	30	58
11:00		**37**	**44**	**81**
11:15		**53**	**43**	**96**
11:30		**36**	**42**	**78**
11:45		**38**	**46**	**84**
Total		654	723	1377
Percent		47.5%	52.5%	
Peak		11:00	11:00	11:00
Vol.		164	175	339
P.H.F.		0.774	0.931	0.883

L2 Data Collection

1770 West State Street #204
Boise, Idaho 83702
(208) 860-7554

Project #: FEHR0021
Type: Volume / Direction
Tech: Vawdrey / Judd
Counter: 12348

Tube Da
Date Start: 19-Jun-07
Date End: 25-Jun-07
US89 S of SR 14
Alton, Utah

Start Time	22-Jun-07 Fri	SB	NB	Total
12:00 PM		30	39	69
12:15		38	37	75
12:30		36	40	76
12:45		28	38	66
01:00		37	**53**	90
01:15		26	**49**	75
01:30		36	**60**	96
01:45		22	**53**	75
02:00		35	51	86
02:15		28	43	71
02:30		**48**	51	**99**
02:45		**32**	61	**93**
03:00		**46**	48	**94**
03:15		**37**	49	**86**
03:30		29	41	70
03:45		19	59	78
04:00		34	56	90
04:15		23	54	77
04:30		40	40	80
04:45		48	43	91
05:00		31	43	74
05:15		36	32	68
05:30		19	48	67
05:45		32	44	76
06:00		39	38	77
06:15		27	28	55
06:30		33	26	59
06:45		17	29	46
07:00		20	25	45
07:15		35	18	53
07:30		35	23	58
07:45		18	21	39
08:00		25	26	51
08:15		21	21	42
08:30		13	28	41
08:45		12	19	31
09:00		28	13	41
09:15		20	16	36
09:30		13	15	28
09:45		13	11	24
10:00		21	17	38
10:15		15	16	31
10:30		20	11	31
10:45		9	5	14
11:00		18	13	31
11:15		7	9	16
11:30		9	11	20
11:45		10	6	16
Total		1268	1577	2845
Percent		44.6%	55.4%	
Peak		14:30	13:00	14:30
Vol.		163	215	372
P.H.F.		0.849	0.881	0.939

L2 Data Collection

1770 West State Street #204
Boise, Idaho 83702
(208) 860-7554

Project #: FEHR0021
Type: Volume / Direction
Tech: Vawdrey / Judd
Counter: 12348

Tube Da
Date Start: 19-Jun-07
Date End: 25-Jun-07
US89 S of SR 14
Alton, Utah

Start Time	23-Jun-07 Sat	SB	NB	Total
12:00 AM		7	7	14
12:15		1	4	5
12:30		2	7	9
12:45		3	6	9
01:00		8	6	14
01:15		2	4	6
01:30		4	5	9
01:45		2	5	7
02:00		1	3	4
02:15		8	1	9
02:30		4	1	5
02:45		5	2	7
03:00		4	4	8
03:15		1	3	4
03:30		3	0	3
03:45		0	1	1
04:00		3	3	6
04:15		2	2	4
04:30		1	2	3
04:45		3	2	5
05:00		7	2	9
05:15		0	6	6
05:30		2	6	8
05:45		3	7	10
06:00		6	12	18
06:15		6	6	12
06:30		7	7	14
06:45		4	12	16
07:00		8	4	12
07:15		8	10	18
07:30		5	23	28
07:45		8	8	16
08:00		17	17	34
08:15		10	11	21
08:30		19	22	41
08:45		12	20	32
09:00		20	28	48
09:15		18	22	40
09:30		41	41	82
09:45		37	40	77
10:00		33	30	63
10:15		32	35	67
10:30		35	44	79
10:45		28	45	73
11:00		**53**	**56**	**109**
11:15		**27**	**50**	**77**
11:30		**43**	**47**	**90**
11:45		**29**	**50**	**79**
Total		582	729	1311
Percent		44.4%	55.6%	
Peak		11:00	11:00	11:00
Vol.		152	203	355
P.H.F.		0.717	0.906	0.814

L2 Data Collection

1770 West State Street #204
Boise, Idaho 83702
(208) 860-7554

Project #: FEHR0021
Type: Volume / Direction
Tech: Vawdrey / Judd
Counter: 12348

Tube Da
Date Start: 19-Jun-07
Date End: 25-Jun-07
US89 S of SR 14
Alton, Utah

Start Time	23-Jun-07 Sat	SB	NB	Total
12:00 PM		32	49	81
12:15		42	52	94
12:30		41	42	83
12:45		28	46	74
01:00		28	51	79
01:15		30	36	66
01:30		19	54	73
01:45		33	41	74
02:00		34	36	70
02:15		30	51	81
02:30		33	35	68
02:45		43	47	90
03:00		29	47	76
03:15		**43**	44	87
03:30		**38**	48	86
03:45		**33**	53	86
04:00		**42**	33	75
04:15		32	**70**	**102**
04:30		39	**73**	**112**
04:45		38	**46**	**84**
05:00		39	**46**	**85**
05:15		27	39	66
05:30		42	39	81
05:45		34	29	63
06:00		33	36	69
06:15		33	45	78
06:30		34	23	57
06:45		23	36	59
07:00		19	25	44
07:15		9	14	23
07:30		32	23	55
07:45		17	15	32
08:00		21	24	45
08:15		27	28	55
08:30		21	29	50
08:45		19	18	37
09:00		18	22	40
09:15		15	10	25
09:30		18	15	33
09:45		17	6	23
10:00		15	6	21
10:15		11	7	18
10:30		13	7	20
10:45		12	6	18
11:00		5	7	12
11:15		4	4	8
11:30		8	4	12
11:45		3	5	8
Total		1256	1522	2778
Percent		45.2%	54.8%	
Peak		15:15	16:15	16:15
Vol.		156	235	383
P.H.F.		0.907	0.805	0.855

L2 Data Collection

1770 West State Street #204
Boise, Idaho 83702
(208) 860-7554

Project #: FEHR0021
Type: Volume / Direction
Tech: Vawdrey / Judd
Counter: 12348

Tube Da
Date Start: 19-Jun-07
Date End: 25-Jun-07
US89 S of SR 14
Alton, Utah

Start Time	24-Jun-07 Sun	SB	NB	Total
12:00 AM		10	7	17
12:15		10	3	13
12:30		2	4	6
12:45		2	1	3
01:00		0	3	3
01:15		4	3	7
01:30		4	3	7
01:45		1	4	5
02:00		2	2	4
02:15		5	2	7
02:30		1	1	2
02:45		0	3	3
03:00		3	1	4
03:15		0	2	2
03:30		2	2	4
03:45		0	2	2
04:00		0	1	1
04:15		3	1	4
04:30		6	1	7
04:45		0	0	0
05:00		0	2	2
05:15		3	3	6
05:30		0	1	1
05:45		3	1	4
06:00		0	2	2
06:15		2	2	4
06:30		4	4	8
06:45		5	4	9
07:00		5	6	11
07:15		10	7	17
07:30		15	8	23
07:45		9	10	19
08:00		10	10	20
08:15		22	16	38
08:30		34	34	68
08:45		19	14	33
09:00		30	22	52
09:15		31	30	61
09:30		28	37	65
09:45		45	17	62
10:00		42	45	87
10:15		49	39	88
10:30		38	42	80
10:45		44	48	92
11:00		**51**	**49**	**100**
11:15		**51**	**43**	**94**
11:30		**48**	**49**	**97**
11:45		**47**	**51**	**98**
Total		700	642	1342
Percent		52.2%	47.8%	
Peak		11:00	11:00	11:00
Vol.		197	192	389
P.H.F.		0.966	0.941	0.973

L2 Data Collection

1770 West State Street #204
Boise, Idaho 83702
(208) 860-7554

Project #: FEHR0021
Type: Volume / Direction
Tech: Vawdrey / Judd
Counter: 12348

Tube Da
Date Start: 19-Jun-07
Date End: 25-Jun-07
US89 S of SR 14
Alton, Utah

Start Time	24-Jun-07 Sun	SB	NB	Total
12:00 PM		41	**66**	**107**
12:15		**47**	**54**	**101**
12:30		**35**	**49**	**84**
12:45		**49**	**42**	**91**
01:00		**62**	43	105
01:15		47	54	101
01:30		32	41	73
01:45		34	64	98
02:00		40	36	76
02:15		40	56	96
02:30		55	40	95
02:45		40	44	84
03:00		43	62	105
03:15		38	51	89
03:30		45	39	84
03:45		40	42	82
04:00		38	40	78
04:15		33	59	92
04:30		41	58	99
04:45		36	38	74
05:00		41	42	83
05:15		40	56	96
05:30		40	46	86
05:45		27	52	79
06:00		39	48	87
06:15		33	32	65
06:30		27	30	57
06:45		25	27	52
07:00		24	27	51
07:15		23	31	54
07:30		40	23	63
07:45		21	12	33
08:00		17	28	45
08:15		9	26	35
08:30		15	17	32
08:45		24	17	41
09:00		11	17	28
09:15		8	17	25
09:30		25	10	35
09:45		12	4	16
10:00		10	13	23
10:15		13	8	21
10:30		7	13	20
10:45		9	10	19
11:00		6	10	16
11:15		7	10	17
11:30		2	4	6
11:45		4	3	7
Total		1395	1611	3006
Percent		46.4%	53.6%	
Peak		12:15	12:00	12:00
Vol.		193	211	383
P.H.F.		0.778	0.799	0.895

L2 Data Collection

1770 West State Street #204
Boise, Idaho 83702
(208) 860-7554

Project #: FEHR0021
Type: Volume / Direction
Tech: Vawdrey / Judd
Counter: 12348

Tube Da
Date Start: 19-Jun-07
Date End: 25-Jun-07
US89 S of SR 14
Alton, Utah

Start Time	25-Jun-07 Mon	SB	NB	Total
12:00 AM		4	9	13
12:15		4	7	11
12:30		4	2	6
12:45		1	4	5
01:00		2	2	4
01:15		3	1	4
01:30		1	5	6
01:45		1	1	2
02:00		0	5	5
02:15		1	6	7
02:30		3	3	6
02:45		3	4	7
03:00		0	3	3
03:15		1	1	2
03:30		1	3	4
03:45		1	2	3
04:00		1	4	5
04:15		1	1	2
04:30		3	4	7
04:45		1	3	4
05:00		2	3	5
05:15		5	5	10
05:30		3	1	4
05:45		1	11	12
06:00		2	6	8
06:15		7	3	10
06:30		4	6	10
06:45		7	15	22
07:00		4	7	11
07:15		11	6	17
07:30		12	9	21
07:45		19	11	30
08:00		17	18	35
08:15		19	19	38
08:30		16	16	32
08:45		24	24	48
09:00		33	24	57
09:15		28	24	52
09:30		25	24	49
09:45		47	29	76
10:00		40	39	79
10:15		36	32	68
10:30		28	37	65
10:45		36	34	70
11:00		**39**	**40**	**79**
11:15		**32**	**31**	**63**
11:30		**40**	**42**	**82**
11:45		**42**	**37**	**79**
Total		615	623	1238
Percent		49.7%	50.3%	
Peak		11:00	11:00	11:00
Vol.		153	150	303
P.H.F.		0.814	0.893	0.924

L2 Data Collection

1770 West State Street #204
Boise, Idaho 83702
(208) 860-7554

Project #: FEHR0021
Type: Volume / Direction
Tech: Vawdrey / Judd
Counter: 12348

Tube Da
Date Start: 19-Jun-07
Date End: 25-Jun-07
US89 S of SR 14
Alton, Utah

Start Time	25-Jun-07 Mon	SB	NB	Total
12:00 PM		30	37	67
12:15		33	30	63
12:30		31	36	67
12:45		30	44	74
01:00		30	37	67
01:15		39	35	74
01:30		23	36	59
01:45		**42**	43	85
02:00		**32**	30	62
02:15		**32**	34	66
02:30		**53**	34	**87**
02:45		30	40	**70**
03:00		34	38	**72**
03:15		29	48	**77**
03:30		28	37	65
03:45		26	39	65
04:00		46	42	88
04:15		25	**39**	64
04:30		29	**47**	76
04:45		38	**38**	76
05:00		33	**44**	77
05:15		35	37	72
05:30		19	28	47
05:45		32	18	50
06:00		23	29	52
06:15		36	43	79
06:30		33	32	65
06:45		31	34	65
07:00		15	28	43
07:15		19	25	44
07:30		23	12	35
07:45		27	24	51
08:00		18	13	31
08:15		23	18	41
08:30		12	20	32
08:45		11	10	21
09:00		11	13	24
09:15		14	14	28
09:30		13	12	25
09:45		12	8	20
10:00		8	11	19
10:15		10	9	19
10:30		7	14	21
10:45		6	6	12
11:00		2	5	7
11:15		5	6	11
11:30		2	5	7
11:45		6	3	9
Total		1146	1285	2431
Percent		47.1%	52.9%	
Peak		13:45	16:15	14:30
Vol.		159	168	306
P.H.F.		0.750	0.875	0.869
Grand Total		13073	14776	27849
Percent		46.9%	53.1%	
ADT		ADT 3,978	AADT 3,978	

L2 Data Collection

1770 West State Street #204
Boise, Idaho 83702
(208) 860-7554

Project #: FEHR0021
Type: Volume / Direction
Tech: Vawdrey / Judd
Counter: 10009

Tube Da
Date Start: 19-Jun-07
Date End: 25-Jun-07
US89 E of Panguitch
Panguitch, Utah

Start Time	19-Jun-07 Tue	SB	NB	Total
12:00 AM		3	3	6
12:15		2	3	5
12:30		5	0	5
12:45		4	2	6
01:00		1	4	5
01:15		4	4	8
01:30		1	2	3
01:45		1	3	4
02:00		2	0	2
02:15		1	6	7
02:30		4	1	5
02:45		1	3	4
03:00		1	2	3
03:15		1	0	1
03:30		0	5	5
03:45		1	1	2
04:00		0	4	4
04:15		1	1	2
04:30		5	0	5
04:45		3	1	4
05:00		2	3	5
05:15		5	4	9
05:30		6	4	10
05:45		10	4	14
06:00		7	2	9
06:15		7	2	9
06:30		19	5	24
06:45		15	10	25
07:00		13	9	22
07:15		20	9	29
07:30		20	18	38
07:45		14	15	29
08:00		20	13	33
08:15		23	27	50
08:30		26	24	50
08:45		27	20	47
09:00		22	26	48
09:15		29	23	52
09:30		34	19	53
09:45		27	18	45
10:00		34	38	72
10:15		23	28	51
10:30		37	25	62
10:45		**37**	22	59
11:00		**26**	**35**	**61**
11:15		**35**	**30**	**65**
11:30		**39**	**22**	**61**
11:45		32	**33**	**65**
Total		650	533	1183
Percent		54.9%	45.1%	
Peak		10:45	11:00	11:00
Vol.		137	120	252
P.H.F.		0.878	0.789	0.875

L2 Data Collection

1770 West State Street #204
Boise, Idaho 83702
(208) 860-7554

Project #: FEHR0021
Type: Volume / Direction
Tech: Vawdrey / Judd
Counter: 10009

Tube Da
Date Start: 19-Jun-07
Date End: 25-Jun-07
US89 E of Panguitch
Panguitch, Utah

Start Time	19-Jun-07 Tue	SB	NB	Total
12:00 PM		26	34	60
12:15		32	31	63
12:30		36	37	73
12:45		29	34	63
01:00		**46**	29	75
01:15		**37**	28	65
01:30		**45**	34	79
01:45		**32**	34	66
02:00		36	37	73
02:15		31	34	65
02:30		42	37	79
02:45		19	30	49
03:00		31	33	64
03:15		40	49	89
03:30		32	35	67
03:45		27	25	52
04:00		20	**41**	61
04:15		37	**50**	**87**
04:30		21	**39**	**60**
04:45		21	**50**	**71**
05:00		34	34	**68**
05:15		27	36	63
05:30		31	35	66
05:45		22	39	61
06:00		24	37	61
06:15		25	35	60
06:30		29	33	62
06:45		22	14	36
07:00		21	29	50
07:15		22	24	46
07:30		20	15	35
07:45		33	21	54
08:00		16	17	33
08:15		13	23	36
08:30		13	17	30
08:45		15	14	29
09:00		7	13	20
09:15		10	15	25
09:30		9	16	25
09:45		12	16	28
10:00		13	19	32
10:15		8	11	19
10:30		12	6	18
10:45		6	12	18
11:00		4	15	19
11:15		7	9	16
11:30		2	11	13
11:45		4	5	9
Total		1101	1292	2393
Percent		46.0%	54.0%	
Peak		13:00	16:00	16:15
Vol.		160	180	286
P.H.F.		0.870	0.900	0.803

L2 Data Collection

1770 West State Street #204
Boise, Idaho 83702
(208) 860-7554

Project #: FEHR0021
Type: Volume / Direction
Tech: Vawdrey / Judd
Counter: 10009

Tube Da
Date Start: 19-Jun-07
Date End: 25-Jun-07
US89 E of Panguitch
Panguitch, Utah

Start Time	20-Jun-07 Wed	SB	NB	Total
12:00 AM		5	4	9
12:15		3	5	8
12:30		3	2	5
12:45		1	3	4
01:00		2	0	2
01:15		2	2	4
01:30		7	1	8
01:45		1	5	6
02:00		1	0	1
02:15		1	3	4
02:30		2	2	4
02:45		0	1	1
03:00		1	3	4
03:15		1	0	1
03:30		1	1	2
03:45		0	0	0
04:00		2	7	9
04:15		3	1	4
04:30		2	3	5
04:45		2	4	6
05:00		6	0	6
05:15		3	2	5
05:30		9	5	14
05:45		7	9	16
06:00		10	7	17
06:15		13	8	21
06:30		17	4	21
06:45		14	13	27
07:00		9	16	25
07:15		20	11	31
07:30		23	15	38
07:45		19	27	46
08:00		27	26	53
08:15		35	17	52
08:30		23	17	40
08:45		22	20	42
09:00		23	**32**	55
09:15		33	**33**	66
09:30		25	**31**	56
09:45		31	**33**	64
10:00		24	24	48
10:15		35	37	72
10:30		34	28	62
10:45		33	31	64
11:00		**28**	25	**53**
11:15		**40**	26	**66**
11:30		**31**	29	**60**
11:45		**45**	38	**83**
Total		679	611	1290
Percent		52.6%	47.4%	
Peak		11:00	09:00	11:00
Vol.		144	129	262
P.H.F.		0.800	0.849	0.789

L2 Data Collection

1770 West State Street #204
Boise, Idaho 83702
(208) 860-7554

Project #: FEHR0021
Type: Volume / Direction
Tech: Vawdrey / Judd
Counter: 10009

Tube Da
Date Start: 19-Jun-07
Date End: 25-Jun-07
US89 E of Panguitch
Panguitch, Utah

Start Time	20-Jun-07 Wed	SB	NB	Total
12:00 PM		32	39	71
12:15		44	30	74
12:30		33	36	69
12:45		28	31	59
01:00		33	30	63
01:15		31	46	77
01:30		**40**	35	**75**
01:45		**45**	56	**101**
02:00		**42**	44	**86**
02:15		**43**	41	**84**
02:30		37	33	70
02:45		31	27	58
03:00		35	40	75
03:15		39	32	71
03:30		40	42	82
03:45		32	36	68
04:00		24	38	62
04:15		31	**43**	74
04:30		36	**48**	84
04:45		47	**54**	101
05:00		29	**48**	77
05:15		29	27	56
05:30		35	53	88
05:45		30	41	71
06:00		31	31	62
06:15		34	38	72
06:30		20	32	52
06:45		29	47	76
07:00		26	25	51
07:15		32	26	58
07:30		23	17	40
07:45		30	16	46
08:00		31	27	58
08:15		21	20	41
08:30		20	13	33
08:45		14	15	29
09:00		21	18	39
09:15		16	16	32
09:30		17	8	25
09:45		13	18	31
10:00		12	22	34
10:15		16	17	33
10:30		11	12	23
10:45		8	9	17
11:00		15	8	23
11:15		12	7	19
11:30		5	11	16
11:45		5	4	9
Total		1308	1407	2715
Percent		48.2%	51.8%	
Peak		13:30	16:15	13:30
Vol.		170	193	346
P.H.F.		0.904	0.862	0.856

L2 Data Collection

1770 West State Street #204
Boise, Idaho 83702
(208) 860-7554

Project #: FEHR0021
Type: Volume / Direction
Tech: Vawdrey / Judd
Counter: 10009

Tube Da
Date Start: 19-Jun-07
Date End: 25-Jun-07
US89 E of Panguitch
Panguitch, Utah

Start Time	21-Jun-07 Thu	SB	NB	Total
12:00 AM		2	5	7
12:15		8	4	12
12:30		1	2	3
12:45		3	0	3
01:00		1	0	1
01:15		1	2	3
01:30		4	2	6
01:45		1	4	5
02:00		0	3	3
02:15		2	0	2
02:30		1	3	4
02:45		2	2	4
03:00		1	5	6
03:15		2	2	4
03:30		2	2	4
03:45		3	5	8
04:00		2	4	6
04:15		1	1	2
04:30		5	3	8
04:45		10	2	12
05:00		4	5	9
05:15		1	1	2
05:30		9	5	14
05:45		8	2	10
06:00		6	10	16
06:15		12	6	18
06:30		17	4	21
06:45		11	8	19
07:00		12	13	25
07:15		13	12	25
07:30		21	18	39
07:45		30	25	55
08:00		22	27	49
08:15		26	11	37
08:30		28	20	48
08:45		31	23	54
09:00		23	22	45
09:15		32	22	54
09:30		39	29	68
09:45		41	28	69
10:00		35	35	70
10:15		25	15	40
10:30		33	29	62
10:45		27	29	56
11:00		**53**	**25**	**78**
11:15		**47**	**46**	**93**
11:30		**35**	**50**	**85**
11:45		**37**	**32**	**69**
Total		730	603	1333
Percent		54.8%	45.2%	
Peak		11:00	11:00	11:00
Vol.		172	153	325
P.H.F.		0.811	0.765	0.874

L2 Data Collection

1770 West State Street #204
Boise, Idaho 83702
(208) 860-7554

Project #: FEHR0021
Type: Volume / Direction
Tech: Vawdrey / Judd
Counter: 10009

Tube Da
Date Start: 19-Jun-07
Date End: 25-Jun-07
US89 E of Panguitch
Panguitch, Utah

Start Time	21-Jun-07 Thu	SB	NB	Total
12:00 PM		45	39	84
12:15		26	41	67
12:30		44	39	83
12:45		39	38	77
01:00		48	37	85
01:15		36	42	78
01:30		46	34	80
01:45		50	38	88
02:00		35	28	63
02:15		42	49	91
02:30		41	41	82
02:45		**55**	40	95
03:00		**44**	39	83
03:15		**50**	48	98
03:30		**54**	41	95
03:45		39	40	79
04:00		41	38	79
04:15		47	**50**	**97**
04:30		47	**58**	**105**
04:45		35	**51**	**86**
05:00		43	**55**	**98**
05:15		43	26	69
05:30		28	52	80
05:45		46	36	82
06:00		32	38	70
06:15		35	38	73
06:30		33	32	65
06:45		35	47	82
07:00		29	41	70
07:15		30	27	57
07:30		31	24	55
07:45		28	24	52
08:00		26	20	46
08:15		30	20	50
08:30		29	13	42
08:45		25	24	49
09:00		33	26	59
09:15		20	17	37
09:30		28	27	55
09:45		15	25	40
10:00		20	15	35
10:15		16	20	36
10:30		16	19	35
10:45		10	13	23
11:00		15	11	26
11:15		9	16	25
11:30		11	7	18
11:45		7	8	15
Total		1587	1552	3139
Percent		50.6%	49.4%	
Peak		14:45	16:15	16:15
Vol.		203	214	386
P.H.F.		0.923	0.922	0.919

L2 Data Collection

1770 West State Street #204
Boise, Idaho 83702
(208) 860-7554

Project #: FEHR0021
Type: Volume / Direction
Tech: Vawdrey / Judd
Counter: 10009

Tube Da
Date Start: 19-Jun-07
Date End: 25-Jun-07
US89 E of Panguitch
Panguitch, Utah

Start Time	22-Jun-07 Fri	SB	NB	Total
12:00 AM		8	13	21
12:15		8	7	15
12:30		3	6	9
12:45		3	6	9
01:00		5	14	19
01:15		4	6	10
01:30		4	1	5
01:45		0	2	2
02:00		3	3	6
02:15		3	3	6
02:30		2	11	13
02:45		1	1	2
03:00		2	5	7
03:15		1	5	6
03:30		0	3	3
03:45		2	1	3
04:00		0	5	5
04:15		2	3	5
04:30		2	4	6
04:45		6	0	6
05:00		5	4	9
05:15		4	4	8
05:30		4	4	8
05:45		11	15	26
06:00		10	17	27
06:15		7	13	20
06:30		12	8	20
06:45		9	9	18
07:00		10	14	24
07:15		13	24	37
07:30		23	17	40
07:45		43	19	62
08:00		24	18	42
08:15		33	25	58
08:30		24	14	38
08:45		29	35	64
09:00		31	18	49
09:15		34	31	65
09:30		38	27	65
09:45		24	**55**	**79**
10:00		33	**41**	**74**
10:15		33	**37**	**70**
10:30		42	**38**	**80**
10:45		**45**	25	70
11:00		**34**	20	54
11:15		**36**	26	62
11:30		**52**	40	92
11:45		28	41	69
Total		750	738	1488
Percent		50.4%	49.6%	
Peak		10:45	09:45	09:45
Vol.		167	171	303
P.H.F.		0.803	0.777	0.823

L2 Data Collection

1770 West State Street #204
Boise, Idaho 83702
(208) 860-7554

Project #: FEHR0021
Type: Volume / Direction
Tech: Vawdrey / Judd
Counter: 10009

Tube Da
Date Start: 19-Jun-07
Date End: 25-Jun-07
US89 E of Panguitch
Panguitch, Utah

Start Time	22-Jun-07 Fri	SB	NB	Total
12:00 PM		41	27	68
12:15		47	29	76
12:30		38	35	73
12:45		34	56	90
01:00		44	46	90
01:15		31	55	86
01:30		51	49	100
01:45		46	37	83
02:00		46	31	77
02:15		34	42	76
02:30		52	49	101
02:45		46	50	96
03:00		40	**66**	106
03:15		29	**44**	73
03:30		45	**55**	100
03:45		**48**	**51**	**99**
04:00		**39**	45	**84**
04:15		**57**	42	**99**
04:30		**52**	67	**119**
04:45		43	36	79
05:00		35	39	74
05:15		33	42	75
05:30		33	37	70
05:45		36	46	82
06:00		25	35	60
06:15		31	35	66
06:30		31	28	59
06:45		22	35	57
07:00		29	17	46
07:15		38	23	61
07:30		21	17	38
07:45		28	34	62
08:00		29	19	48
08:15		12	16	28
08:30		14	17	31
08:45		24	19	43
09:00		16	26	42
09:15		14	18	32
09:30		17	14	31
09:45		22	13	35
10:00		13	22	35
10:15		17	4	21
10:30		12	11	23
10:45		12	11	23
11:00		12	7	19
11:15		7	10	17
11:30		10	9	19
11:45		8	6	14
Total		1464	1522	2986
Percent		49.0%	51.0%	
Peak		15:45	15:00	15:45
Vol.		196	216	401
P.H.F.		0.860	0.806	0.842

L2 Data Collection

1770 West State Street #204
Boise, Idaho 83702
(208) 860-7554

Project #: FEHR0021
Type: Volume / Direction
Tech: Vawdrey / Judd
Counter: 10009

Tube Da
Date Start: 19-Jun-07
Date End: 25-Jun-07
US89 E of Panguitch
Panguitch, Utah

Start Time	23-Jun-07 Sat	SB	NB	Total
12:00 AM		0	6	6
12:15		1	5	6
12:30		3	2	5
12:45		8	8	16
01:00		2	3	5
01:15		2	6	8
01:30		3	4	7
01:45		1	3	4
02:00		5	5	10
02:15		3	2	5
02:30		6	1	7
02:45		9	4	13
03:00		3	1	4
03:15		2	2	4
03:30		1	3	4
03:45		1	0	1
04:00		1	2	3
04:15		1	3	4
04:30		3	1	4
04:45		4	3	7
05:00		2	2	4
05:15		1	7	8
05:30		2	6	8
05:45		3	6	9
06:00		3	12	15
06:15		6	10	16
06:30		6	6	12
06:45		4	6	10
07:00		11	9	20
07:15		3	7	10
07:30		3	10	13
07:45		14	32	46
08:00		17	13	30
08:15		27	12	39
08:30		26	9	35
08:45		21	17	38
09:00		32	25	57
09:15		30	27	57
09:30		29	20	49
09:45		46	37	83
10:00		34	45	79
10:15		31	39	70
10:30		24	39	63
10:45		**46**	**49**	**95**
11:00		**27**	**60**	**87**
11:15		**43**	**50**	**93**
11:30		**49**	**46**	**95**
11:45		44	38	82
Total		643	703	1346
Percent		47.8%	52.2%	
Peak		10:45	10:45	10:45
Vol.		165	205	370
P.H.F.		0.842	0.854	0.974

L2 Data Collection

1770 West State Street #204
Boise, Idaho 83702
(208) 860-7554

Project #: FEHR0021
Type: Volume / Direction
Tech: Vawdrey / Judd
Counter: 10009

Tube Da
Date Start: 19-Jun-07
Date End: 25-Jun-07
US89 E of Panguitch
Panguitch, Utah

Start Time	23-Jun-07 Sat	SB	NB	Total
12:00 PM		40	**65**	105
12:15		27	**56**	83
12:30		36	**31**	67
12:45		45	**44**	89
01:00		41	58	99
01:15		19	41	60
01:30		39	50	89
01:45		41	37	78
02:00		37	38	75
02:15		34	52	86
02:30		45	36	81
02:45		38	52	90
03:00		28	42	70
03:15		42	45	87
03:30		**50**	37	87
03:45		**49**	37	86
04:00		**40**	48	**88**
04:15		**45**	31	**76**
04:30		44	62	**106**
04:45		42	49	**91**
05:00		39	41	80
05:15		35	39	74
05:30		34	45	79
05:45		42	39	81
06:00		45	35	80
06:15		39	29	68
06:30		23	32	55
06:45		17	28	45
07:00		15	25	40
07:15		37	8	45
07:30		20	25	45
07:45		22	19	41
08:00		24	23	47
08:15		16	20	36
08:30		17	24	41
08:45		16	20	36
09:00		18	8	26
09:15		9	18	27
09:30		10	11	21
09:45		8	7	15
10:00		24	5	29
10:15		23	5	28
10:30		13	6	19
10:45		11	4	15
11:00		7	10	17
11:15		6	2	8
11:30		3	3	6
11:45		5	1	6
Total		1360	1443	2803
Percent		48.5%	51.5%	
Peak		15:30	12:00	16:00
Vol.		184	196	361
P.H.F.		0.920	0.754	0.851

L2 Data Collection

1770 West State Street #204
Boise, Idaho 83702
(208) 860-7554

Project #: FEHR0021
Type: Volume / Direction
Tech: Vawdrey / Judd
Counter: 10009

Tube Da
Date Start: 19-Jun-07
Date End: 25-Jun-07
US89 E of Panguitch
Panguitch, Utah

Start Time	24-Jun-07 Sun	SB	NB	Total
12:00 AM		7	7	14
12:15		6	3	9
12:30		3	2	5
12:45		0	1	1
01:00		5	1	6
01:15		2	3	5
01:30		1	4	5
01:45		1	1	2
02:00		2	3	5
02:15		1	0	1
02:30		1	3	4
02:45		1	4	5
03:00		2	2	4
03:15		1	1	2
03:30		0	2	2
03:45		0	2	2
04:00		5	2	7
04:15		4	0	4
04:30		1	2	3
04:45		1	0	1
05:00		0	1	1
05:15		2	1	3
05:30		0	3	3
05:45		2	0	2
06:00		1	2	3
06:15		5	1	6
06:30		3	2	5
06:45		3	4	7
07:00		7	4	11
07:15		15	9	24
07:30		7	16	23
07:45		7	6	13
08:00		18	16	34
08:15		25	13	38
08:30		24	21	45
08:45		37	25	62
09:00		41	18	59
09:15		23	24	47
09:30		41	24	65
09:45		38	27	65
10:00		**47**	32	79
10:15		**43**	25	68
10:30		**40**	30	70
10:45		**42**	**55**	**97**
11:00		43	**41**	**84**
11:15		47	**48**	**95**
11:30		30	**41**	**71**
11:45		43	35	78
Total		678	567	1245
Percent		54.5%	45.5%	
Peak		10:00	10:45	10:45
Vol.		172	185	347
P.H.F.		0.915	0.841	0.894

L2 Data Collection

1770 West State Street #204
Boise, Idaho 83702
(208) 860-7554

Project #: FEHR0021
Type: Volume / Direction
Tech: Vawdrey / Judd
Counter: 10009

Tube Da
Date Start: 19-Jun-07
Date End: 25-Jun-07
US89 E of Panguitch
Panguitch, Utah

Start Time	24-Jun-07 Sun	SB	NB	Total
12:00 PM		**47**	**56**	**103**
12:15		**56**	**47**	**103**
12:30		**49**	**60**	**109**
12:45		**42**	**43**	**85**
01:00		39	40	79
01:15		36	49	85
01:30		35	46	81
01:45		44	39	83
02:00		44	32	76
02:15		50	65	115
02:30		30	45	75
02:45		35	59	94
03:00		43	29	72
03:15		27	53	80
03:30		36	43	79
03:45		31	64	95
04:00		52	46	98
04:15		25	46	71
04:30		34	40	74
04:45		39	48	87
05:00		45	49	94
05:15		25	51	76
05:30		42	45	87
05:45		22	43	65
06:00		37	52	89
06:15		21	45	66
06:30		17	39	56
06:45		42	34	76
07:00		29	23	52
07:15		15	24	39
07:30		12	23	35
07:45		20	33	53
08:00		19	14	33
08:15		16	19	35
08:30		19	19	38
08:45		12	19	31
09:00		17	22	39
09:15		16	21	37
09:30		8	13	21
09:45		15	19	34
10:00		9	14	23
10:15		11	6	17
10:30		6	18	24
10:45		9	7	16
11:00		2	9	11
11:15		3	11	14
11:30		4	9	13
11:45		5	6	11
Total		1292	1637	2929
Percent		44.1%	55.9%	
Peak		12:00	12:00	12:00
Vol.		194	206	400
P.H.F.		0.866	0.792	0.870

L2 Data Collection

1770 West State Street #204
Boise, Idaho 83702
(208) 860-7554

Project #: FEHR0021
Type: Volume / Direction
Tech: Vawdrey / Judd
Counter: 10009

Tube Da
Date Start: 19-Jun-07
Date End: 25-Jun-07
US89 E of Panguitch
Panguitch, Utah

Start Time	25-Jun-07 Mon	SB	NB	Total
12:00 AM		4	3	7
12:15		2	6	8
12:30		1	9	10
12:45		4	2	6
01:00		2	2	4
01:15		0	7	7
01:30		1	5	6
01:45		1	1	2
02:00		2	5	7
02:15		4	1	5
02:30		1	6	7
02:45		0	5	5
03:00		2	7	9
03:15		0	2	2
03:30		0	2	2
03:45		2	4	6
04:00		1	0	1
04:15		2	2	4
04:30		1	3	4
04:45		3	2	5
05:00		2	4	6
05:15		3	4	7
05:30		5	5	10
05:45		7	6	13
06:00		7	4	11
06:15		10	10	20
06:30		13	5	18
06:45		13	10	23
07:00		13	9	22
07:15		14	9	23
07:30		19	15	34
07:45		14	19	33
08:00		17	18	35
08:15		21	16	37
08:30		23	28	51
08:45		25	32	57
09:00		25	17	42
09:15		29	37	66
09:30		21	30	51
09:45		23	34	57
10:00		25	30	55
10:15		39	35	74
10:30		25	27	52
10:45		39	**35**	**74**
11:00		**32**	**34**	**66**
11:15		**39**	**28**	**67**
11:30		**34**	**36**	**70**
11:45		**41**	30	71
Total		611	641	1252
Percent		48.8%	51.2%	
Peak		11:00	10:45	10:45
Vol.		146	133	277
P.H.F.		0.890	0.899	0.936

L2 Data Collection

1770 West State Street #204
Boise, Idaho 83702
(208) 860-7554

Project #: FEHR0021
Type: Volume / Direction
Tech: Vawdrey / Judd
Counter: 10009

Tube Da
Date Start: 19-Jun-07
Date End: 25-Jun-07
US89 E of Panguitch
Panguitch, Utah

Start Time	25-Jun-07 Mon	SB	NB	Total
12:00 PM		28	40	68
12:15		29	29	58
12:30		41	27	68
12:45		41	19	60
01:00		23	21	44
01:15		27	28	55
01:30		38	35	73
01:45		**41**	26	67
02:00		**41**	26	67
02:15		**40**	27	67
02:30		**41**	28	69
02:45		34	41	75
03:00		39	30	69
03:15		30	37	67
03:30		34	28	62
03:45		28	37	65
04:00		23	**37**	60
04:15		32	**40**	72
04:30		31	**40**	71
04:45		28	**52**	**80**
05:00		42	35	**77**
05:15		37	34	**71**
05:30		35	40	**75**
05:45		46	34	80
06:00		26	32	58
06:15		13	20	33
06:30		33	30	63
06:45		22	20	42
07:00		19	28	47
07:15		12	28	40
07:30		19	28	47
07:45		13	15	28
08:00		19	17	36
08:15		14	23	37
08:30		8	19	27
08:45		14	11	25
09:00		11	14	25
09:15		10	19	29
09:30		11	13	24
09:45		10	14	24
10:00		12	13	25
10:15		9	11	20
10:30		8	8	16
10:45		3	19	22
11:00		4	6	10
11:15		4	10	14
11:30		8	7	15
11:45		5	3	8
Total		1136	1199	2335
Percent		48.7%	51.3%	
Peak		13:45	16:00	16:45
Vol.		163	169	303
P.H.F.		0.886	0.813	0.947
Grand Total		13989	14448	28437
Percent		49.2%	50.8%	
ADT		ADT 4,062	AADT 4,062	

APPENDIX B
Detailed Level of Service Reports

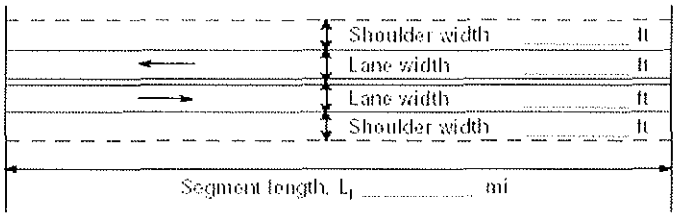
Existing Conditions

DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*Bjornstad*	Highway / Direction of Travel	*US-89*
Agency or Company	*Fehr & Peers*	From/To	*Alton / SR-14*
Date Performed	*7/24/2007*	Jurisdiction	*Kane County, UT*
Analysis Time Period	*Weekday Average*	Analysis Year	*2007*

Project Description: *06-721 Coal Hollow EIS*

Input Data



Analysis direction vol., V_d *137* veh/h

Opposing direction vol., V_o *113* veh/h

☐ Class I highway ☐ Class II highway

Terrain ☐ Level ☐ Rolling

Grade Length *1.60* mi Up/down *3.0*

Peak-hour factor, PHF *0.85*

No-passing zone *20%*

% Trucks and Buses , P_T *18 %*

% Recreational vehicles, P_R *12%*

Access points/ *mi* *1*

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 20-9 or 20-15)	*6.1*	*6.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9 or 20-17)	*1.4*	*1.4*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.509*	*0.509*
Grade adjustment factor [1], f_G (Exhibit 20-7 or 20-13)	*1.00*	*0.99*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV}*f_G)$	*317*	*265*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field measured speed[3], S_{FM}	*mi/h*	Base free-flow speed[3], $BFFS_{FM}$	*65.0 mi/h*
Observed volume[3], V_f	veh/h	Adj. for lane width and shoulder width,[3] f_{LS}(Exh 20-5)	*2.6 mi/h*
Free-flow speed, FFS_d $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points[3], f_A (Exhibit 20-5)	*0.3 mi/h*
Adjustment for no-passing zones, f_{np} (Exhibit 20-19)	*1.9 mi/h*	Free-flow speed, FFS_d $(FSS=BFFS-f_{LS}-f_A)$	*62.2 mi/h*
		Average travel speed, $ATS=FFS-0.00776v_p-f_{np}$	*55.8 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*1.000*	*1.000*
Grade adjustment factor[1], f_G (Exhibit 20-8 or 20-14)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h)$=V_i/(PHF*f_{HV}*f_G)$	*161*	*133*
Base percent time-spent-following[4], $BPTSF(\%)=100(1-e^{av_d^b})$	*17.8*	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	*34.1*	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$	*33.3*	

Level of Service and Other Performance Measures

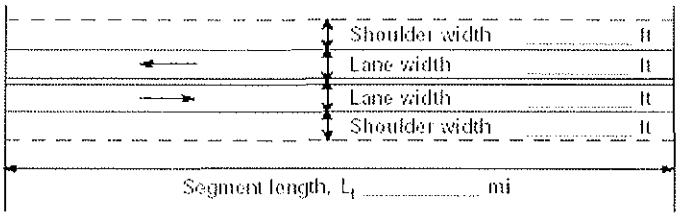
Level of service, LOS (Exhibit 20-3 or 20-4)	*A*
Volume to capacity ratio, $v/c=V_p/1{,}700$	*0.19*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)$=0.25L_t(V/PHF)$	*64*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)$=V*L_t$	*219*
Peak 15-min total travel time, TT_{15}(veh-h)$=VMT_{15}/ATS$	*1.1*

DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*Bjornstad*	Highway / Direction of Travel	*US-89*
Agency or Company	*Fehr & Peers*	From/To	*Alton / SR-14*
Date Performed	*7/24/2007*	Jurisdiction	*Kane County, UT*
Analysis Time Period	*Weekend*	Analysis Year	*2007*

Project Description: *06-721 Coal Hollow EIS*

Input Data



☐ Class I highway ☐ Class II highway

Terrain ☐ Level ☐ Rolling

Grade Length *1.60* mi Up/down *3.0*

Peak-hour factor, PHF *0.85*

No-passing zone *20%*

% Trucks and Buses , P_T *25 %*

% Recreational vehicles, P_R *18%*

Access points/ *mi* *1*

Analysis direction vol., V_d *167*veh/h

Opposing direction vol., V_o *134*veh/h

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 20-9 or 20-15)	*6.1*	*6.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9 or 20-17)	*1.4*	*1.4*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.426*	*0.426*
Grade adjustment factor [1], f_G (Exhibit 20-7 or 20-13)	*1.00*	*0.99*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV}*f_G)$	*461*	*375*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field measured speed[3], S_{FM}	*mi/h*	Base free-flow speed[3], $BFFS_{FM}$	*65.0 mi/h*
Observed volume[3], V_f	veh/h	Adj. for lane width and shoulder width,[3] f_{LS}(Exh 20-5)	*2.6 mi/h*
Free-flow speed, FFS_d $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points[3], f_A (Exhibit 20-5)	*0.3 mi/h*
Adjustment for no-passing zones, f_{np} (Exhibit 20-19)	*1.6 mi/h*	Free-flow speed, FFS_d (FSS=BFFS-f_{LS}-f_A)	*62.2 mi/h*
		Average travel speed, ATS=FFS-0.00776v_p-f_{np}	*54.1 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*1.000*	*1.000*
Grade adjustment factor[1], f_G (Exhibit 20-8 or 20-14)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h)=$V_i/(PHF*f_{HV}*f_G)$	*196*	*158*
Base percent time-spent-following[4], $BPTSF(\%)=100(1-e^{av_d^b})$	*21.2*	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	*36.6*	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$	*37.5*	

Level of Service and Other Performance Measures

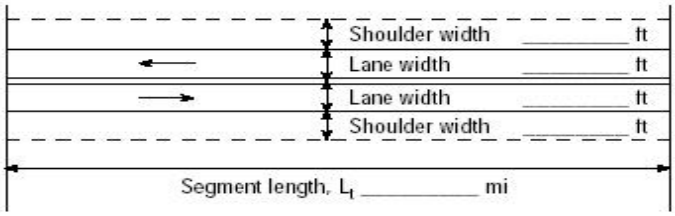
Level of service, LOS (Exhibit 20-3 or 20-4)	*B*
Volume to capacity ratio, v/c=V_p/ 1,700	*0.27*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)=0.25L_t(V/PHF)	*79*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=V*L_t	*267*
Peak 15-min total travel time, TT_{15}(veh-h)=VMT_{15}/ATS	*1.5*

DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*Bjornstad*	Highway / Direction of Travel	*US-89*
Agency or Company	*Fehr & Peers*	From/To	*SR-14 / Hatch*
Date Performed	*7/24/2007*	Jurisdiction	*Garfield County, Utah*
Analysis Time Period	*Weekday Average*	Analysis Year	*2007*

Project Description: *06-721 Coal Hollow EIS*

Input Data



Analysis direction vol., V_d *137*veh/h

Opposing direction vol., V_o *113*veh/h

☑ Class I highway ☐ Class II highway

Terrain ☑ Level ☐ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.85*

No-passing zone *30*%

% Trucks and Buses , P_T *18* %

% Recreational vehicles, P_R *12*%

Access points/ *mi* *1*

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 20-9 or 20-15)	*1.7*	*1.7*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9 or 20-17)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.888*	*0.888*
Grade adjustment factor [1], f_G (Exhibit 20-7 or 20-13)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV}*f_G)$	*181*	*150*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field measured speed[3], S_{FM}	*mi/h*	Base free-flow speed[3], $BFFS_{FM}$	*65.0 mi/h*
Observed volume[3], V_f	veh/h	Adj. for lane width and shoulder width,[3] f_{LS}(Exh 20-5)	*1.3 mi/h*
Free-flow speed, FFS_d $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points[3], f_A (Exhibit 20-5)	*0.3 mi/h*
Adjustment for no-passing zones, f_{np} (Exhibit 20-19)	*2.1 mi/h*	Free-flow speed, FFS_d $(FSS=BFFS-f_{LS}-f_A)$	*63.5 mi/h*
		Average travel speed, $ATS=FFS-0.00776v_p-f_{np}$	*58.8 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 20-10 or 20-16)	*1.1*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.982*	*0.982*
Grade adjustment factor[1], f_G (Exhibit 20-8 or 20-14)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h)=$V_i/(PHF*f_{HV}*f_G)$	*164*	*135*
Base percent time-spent-following[4], $BPTSF(\%)=100(1-e^{av_d^b})$	*18.1*	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	*40.4*	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$	*40.3*	

Level of Service and Other Performance Measures

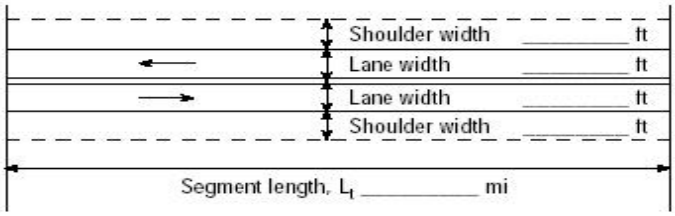
Level of service, LOS (Exhibit 20-3 or 20-4)	*B*
Volume to capacity ratio, $v/c=V_p/1{,}700$	*0.11*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)=$0.25L_t(V/PHF)$	*471*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=$V*L_t$	*1603*
Peak 15-min total travel time, TT_{15}(veh-h)=VMT_{15}/ATS	*8.0*

DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*Bjornstad*	Highway / Direction of Travel	*US-89*
Agency or Company	*Fehr & Peers*	From/To	*SR-14 / Hatch*
Date Performed	*7/24/2007*	Jurisdiction	*Garfield County, Utah*
Analysis Time Period	*Weekend*	Analysis Year	*2007*

Project Description: *06-721 Coal Hollow EIS*

Input Data



Analysis direction vol., V_d *167*veh/h

Opposing direction vol., V_o *134*veh/h

☑ Class I highway ☐ Class II highway

Terrain ☑ Level ☐ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.85*

No-passing zone *30*%

% Trucks and Buses , P_T *25* %

% Recreational vehicles, P_R *18*%

Access points/ *mi* *1*

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 20-9 or 20-15)	*1.7*	*1.7*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9 or 20-17)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.851*	*0.851*
Grade adjustment factor [1], f_G (Exhibit 20-7 or 20-13)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV}*f_G)$	*231*	*185*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field measured speed[3], S_{FM}	*mi/h*	Base free-flow speed[3], $BFFS_{FM}$	*65.0 mi/h*
Observed volume[3], V_f	veh/h	Adj. for lane width and shoulder width,[3] f_{LS}(Exh 20-5)	*1.3 mi/h*
Free-flow speed, FFS_d $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points[3], f_A (Exhibit 20-5)	*0.3 mi/h*
Adjustment for no-passing zones, f_{np} (Exhibit 20-19)	*2.5 mi/h*	Free-flow speed, FFS_d $(FSS=BFFS-f_{LS}-f_A)$	*63.5 mi/h*
		Average travel speed, $ATS=FFS-0.00776v_p-f_{np}$	*57.7 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 20-10 or 20-16)	*1.1*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.976*	*0.976*
Grade adjustment factor[1], f_G (Exhibit 20-8 or 20-14)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h)=$V_i/(PHF*f_{HV}*f_G)$	*201*	*162*
Base percent time-spent-following[4], $BPTSF(\%)=100(1-e^{av_d^b})$	*21.6*	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	*42.5*	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$	*45.2*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 or 20-4)	*B*
Volume to capacity ratio, $v/c=V_p/1{,}700$	*0.14*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)=$0.25L_t(V/PHF)$	*575*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=$V*L_t$	*1954*
Peak 15-min total travel time, TT_{15}(veh-h)=VMT_{15}/ATS	*10.0*

HIGHPLAN 2002 Conceptual Planning Analysis

Description/File Information

Filename	HP_preview.xml	**Date Prepared**	7/25/2007		
Program	HIGHPLAN	**Version**	1.2.0		
Analyst	JB	**Agency**	FP	**District**	Hatch, UT
Road Name	US-89	**From/To**	Hatch		
Analysis Type	Segment	**Peak Direction**	Northbound	**Study Period**	K100
User Notes	Weekday Average				

Facility Data

Roadway Variables				Traffic Variables			
Area Type	Rural developed	**# Thru Lanes**	2	**AADT**	2668	**% Heavy Vehicles**	18
Class	3	**Terrain**	Level	**K**	.0937	**Base Capacity**	1700
Posted Speed	40	**Median**	No	**D**	.526	**Local Adj. Factor**	.92
Free Flow Speed	45	**Left Turn Lanes**	No	**PHF**	.85	**Adjusted Capacity**	1033
Pass Lane Spacing	N/A	**% NPZ**	100				

LOS Results

v/c Ratio	0.16	**Density**	N/A	**PTSF**	87.00	**ATS**	37.00	**% FFS**	83.0	**LOS**	C

Service Volume Tables

	A	B	C	D	E
Lanes	**Hourly Volume In Peak Direction**				
1	0	120	350	520	660
2					
3					
4					
Lanes	**Hourly Volume In Both Directions**				
2	0	230	660	980	1260
4					
6					
8					
Lanes	**Annual Average Daily Traffic**				
2	0	2500	7000	10500	13400
4					
6					
8					
Lanes	**Maximum v/c Ratio**				
1	0.00	0.15	0.37	0.56	0.71
2					
3					
4					

HIGHPLAN 2002 Conceptual Planning Analysis

Description/File Information

Filename	HP_preview.xml	**Date Prepared**	7/25/2007		
Program	HIGHPLAN	**Version**	1.2.0		
Analyst	JB	**Agency**	FP	**District**	Hatch, UT
Road Name	US-89	**From/To**	Hatch		
Analysis Type	Segment	**Peak Direction**	Northbound	**Study Period**	K100
User Notes	Weekend				

Facility Data

Roadway Variables				Traffic Variables			
Area Type	Rural developed	**# Thru Lanes**	2	**AADT**	2930	**% Heavy Vehicles**	25
Class	3	**Terrain**	Level	**K**	.10273	**Base Capacity**	1700
Posted Speed	40	**Median**	No	**D**	.534	**Local Adj. Factor**	.92
Free Flow Speed	45	**Left Turn Lanes**	No	**PHF**	.85	**Adjusted Capacity**	1001
Pass Lane Spacing	N/A	**% NPZ**	100				

LOS Results

v/c Ratio	0.18	**Density**	N/A	**PTSF**	97.00	**ATS**	37.00	**% FFS**	82.0	**LOS**	C

Service Volume Tables

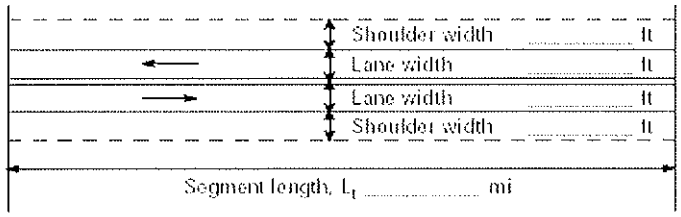
	A	B	C	D	E
Lanes	**Hourly Volume In Peak Direction**				
1	0	120	350	520	660
2					
3					
4					
Lanes	**Hourly Volume In Both Directions**				
2	0	220	650	980	1240
4					
6					
8					
Lanes	**Annual Average Daily Traffic**				
2	0	2100	6300	9500	12100
4					
6					
8					
Lanes	**Maximum v/c Ratio**				
1	0.00	0.14	0.37	0.56	0.71
2					
3					
4					

DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*Bjornstad*	Highway / Direction of Travel	*US-89*
Agency or Company	*Fehr & Peers*	From/To	*Hatch / SR-12*
Date Performed	*7/24/2007*	Jurisdiction	*Garfield Couty, UT*
Analysis Time Period	*Weekday Average*	Analysis Year	*2007*

Project Description: *06-721 Coal Hollow EIS*

Input Data



☑ Class I highway ☐ Class II highway

Terrain ☑ Level ☐ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.87*

No-passing zone *35%*

% Trucks and Buses , P_T *21 %*

% Recreational vehicles, P_R *18%*

Access points/ *mi* *1*

Analysis direction vol., V_d *138*veh/h

Opposing direction vol., V_o *127*veh/h

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 20-9 or 20-15)	*1.7*	*1.7*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9 or 20-17)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.872*	*0.872*
Grade adjustment factor [1], f_G (Exhibit 20-7 or 20-13)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV}*f_G)$	*182*	*167*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field measured speed[3], S_{FM}	*mi/h*	Base free-flow speed[3], $BFFS_{FM}$	*65.0 mi/h*
Observed volume[3], V_f	veh/h	Adj. for lane width and shoulder width,[3] f_{LS}(Exh 20-5)	*1.3 mi/h*
Free-flow speed, FFS_d $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points[3], f_A (Exhibit 20-5)	*0.3 mi/h*
Adjustment for no-passing zones, f_{np} (Exhibit 20-19)	*2.5 mi/h*	Free-flow speed, FFS_d (FSS=BFFS-f_{LS}-f_A)	*63.5 mi/h*
		Average travel speed, ATS=FFS-0.00776v_p-f_{np}	*58.2 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 20-10 or 20-16)	*1.1*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.979*	*0.979*
Grade adjustment factor[1], f_G (Exhibit 20-8 or 20-14)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h)=$V_i/(PHF*f_{HV}*f_G)$	*162*	*149*
Base percent time-spent-following[4], $BPTSF(\%)=100(1-e^{av_d^b})$	*17.9*	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	*44.9*	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$	*39.5*	

Level of Service and Other Performance Measures

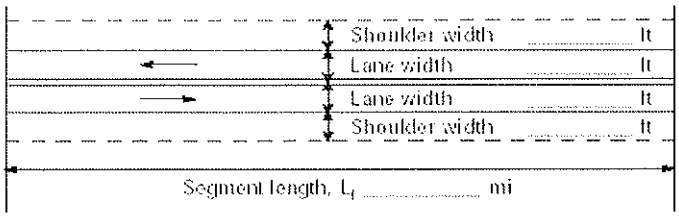
Level of service, LOS (Exhibit 20-3 or 20-4)	*B*
Volume to capacity ratio, v/c=V_p/ 1,700	*0.11*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)=0.25L_t(V/PHF)	*309*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=V*L_t	*1076*
Peak 15-min total travel time, TT_{15}(veh-h)=VMT_{15}/ATS	*5.3*

DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*Bjornstad*	Highway / Direction of Travel	*US-89*
Agency or Company	*Fehr & Peers*	From/To	*Hatch / SR-12*
Date Performed	*7/24/2007*	Jurisdiction	*Garfield Couty, UT*
Analysis Time Period	*Weekend*	Analysis Year	*2007*

Project Description: *06-721 Coal Hollow EIS*

Input Data



☑ Class I highway ☐ Class II highway

Terrain ☑ Level ☐ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.85*

No-passing zone *35%*

% Trucks and Buses , P_T *15 %*

% Recreational vehicles, P_R *21%*

Access points/ *mi* *1*

Analysis direction vol., V_d *146*veh/h

Opposing direction vol., V_o *133*veh/h

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 20-9 or 20-15)	*1.7*	*1.7*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9 or 20-17)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.905*	*0.905*
Grade adjustment factor [1], f_G (Exhibit 20-7 or 20-13)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV}*f_G)$	*190*	*173*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field measured speed[3], S_{FM}	*mi/h*	Base free-flow speed[3], $BFFS_{FM}$	*65.0 mi/h*
Observed volume[3], V_f	veh/h	Adj. for lane width and shoulder width,[3] f_{LS}(Exh 20-5)	*1.3 mi/h*
Free-flow speed, FFS_d $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points[3], f_A (Exhibit 20-5)	*0.3 mi/h*
Adjustment for no-passing zones, f_{np} (Exhibit 20-19)	*2.6 mi/h*	Free-flow speed, FFS_d $(FSS=BFFS-f_{LS}-f_A)$	*63.5 mi/h*
		Average travel speed, $ATS=FFS-0.00776v_p-f_{np}$	*58.0 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 20-10 or 20-16)	*1.1*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.985*	*0.985*
Grade adjustment factor[1], f_G (Exhibit 20-8 or 20-14)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h)=$V_i/(PHF*f_{HV}*f_G)$	*174*	*159*
Base percent time-spent-following[4], $BPTSF(\%)=100(1-e^{av_d^b})$	*19.1*	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	*46.0*	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$	*41.1*	

Level of Service and Other Performance Measures

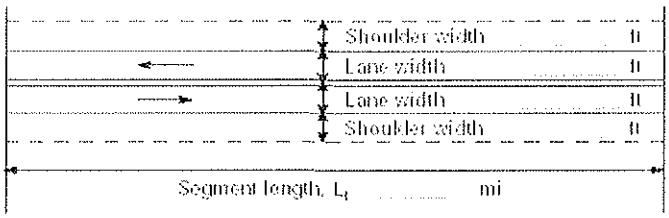
Level of service, LOS (Exhibit 20-3 or 20-4)	*B*
Volume to capacity ratio, v/c=V_p/ 1,700	*0.11*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)=$0.25L_t(V/PHF)$	*335*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=$V*L_t$	*1139*
Peak 15-min total travel time, TT_{15}(veh-h)=VMT_{15}/ATS	*5.8*

DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*Bjornstad*	Highway / Direction of Travel	*US-89*
Agency or Company	*Fehr & Peers*	From/To	*SR-12 / Panguitch*
Date Performed	*7/24/2007*	Jurisdiction	*Garfield Couty, UT*
Analysis Time Period	*Weekday Average*	Analysis Year	*2007*

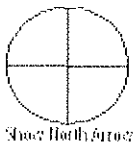
Project Description: *06-721 Coal Hollow EIS*

Input Data



Analysis direction vol., V_d *138*veh/h

Opposing direction vol., V_o *127*veh/h



■ Class I highway ■ Class II highway

Terrain ■ Level ■ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.87*

No-passing zone *5%*

% Trucks and Buses , P_T *21 %*

% Recreational vehicles, P_R *18%*

Access points/ *mi* *2*

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 20-9 or 20-15)	*1.7*	*1.7*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9 or 20-17)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.872*	*0.872*
Grade adjustment factor [1], f_G (Exhibit 20-7 or 20-13)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV}*f_G)$	*182*	*167*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field measured speed[3], S_{FM}	*mi/h*	Base free-flow speed[3], $BFFS_{FM}$	*65.0 mi/h*
Observed volume[3], V_f	veh/h	Adj. for lane width and shoulder width,[3] f_{LS}(Exh 20-5)	*1.3 mi/h*
Free-flow speed, FFS_d $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points[3], f_A (Exhibit 20-5)	*0.5 mi/h*
Adjustment for no-passing zones, f_{np} (Exhibit 20-19)	*1.7 mi/h*	Free-flow speed, FFS_d $(FSS=BFFS-f_{LS}-f_A)$	*63.2 mi/h*
		Average travel speed, $ATS=FFS-0.00776v_p-f_{np}$	*58.8 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 20-10 or 20-16)	*1.1*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.979*	*0.979*
Grade adjustment factor[1], f_G (Exhibit 20-8 or 20-14)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h)$=V_i/(PHF*f_{HV}*f_G)$	*162*	*149*
Base percent time-spent-following[4], $BPTSF(\%)=100(1-e^{av_d^b})$	*17.9*	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	*18.6*	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$	*27.6*	

Level of Service and Other Performance Measures

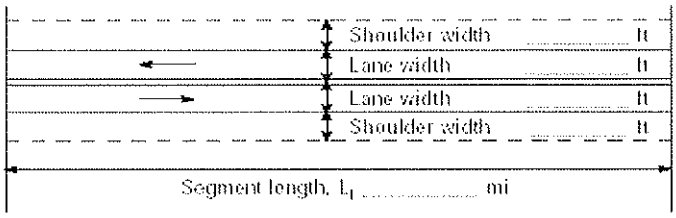
Level of service, LOS (Exhibit 20-3 or 20-4)	*A*
Volume to capacity ratio, $v/c=V_p/1{,}700$	*0.11*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)$=0.25L_t(V/PHF)$	*226*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)$=V*L_t$	*787*
Peak 15-min total travel time, TT_{15}(veh-h)$=VMT_{15}/ATS$	*3.8*

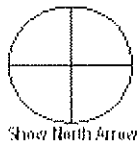
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*Bjornstad*	Highway / Direction of Travel	*US-89*
Agency or Company	*Fehr & Peers*	From/To	*SR-12 / Panguitch*
Date Performed	*7/24/2007*	Jurisdiction	*Garfield Couty, UT*
Analysis Time Period	*Weekend*	Analysis Year	*2007*

Project Description: *06-721 Coal Hollow EIS*

Input Data





☑ Class I highway ☐ Class II highway

Terrain ☑ Level ☐ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.85*

No-passing zone *5%*

% Trucks and Buses , P_T *15 %*

% Recreational vehicles, P_R *21%*

Access points/ *mi* *2*

Analysis direction vol., V_d *146*veh/h

Opposing direction vol., V_o *133*veh/h

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 20-9 or 20-15)	*1.7*	*1.7*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9 or 20-17)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.905*	*0.905*
Grade adjustment factor [1], f_G (Exhibit 20-7 or 20-13)	*1.00*	*1.00*
Directional flow rate [2], $v_i(pc/h)$ $v_i=V_i/(PHF*f_{HV}*f_G)$	*190*	*173*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field measured speed [3], S_{FM}	*mi/h*	Base free-flow speed [3], $BFFS_{FM}$	*65.0 mi/h*
Observed volume [3], V_f	veh/h	Adj. for lane width and shoulder width, [3] f_{LS}(Exh 20-5)	*1.3 mi/h*
Free-flow speed, FFS_d $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points [3], f_A (Exhibit 20-5)	*0.5 mi/h*
Adjustment for no-passing zones, f_{np} (Exhibit 20-19)	*1.8 mi/h*	Free-flow speed, FFS_d $(FSS=BFFS-f_{LS}-f_A)$	*63.2 mi/h*
		Average travel speed, $ATS=FFS-0.00776v_p-f_{np}$	*58.6 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 20-10 or 20-16)	*1.1*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.985*	*0.985*
Grade adjustment factor [1], f_G (Exhibit 20-8 or 20-14)	*1.00*	*1.00*
Directional flow rate [2], $v_i(pc/h)=V_i/(PHF*f_{HV}*f_G)$	*174*	*159*
Base percent time-spent-following [4], $BPTSF(\%)=100(1-e^{av_d^b})$	*19.1*	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	*19.4*	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$	*28.4*	

Level of Service and Other Performance Measures

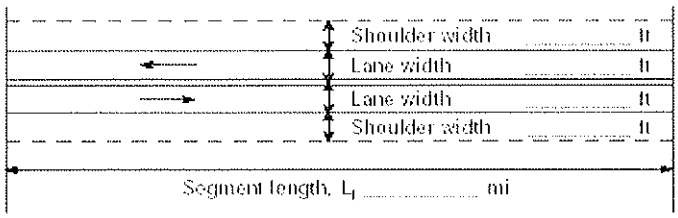
Level of service, LOS (Exhibit 20-3 or 20-4)	*A*
Volume to capacity ratio, $v/c=V_p/1{,}700$	*0.11*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)$=0.25L_t(V/PHF)$	*245*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)$=V*L_t$	*832*
Peak 15-min total travel time, TT_{15}(veh-h)$=VMT_{15}/ATS$	*4.2*

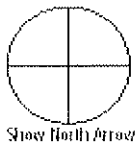
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*Bjornstad*	Highway / Direction of Travel	*US-89*
Agency or Company	*Fehr & Peers*	From/To	*Panguitch / SR-20*
Date Performed	*7/24/2007*	Jurisdiction	*Garfield Couty, UT*
Analysis Time Period	*Weekday Average*	Analysis Year	*2007*

Project Description: *06-721 Coal Hollow EIS*

Input Data





☑ Class I highway ☐ Class II highway

Terrain ☑ Level ☐ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.86*

No-passing zone *15%*

% Trucks and Buses , P_T *25 %*

% Recreational vehicles, P_R *12%*

Access points/ *mi* *3*

Analysis direction vol., V_d *107*veh/h

Opposing direction vol., V_o *112*veh/h

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 20-9 or 20-15)	*1.7*	*1.7*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9 or 20-17)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.851*	*0.851*
Grade adjustment factor [1], f_G (Exhibit 20-7 or 20-13)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_f/(PHF*f_{HV}*f_G)$	*146*	*153*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field measured speed[3], S_{FM}	*mi/h*	Base free-flow speed[3], $BFFS_{FM}$	*65.0 mi/h*
Observed volume[3], V_f	veh/h	Adj. for lane width and shoulder width,[3] f_{LS}(Exh 20-5)	*1.3 mi/h*
Free-flow speed, FFS_d $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points[3], f_A (Exhibit 20-5)	*0.8 mi/h*
Adjustment for no-passing zones, f_{np} (Exhibit 20-19)	*1.5 mi/h*	Free-flow speed, FFS_d $(FSS=BFFS-f_{LS}-f_A)$	*63.0 mi/h*
		Average travel speed, $ATS=FFS-0.00776v_p-f_{np}$	*59.1 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 20-10 or 20-16)	*1.1*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.976*	*0.976*
Grade adjustment factor[1], f_G (Exhibit 20-8 or 20-14)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h)=$V_i/(PHF*f_{HV}*f_G)$	*128*	*133*
Base percent time-spent-following[4], $BPTSF(\%)=100(1-e^{av_d^b})$	*14.5*	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	*27.2*	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$	*28.4*	

Level of Service and Other Performance Measures

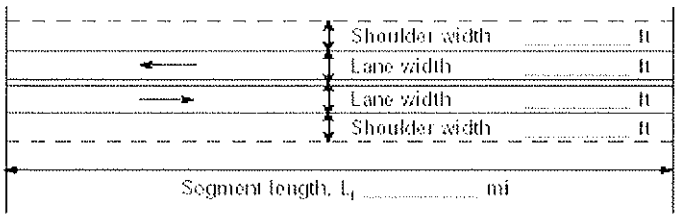
Level of service, LOS (Exhibit 20-3 or 20-4)	*A*
Volume to capacity ratio, v/c=V_p/ 1,700	*0.09*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)=$0.25L_t(V/PHF)$	*292*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=$V*L_t$	*1006*
Peak 15-min total travel time, TT_{15}(veh-h)=VMT_{15}/ATS	*4.9*

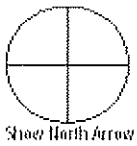
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*Bjornstad*	Highway / Direction of Travel	*US-89*
Agency or Company	*Fehr & Peers*	From/To	*Panguitch / SR-20*
Date Performed	*7/24/2007*	Jurisdiction	*Garfield Couty, UT*
Analysis Time Period	*Weekend*	Analysis Year	*2007*

Project Description: *06-721 Coal Hollow EIS*

Input Data





☑ Class I highway ☐ Class II highway

Terrain ☑ Level ☐ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.94*

No-passing zone *15%*

% Trucks and Buses , P_T *36 %*

% Recreational vehicles, P_R *14%*

Access points/ *mi* 3

Analysis direction vol., V_d *154*veh/h

Opposing direction vol., V_o *113*veh/h

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 20-9 or 20-15)	*1.7*	*1.7*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9 or 20-17)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ $P_T(E_T$-1)+$P_R(E_R$-1))	*0.799*	*0.799*
Grade adjustment factor [1], f_G (Exhibit 20-7 or 20-13)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) v_i=V_i/(PHF*f_{HV}* f_G)	*205*	*151*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field measured speed[3], S_{FM}	*mi/h*	Base free-flow speed[3], $BFFS_{FM}$	*65.0 mi/h*
Observed volume[3], V_f	veh/h	Adj. for lane width and shoulder width,[3] f_{LS}(Exh 20-5)	*1.3 mi/h*
Free-flow speed, FFS_d FFS=S_{FM}+0.00776(V_f/ f_{HV})	*mi/h*	Adj. for access points[3], f_A (Exhibit 20-5)	*0.8 mi/h*
Adjustment for no-passing zones, f_{np} (Exhibit 20-19)	*1.5 mi/h*	Free-flow speed, FFS_d (FSS=BFFS-f_{LS}-f_A)	*63.0 mi/h*
		Average travel speed, ATS=FFS-0.00776v_p-f_{np}	*58.7 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 20-10 or 20-16)	*1.1*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ $P_T(E_T$-1)+$P_R(E_R$-1))	*0.965*	*0.965*
Grade adjustment factor[1], f_G (Exhibit 20-8 or 20-14)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h)=V_i/(PHF*f_{HV}* f_G)	*170*	*125*
Base percent time-spent-following[4], BPTSF(%)=100(1-$e^{av_d{}^b}$)	*18.7*	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	*28.4*	
Percent time-spent-following, PTSF(%)=BPTSF+f_{np}	*30.8*	

Level of Service and Other Performance Measures

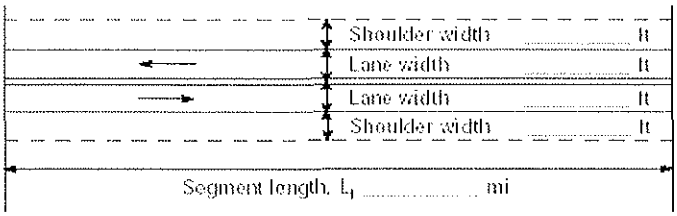
Level of service, LOS (Exhibit 20-3 or 20-4)	*A*
Volume to capacity ratio, v/c=V_p/ 1,700	*0.12*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)=0.25L_t(V/PHF)	*385*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=V*L_t	*1448*
Peak 15-min total travel time, TT_{15}(veh-h)=VMT_{15}/ATS	*6.6*

DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*Bjornstad*	Highway / Direction of Travel	*SR-20*
Agency or Company	*Fehr & Peers*	From/To	*US-89 / Upslope*
Date Performed	*7/24/2007*	Jurisdiction	*Iron County, UT*
Analysis Time Period	*Weekday Average*	Analysis Year	*2007*

Project Description: *06-721 Coal Hollow EIS*

Input Data



☐ Class I highway ☐ Class II highway

Terrain ☐ Level ☐ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.85*

No-passing zone *45%*

% Trucks and Buses , P_T *27 %*

% Recreational vehicles, P_R *14%*

Access points/ *mi* *0*

Analysis direction vol., V_d *73*veh/h

Opposing direction vol., V_o *82*veh/h

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 20-9 or 20-15)	*1.7*	*1.7*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9 or 20-17)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.841*	*0.841*
Grade adjustment factor [1], f_G (Exhibit 20-7 or 20-13)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV}*f_G)$	*102*	*115*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field measured speed[3], S_{FM}	*mi/h*	Base free-flow speed[3], $BFFS_{FM}$	*50.0 mi/h*
Observed volume[3], V_f	veh/h	Adj. for lane width and shoulder width,[3] f_{LS}(Exh 20-5)	*1.3 mi/h*
Free-flow speed, FFS_d $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points[3], f_A (Exhibit 20-5)	*0.0 mi/h*
Adjustment for no-passing zones, f_{np} (Exhibit 20-19)	*1.1 mi/h*	Free-flow speed, FFS_d ($FSS=BFFS-f_{LS}-f_A$)	*48.7 mi/h*
		Average travel speed, $ATS=FFS-0.00776v_p-f_{np}$	*45.9 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 20-10 or 20-16)	*1.1*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.974*	*0.974*
Grade adjustment factor[1], f_G (Exhibit 20-8 or 20-14)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h)=$V_i/(PHF*f_{HV}*f_G)$	*88*	*99*
Base percent time-spent-following[4], $BPTSF(\%)=100(1-e^{av_d^b})$	*10.3*	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	*43.6*	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$	*33.4*	

Level of Service and Other Performance Measures

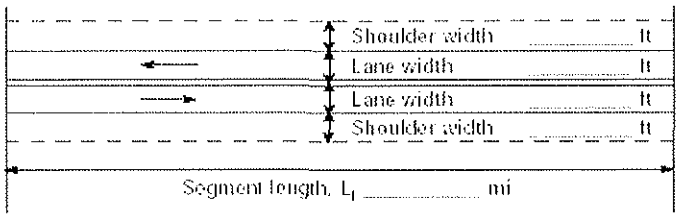
Level of service, LOS (Exhibit 20-3 or 20-4)	*C*
Volume to capacity ratio, $v/c=V_p/1{,}700$	*0.06*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)=$0.25L_t(V/PHF)$	*182*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=$V*L_t$	*621*
Peak 15-min total travel time, TT_{15}(veh-h)=VMT_{15}/ATS	*4.0*

DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*Bjornstad*	Highway / Direction of Travel	*SR-20*
Agency or Company	*Fehr & Peers*	From/To	*US-89 / Upslope*
Date Performed	*7/24/2007*	Jurisdiction	*Iron County, UT*
Analysis Time Period	*Weekend*	Analysis Year	*2007*

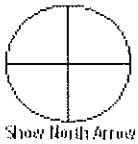
Project Description: *06-721 Coal Hollow EIS*

Input Data



Analysis direction vol., V_d *114*veh/h

Opposing direction vol., V_o *82*veh/h



☐ Class I highway ☐ Class II highway

Terrain ☐ Level ☐ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.85*

No-passing zone *45%*

% Trucks and Buses , P_T *27 %*

% Recreational vehicles, P_R *14%*

Access points/ *mi* *0*

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 20-9 or 20-15)	*1.7*	*1.7*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9 or 20-17)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.841*	*0.841*
Grade adjustment factor [1], f_G (Exhibit 20-7 or 20-13)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV}*f_G)$	*159*	*115*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field measured speed[3], S_{FM}	*mi/h*	Base free-flow speed[3], $BFFS_{FM}$	*50.0 mi/h*
Observed volume[3], V_f	veh/h	Adj. for lane width and shoulder width,[3] f_{LS}(Exh 20-5)	*1.3 mi/h*
Free-flow speed, FFS_d $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points[3], f_A (Exhibit 20-5)	*0.0 mi/h*
Adjustment for no-passing zones, f_{np} (Exhibit 20-19)	*1.1 mi/h*	Free-flow speed, FFS_d $(FSS=BFFS-f_{LS}-f_A)$	*48.7 mi/h*
		Average travel speed, $ATS=FFS-0.00776v_p-f_{np}$	*45.4 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 20-10 or 20-16)	*1.1*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.974*	*0.974*
Grade adjustment factor[1], f_G (Exhibit 20-8 or 20-14)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h)=$V_i/(PHF*f_{HV}*f_G)$	*138*	*99*
Base percent time-spent-following[4], $BPTSF(\%)=100(1-e^{av_d^b})$	*15.6*	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	*44.7*	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$	*34.2*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 or 20-4)	*C*
Volume to capacity ratio, $v/c=V_p/1{,}700$	*0.09*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)=$0.25L_t(V/PHF)$	*285*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=$V*L_t$	*969*
Peak 15-min total travel time, TT_{15}(veh-h)=VMT_{15}/ATS	*6.3*

2

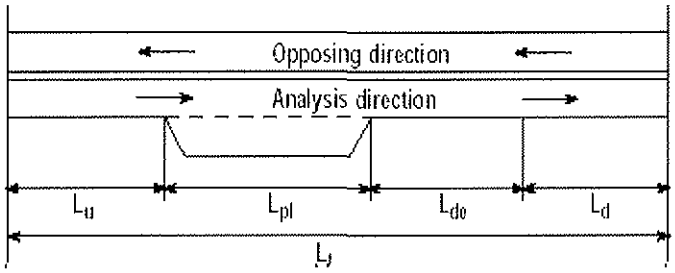
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET WITH PASSING LANE WORKSHEET

General Information		***Site Information***	
Analyst	*Bjornstad*	Highway of Travel	*SR-20*
Agency or Company	*Fehr & Peers*	From/To	*Upslope / Summit*
Date Performed	*7/24/2007*	Jurisdiction	*Iron County, UT*
Analysis Time Period	*Weekday Average*	Analysis Year	*2007*

Project Description: *06-721 Coal Hollow EIS*

Input Data

☐ Class I highway ☑ Class II highway



Show North Arrow

Total length of analysis segment, L_t (*mi*)	*2.3*
Length of two-lane highway upstream of the passing lane, L_u (*mi*)	*0.0*
Length of passing lane ineluding tapers , L_{pl} (*mi*)	*2.2*
Average travel speed, ATS_d (from Directional Two-Lane Highway Segment Worksheet)	*36.0*
Percent time-spent-following, $PTSF_d$ (from Directional Two-Lane Highway Segment Worksheet)	*18.4*
Level of service[1], LOS_d (from Directional Two-Lane Highway Segment Worksheet)	*A*
Average Travel Speed	
Downstream length of two-lane highway within effective length of passing lane for average travel speed, L_{de} (*mi*) (Exhibit 20-23)	*1.70*
Length of two-lane highway downstream of effective length of the passing lane for avg travel speed, L_d (*mi*) $L_d=L_t-(L_u+L_{pl}+L_{de})$	*-1.60*
Adj. factor for the effect of passing lane on average speed, f_{pl} (Exhibit 20-24)	*1.10*
Average travel speed including passing lane[2], $ATS_{pl} = (ATS_d * L_t) / (L_u+L_d+(L_{pl}/f_{pl})+ (2L_{de}/(1+f_{pl}))$)	*39.5*
Percent Time-Spent-Following	
Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, L_{de} (*mi*)(Exhibit 20-23)	*13.00*
Length of two-lane highway downstream of effective length of the passing lane for percent-time-following, L_d (*mi*)$=L_t-(L_u+L_{pl}+L_{de})$	*-12.90*
Adj. factor for the effect of passing lane on percent time-spent-following, f_{pl}(Exhibit 20-24)	*0.58*
Percent time-spent-following including passing lane[3], $PTSF_{pl}$(%) $PTSF_{pl}= PTSF_d[L_u+L_d+f_{pl}L_{pl}+((1+f_{pl})/2)L_{de}]/L_t$	*10.7*

2

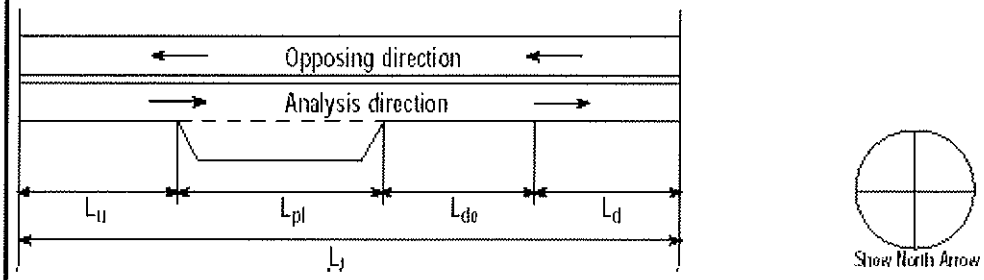
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET WITH PASSING LANE WORKSHEET

General Information		***Site Information***	
Analyst	*Bjornstad*	Highway of Travel	*SR-20*
Agency or Company	*Fehr & Peers*	From/To	*Upslope / Summit*
Date Performed	*7/24/2007*	Jurisdiction	*Iron County, UT*
Analysis Time Period	*Weekend*	Analysis Year	*2007*

Project Description: *06-721 Coal Hollow EIS*

Input Data

☐ Class I highway ☑ Class II highway



Show North Arrow

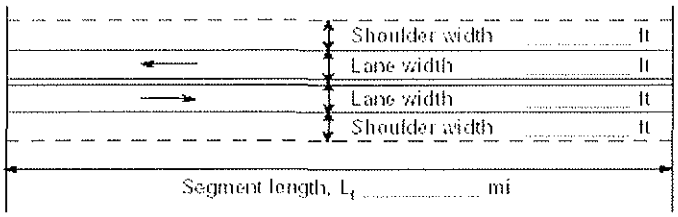
Total length of analysis segment, L_t (*mi*)	*2.3*
Length of two-lane highway upstream of the passing lane, L_u (*mi*)	*0.0*
Length of passing lane including tapers , L_{pl} (*mi*)	*2.0*
Average travel speed, ATS_d (from Directional Two-Lane Highway Segment Worksheet)	*34.9*
Percent time-spent-following, $PTSF_d$ (from Directional Two-Lane Highway Segment Worksheet)	*23.6*
Level of service[1], LOS_d (from Directional Two-Lane Highway Segment Worksheet)	*A*
Average Travel Speed	
Downstream length of two-lane highway within effective length of passing lane for average travel speed, L_{de} (*mi*) (Exhibit 20-23)	*1.70*
Length of two-lane highway downstream of effective length of the passing lane for avg travel speed, L_d (*mi*) $L_d=L_t-(L_u+L_{pl}+L_{de})$	*-1.40*
Adj. factor for the effect of passing lane on average speed, f_{pl} (Exhibit 20-24)	*1.11*
Average travel speed including passing lane[2], $ATS_{pl} = (ATS_d * L_t) / (L_u+L_d+(L_{pl}/f_{pl})+ (2L_{de}/(1+f_{pl}))$)	*38.7*
Percent Time-Spent-Following	
Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, L_{de} (*mi*)(Exhibit 20-23)	*13.00*
Length of two-lane highway downstream of effective length of the passing lane for percent-time-following, L_d (*mi*)$=L_t-(L_u+L_{pl}+L_{de})$	*-12.70*
Adj. factor for the effect of passing lane on percent time-spent-following, f_{pl}(Exhibit 20-24)	*0.58*
Percent time-spent-following including passing lane[3], $PTSF_{pl}$(%) $PTSF_{pl}= PTSF_d[L_u+L_d+f_{pl}L_{pl}+((1+f_{pl})/2)L_{de}]/L_t$	*13.7*

DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*Bjornstad*	Highway / Direction of Travel	*SR-20*
Agency or Company	*Fehr & Peers*	From/To	*Summit / Downslope*
Date Performed	*7/24/2007*	Jurisdiction	*Iron County, UT*
Analysis Time Period	*Weekday Average*	Analysis Year	*2007*

Project Description: *06-721 Coal Hollow EIS*

Input Data



Analysis direction vol., V_d 73veh/h

Opposing direction vol., V_o 82veh/h

☑ Class I highway ☐ Class II highway

Terrain ☐ Level ☐ Rolling

Grade Length *1.30* mi Up/down *7.1*

Peak-hour factor, PHF *0.85*

No-passing zone *100%*

% Trucks and Buses , P_T *27 %*

% Recreational vehicles, P_R *14%*

Access points/ *mi* *1*

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 20-9 or 20-15)	*12.9*	*12.9*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9 or 20-17)	*1.6*	*1.6*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.233*	*0.233*
Grade adjustment factor [1], f_G (Exhibit 20-7 or 20-13)	*1.00*	*0.91*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV}*f_G)$	*369*	*456*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field measured speed[3], S_{FM}	*mi/h*	Base free-flow speed[3], $BFFS_{FM}$	*60.0 mi/h*
Observed volume[3], V_f	veh/h	Adj. for lane width and shoulder width,[3] f_{LS}(Exh 20-5)	*1.3 mi/h*
Free-flow speed, FFS_d $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points[3], f_A (Exhibit 20-5)	*0.3 mi/h*
Adjustment for no-passing zones, f_{np} (Exhibit 20-19)	*2.6 mi/h*	Free-flow speed, FFS_d (FSS=BFFS-f_{LS}-f_A)	*58.5 mi/h*
		Average travel speed, ATS=FFS-0.00776v_p-f_{np}	*49.4 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 20-10 or 20-16)	*2.8*	*2.8*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.673*	*0.673*
Grade adjustment factor[1], f_G (Exhibit 20-8 or 20-14)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h)=$V_i/(PHF*f_{HV}*f_G)$	*128*	*143*
Base percent time-spent-following[4], $BPTSF(\%)=100(1-e^{av_d^b})$	*14.5*	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	*54.5*	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$	*43.3*	

Level of Service and Other Performance Measures

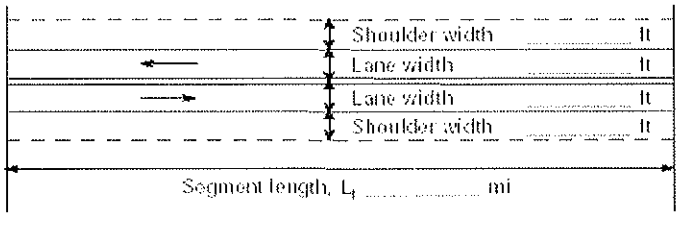
Level of service, LOS (Exhibit 20-3 or 20-4)	*C*
Volume to capacity ratio, v/c=V_p/ 1,700	*0.22*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)=0.25L_t(V/PHF)	*28*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=V*L_t	*95*
Peak 15-min total travel time, TT_{15}(veh-h)=VMT_{15}/ATS	*0.6*

DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*Bjornstad*	Highway / Direction of Travel	*SR-20*
Agency or Company	*Fehr & Peers*	From/To	*Summit / Downslope*
Date Performed	*7/24/2007*	Jurisdiction	*Iron County, UT*
Analysis Time Period	*Weekend*	Analysis Year	*2007*

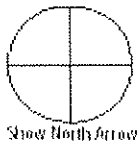
Project Description: *06-721 Coal Hollow EIS*

Input Data



Analysis direction vol., V_d *114*veh/h

Opposing direction vol., V_o *82*veh/h



☐ Class I highway ☐ Class II highway

Terrain ☐ Level ☐ Rolling

Grade Length *1.30* mi Up/down *7.1*

Peak-hour factor, PHF *0.85*

No-passing zone *100%*

% Trucks and Buses , P_T *27 %*

% Recreational vehicles, P_R *14%*

Access points/ *mi* *1*

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 20-9 or 20-15)	*12.9*	*12.9*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9 or 20-17)	*1.6*	*1.6*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.233*	*0.233*
Grade adjustment factor [1], f_G (Exhibit 20-7 or 20-13)	*1.00*	*0.91*
Directional flow rate[2], $v_i(pc/h)$ $v_i=V_i/(PHF*f_{HV}*f_G)$	*576*	*456*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field measured speed[3], S_{FM}	*mi/h*	Base free-flow speed[3], $BFFS_{FM}$	*60.0 mi/h*
Observed volume[3], V_f	veh/h	Adj. for lane width and shoulder width,[3] f_{LS}(Exh 20-5)	*1.3 mi/h*
Free-flow speed, FFS_d $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points[3], f_A (Exhibit 20-5)	*0.3 mi/h*
Adjustment for no-passing zones, f_{np} (Exhibit 20-19)	*2.6 mi/h*	Free-flow speed, FFS_d $(FSS=BFFS-f_{LS}-f_A)$	*58.5 mi/h*
		Average travel speed, $ATS=FFS-0.00776v_p-f_{np}$	*47.8 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 20-10 or 20-16)	*2.8*	*2.8*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.673*	*0.673*
Grade adjustment factor[1], f_G (Exhibit 20-8 or 20-14)	*1.00*	*1.00*
Directional flow rate[2], $v_i(pc/h)=V_i/(PHF*f_{HV}*f_G)$	*199*	*143*
Base percent time-spent-following[4], $BPTSF(\%)=100(1-e^{av_d^b})$	*21.5*	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	*56.8*	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$	*45.2*	

Level of Service and Other Performance Measures

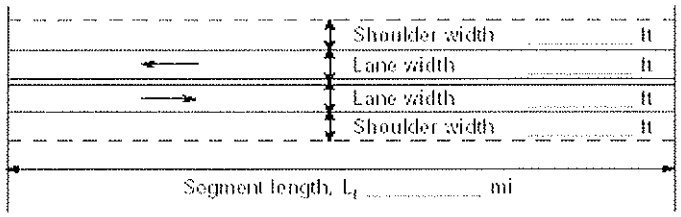
Level of service, LOS (Exhibit 20-3 or 20-4)	*C*
Volume to capacity ratio, $v/c=V_p/1,700$	*0.34*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)$=0.25L_t(V/PHF)$	*44*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)$=V*L_t$	*148*
Peak 15-min total travel time, TT_{15}(veh-h)$=VMT_{15}/ATS$	*0.9*

DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*Bjornstad*	Highway / Direction of Travel	*SR-20*
Agency or Company	*Fehr & Peers*	From/To	*Downslope / I-15*
Date Performed	*7/24/2007*	Jurisdiction	*Iron County, UT*
Analysis Time Period	*Weekday average*	Analysis Year	*2007*

Project Description: *06-721 Coal Hollow EIS*

Input Data



Class I highway ☐ Class II highway

Terrain ☐ Level ☐ Rolling

Grade Length *4.00* mi Up/down *3.4*

Peak-hour factor, PHF *0.85*

No-passing zone *70%*

% Trucks and Buses , P_T *27 %*

% Recreational vehicles, P_R *14%*

Access points/ *mi* *1*

Analysis direction vol., V_d *73*veh/h

Opposing direction vol., V_o *82*veh/h

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 20-9 or 20-15)	*9.1*	*9.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9 or 20-17)	*1.5*	*1.5*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.307*	*0.307*
Grade adjustment factor [1], f_G (Exhibit 20-7 or 20-13)	*1.00*	*0.94*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV}*f_G)$	*280*	*334*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field measured speed[3], S_{FM}	*mi/h*	Base free-flow speed[3], $BFFS_{FM}$	*60.0 mi/h*
Observed volume[3], V_f	veh/h	Adj. for lane width and shoulder width,[3] f_{LS}(Exh 20-5)	*1.3 mi/h*
Free-flow speed, FFS_d $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points[3], f_A (Exhibit 20-5)	*0.3 mi/h*
Adjustment for no-passing zones, f_{np} (Exhibit 20-19)	*3.0 mi/h*	Free-flow speed, FFS_d (FSS=BFFS-f_{LS}-f_A)	*58.5 mi/h*
		Average travel speed, ATS=FFS-0.00776v_p-f_{np}	*50.7 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 20-10 or 20-16)	*1.5*	*1.5*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.881*	*0.881*
Grade adjustment factor[1], f_G (Exhibit 20-8 or 20-14)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h)=V_i/(PHF*f_{HV}*f_G)	*97*	*109*
Base percent time-spent-following[4], $BPTSF(\%)=100(1-e^{av_d^b})$	*11.3*	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	*51.8*	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$	*38.7*	

Level of Service and Other Performance Measures

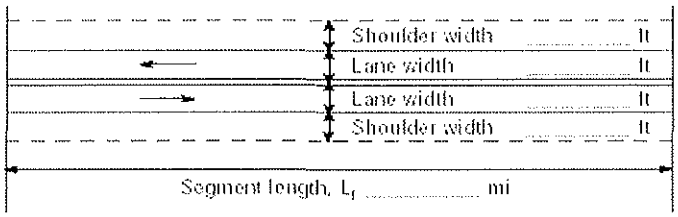
Level of service, LOS (Exhibit 20-3 or 20-4)	*B*
Volume to capacity ratio, v/c=V_p/ 1,700	*0.16*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)=0.25L_t(V/PHF)	*167*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=V*L_t	*569*
Peak 15-min total travel time, TT_{15}(veh-h)=VMT_{15}/ATS	*3.3*

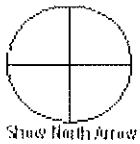
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*Bjornstad*	Highway / Direction of Travel	*SR-20*
Agency or Company	*Fehr & Peers*	From/To	*Downslope / I-15*
Date Performed	*7/24/2007*	Jurisdiction	*Iron County, UT*
Analysis Time Period	*Weekend*	Analysis Year	*2007*

Project Description: *06-721 Coal Hollow EIS*

Input Data





Class I highway ☐ Class II highway ☐

Terrain ☐ Level ☐ Rolling

Grade Length *4.00* mi Up/down *3.4*

Peak-hour factor, PHF *0.85*

No-passing zone *70%*

% Trucks and Buses , P_T *27 %*

% Recreational vehicles, P_R *14%*

Access points/ *mi* *1*

Analysis direction vol., V_d *114*veh/h

Opposing direction vol., V_o *82*veh/h

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 20-9 or 20-15)	*9.1*	*9.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9 or 20-17)	*1.5*	*1.5*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$)	*0.307*	*0.307*
Grade adjustment factor [1], f_G (Exhibit 20-7 or 20-13)	*1.00*	*0.94*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV}*f_G)$	*437*	*334*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field measured speed[3], S_{FM}	*mi/h*	Base free-flow speed[3], $BFFS_{FM}$	*60.0 mi/h*
Observed volume[3], V_f	veh/h	Adj. for lane width and shoulder width,[3] f_{LS}(Exh 20-5)	*1.3 mi/h*
Free-flow speed, FFS_d $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points[3], f_A (Exhibit 20-5)	*0.3 mi/h*
Adjustment for no-passing zones, f_{np} (Exhibit 20-19)	*3.0 mi/h*	Free-flow speed, FFS_d ($FSS=BFFS-f_{LS}-f_A$)	*58.5 mi/h*
		Average travel speed, $ATS=FFS-0.00776v_p-f_{np}$	*49.5 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 20-10 or 20-16)	*1.5*	*1.5*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ $P_T(E_T-1)+P_R(E_R-1)$)	*0.881*	*0.881*
Grade adjustment factor[1], f_G (Exhibit 20-8 or 20-14)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h)=$V_i/(PHF*f_{HV}*f_G)$	*152*	*109*
Base percent time-spent-following[4], $BPTSF(\%)=100(1-e^{av_d^b})$	*17.0*	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	*52.8*	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$	*39.0*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 or 20-4)	*C*
Volume to capacity ratio, v/c=V_p/ 1,700	*0.26*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)=$0.25L_t(V/PHF)$	*262*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=$V*L_t$	*889*
Peak 15-min total travel time, TT_{15}(veh-h)=VMT_{15}/ATS	*5.3*

ALL-WAY STOP CONTROL ANALYSIS

General Information

Analyst	Bjomstad
Agency/Co.	Fehr & Peers
Date Performed	7/30/2007
Analysis Time Period	8:00 - 9:00

Site Information

Intersection	US-89 / Main Street
Jurisdiction	Panguitch, UT
Analysis Year	2007

Project ID 06-721 Coal Hollow EIS

East/West Street: US-89 / Center Street

North/South Street: SR-143 / US-89

Volume Adjustments and Site Characteristics

Approach	Eastbound			Westbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	6	20	3	18	12	67
%Thrus Left Lane						

Approach	Northbound			Southbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	4	37	38	68	23	9
%Thrus Left Lane						

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Configuration	LT	R	LT	R	LT	R	L	TR
PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Flow Rate (veh/h)	28	3	33	76	46	43	77	36
% Heavy Vehicles	0	0	6	14	5	0	18	0
No. Lanes	2		2		2		2	
Geometry Group	5		5		5		5	
Duration, T	0.25							

Saturation Headway Adjustment Worksheet

Prop. Left-Turns	0.2	0.0	0.6	0.0	0.1	0.0	1.0	0.0
Prop. Right-Turns	0.0	1.0	0.0	1.0	0.0	1.0	0.0	0.3
Prop. Heavy Vehicle	0.0	0.0	0.1	0.1	0.0	0.0	0.2	0.0
hLT-adj	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
hRT-adj	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7
hHV-adj	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
hadj, computed	0.1	-0.7	0.4	-0.5	0.1	-0.7	0.8	-0.2

Departure Headway and Service Time

hd, initial value (s)	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20
x, initial	0.02	0.00	0.03	0.07	0.04	0.04	0.07	0.03
hd, final value (s)	5.21	4.40	5.44	4.57	5.07	4.25	5.72	4.72
x, final value	0.04	0.00	0.05	0.10	0.06	0.05	0.12	0.05
Move-up time, m (s)	2.3		2.3		2.3		2.3	
Service Time, t_s (s)	2.9	2.1	3.1	2.3	2.8	1.9	3.4	2.4

Capacity and Level of Service

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Capacity (veh/h)	278	253	283	326	296	293	327	286
Delay (s/veh)	8.13	7.11	8.42	7.76	8.13	7.17	9.21	7.65
LOS	A	A	A	A	A	A	A	A
Approach: Delay (s/veh)	8.03		7.96		7.66		8.72	
LOS	A		A		A		A	
Intersection Delay (s/veh)	8.14							
Intersection LOS	A							

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ALL-WAY STOP CONTROL ANALYSIS

General Information

Analyst	*Bjornstad*
Agency/Co.	*Fehr & Peers*
Date Performed	*7/30/2007*
Analysis Time Period	*16:15 - 17:15*

Site Information

Intersection	*US-89 / Main Street*
Jurisdiction	*Panguitch, UT*
Analysis Year	*2007*

Project ID *06-721 Coal Hollow EIS*

East/West Street: *US-89 / Center Street* North/South Street: *SR-143 / US-89*

Volume Adjustments and Site Characteristics

Approach	Eastbound			Westbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	*17*	*34*	*9*	*41*	*35*	*140*
%Thrus Left Lane						

Approach	Northbound			Southbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	*7*	*51*	*19*	*108*	*40*	*27*
%Thrus Left Lane						

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Configuration	*LT*	*R*	*LT*	*R*	*LT*	*R*	*L*	*TR*
PHF	*0.85*	*0.85*	*0.85*	*0.85*	*0.85*	*0.85*	*0.85*	*0.85*
Flow Rate (veh/h)	*58*	*10*	*89*	*164*	*67*	*22*	*127*	*78*
% Heavy Vehicles	*4*	*7*	*6*	*14*	*5*	*6*	*13*	*4*
No. Lanes	*2*		*2*		*2*		*2*	
Geometry Group	*5*		*5*		*5*		*5*	
Duration, T	*0.25*							

Saturation Headway Adjustment Worksheet

Prop. Left-Turns	*0.3*	*0.0*	*0.5*	*0.0*	*0.1*	*0.0*	*1.0*	*0.0*
Prop. Right-Turns	*0.0*	*1.0*	*0.0*	*1.0*	*0.0*	*1.0*	*0.0*	*0.4*
Prop. Heavy Vehicle	*0.0*	*0.1*	*0.1*	*0.1*	*0.0*	*0.1*	*0.1*	*0.0*
hLT-adj	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*
hRT-adj	*-0.7*	*-0.7*	*-0.7*	*-0.7*	*-0.7*	*-0.7*	*-0.7*	*-0.7*
hHV-adj	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*
hadj, computed	*0.2*	*-0.6*	*0.4*	*-0.5*	*0.1*	*-0.6*	*0.7*	*-0.2*

Departure Headway and Service Time

hd, initial value (s)	*3.20*	*3.20*	*3.20*	*3.20*	*3.20*	*3.20*	*3.20*	*3.20*
x, initial	*0.05*	*0.01*	*0.08*	*0.15*	*0.06*	*0.02*	*0.11*	*0.07*
hd, final value (s)	*5.80*	*4.99*	*5.75*	*4.91*	*5.70*	*4.96*	*6.13*	*5.20*
x, final value	*0.09*	*0.01*	*0.14*	*0.22*	*0.11*	*0.03*	*0.22*	*0.11*
Move-up time, m (s)	*2.3*		*2.3*		*2.3*		*2.3*	
Service Time, t_s (s)	*3.5*	*2.7*	*3.4*	*2.6*	*3.4*	*2.7*	*3.8*	*2.9*

Capacity and Level of Service

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Capacity (veh/h)	*308*	*260*	*339*	*414*	*317*	*272*	*377*	*328*
Delay (s/veh)	*9.10*	*7.76*	*9.40*	*9.03*	*9.08*	*7.81*	*10.52*	*8.56*
LOS	*A*	*A*	*A*	*A*	*A*	*A*	*B*	*A*
Approach: Delay (s/veh)	*8.90*		*9.16*		*8.76*		*9.77*	
LOS	*A*		*A*		*A*		*A*	
Intersection Delay (s/veh)	*9.28*							
Intersection LOS	*A*							

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*Bjornstad*	Intersection	*US-89 / SR-12*
Agency/Co.	*Fehr & Peers*	Jurisdiction	*Panguitch, UT*
Date Performed	*7/19/2007*	Analysis Year	*2007*
Analysis Time Period	*8:00 - 9:00*		

Project Description *06-721 Coal Hollow EIS*

East/West Street: *SR-12* | North/South Street: *US-89*

Intersection Orientation: *North-South* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*33*	*24*	*45*	*27*	
Peak-Hour Factor, PHF	*1.00*	*0.85*	*0.85*	*0.85*	*0.85*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*43*	*0*	*37*
Percent Heavy Vehicles	*0*	--	--	*25*	--	--
Median Type	*Undivided*					
RT Channelized			*1*			*0*
Lanes	*0*	*1*	*1*	*1*	*1*	*0*
Configuration		*T*	*R*	*L*	*T*	
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*37*		*32*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*0.85*	*1.00*	*0.85*
Hourly Flow Rate, HFR (veh/h)	*52*	*31*	*0*	*0*	*38*	*28*
Percent Heavy Vehicles	*0*	*0*	*0*	*21*	*0*	*10*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*1*
Lanes	*0*	*0*	*0*	*1*	*0*	*1*
Configuration				*L*		*R*

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*L*	*L*		*R*			
v (veh/h)		*52*	*43*		*37*			
C (m) (veh/h)		*1436*	*747*		*1012*			
v/c		*0.04*	*0.06*		*0.04*			
95% queue length		*0.11*	*0.18*		*0.11*			
Control Delay (s/veh)		*7.6*	*10.1*		*8.7*			
LOS		*A*	*B*		*A*			
Approach Delay (s/veh)	--	--	*9.5*					
Approach LOS	--	--	*A*					

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LOS A

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Bjornstad*
Agency/Co.	*Fehr & Peers*
Date Performed	*7/19/2007*
Analysis Time Period	*16:00 - 17:00*

Site Information

Intersection	*US-89 / SR-12*
Jurisdiction	*Panguitch, UT*
Analysis Year	*2007*

Project Description *06-721 Coal Hollow EIS*

East/West Street: *SR-12* North/South Street: *US-89*

Intersection Orientation: *North-South* Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*75*	*64*	*35*	*43*	
Peak-Hour Factor, PHF	*1.00*	*0.89*	*0.89*	*0.89*	*0.89*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*68*	*0*	*69*
Percent Heavy Vehicles	*0*	--	--	*25*	--	--
Median Type	*Undivided*					
RT Channelized			*1*			*0*
Lanes	*0*	*1*	*1*	*1*		*0*
Configuration		*T*	*R*	*L*	*T*	
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*61*		*62*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*0.89*	*1.00*	*0.89*
Hourly Flow Rate, HFR (veh/h)	*39*	*48*	*0*	*0*	*84*	*71*
Percent Heavy Vehicles	*0*	*0*	*0*	*13*	*0*	*4*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*1*
Lanes	*0*	*0*	*0*	*1*	*0*	*1*
Configuration				*L*		*R*

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*L*	*L*		*R*			
v (veh/h)		*39*	*68*		*69*			
C (m) (veh/h)		*1380*	*733*		*970*			
v/c		*0.03*	*0.09*		*0.07*			
95% queue length		*0.09*	*0.31*		*0.23*			
Control Delay (s/veh)		*7.7*	*10.4*		*9.0*			
LOS		*A*	*B*		*A*			
Approach Delay (s/veh)	--	--	*9.7*					
Approach LOS	--	--	*A*					

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DELAY 4.79

LOS A

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Bjornstad*
Agency/Co.	*Fehr & Peers*
Date Performed	*7/19/2007*
Analysis Time Period	*8:00 - 9:00*

Site Information

Intersection	*US-89 / SR-14*
Jurisdiction	*Panguitch, UT*
Analysis Year	*2007*

Project Description *06-721 Coal Hollow EIS*

East/West Street: *SR-14* North/South Street: *US-89*

Intersection Orientation: *North-South* Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*25*	*40*	*1*	*2*	*44*	*13*
Peak-Hour Factor, PHF	*0.85*	*0.85*	*0.85*	*0.85*	*0.85*	*0.85*
Hourly Flow Rate, HFR (veh/h)	*17*	*3*	*17*	*0*	*1*	*3*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*1*	*1*	*0*	*0*	*2*	*0*
Configuration	*L*		*TR*	*LT*		*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*15*	*3*	*15*	*0*	*1*	*3*
Peak-Hour Factor, PHF	*0.85*	*0.85*	*0.85*	*0.85*	*0.85*	*0.85*
Hourly Flow Rate, HFR (veh/h)	*2*	*51*	*15*	*29*	*47*	*1*
Percent Heavy Vehicles	*6*	*0*	*5*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*	*LT*		*LTR*			*LTR*	
v (veh/h)	*29*	*2*		*4*			*37*	
C (m) (veh/h)	*1549*	*1572*		*917*			*852*	
v/c	*0.02*	*0.00*		*0.00*			*0.04*	
95% queue length	*0.06*	*0.00*		*0.01*			*0.14*	
Control Delay (s/veh)	*7.4*	*7.3*		*8.9*			*9.4*	
LOS	*A*	*A*		*A*			*A*	
Approach Delay (s/veh)	--	--	*8.9*			*9.4*		
Approach LOS	--	--	*A*			*A*		

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DELAY 3.78

LOS A

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*Bjornstad*	Intersection	*US-89 / SR-14*
Agency/Co.	*Fehr & Peers*	Jurisdiction	*Panguitch, UT*
Date Performed	*7/19/2007*	Analysis Year	*2007*
Analysis Time Period	*16:00 - 17:00*		

Project Description *06-721 Coal Hollow EIS*

East/West Street: *SR-14*	North/South Street: *US-89*
Intersection Orientation: *North-South*	Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*25*	*102*	*0*	*4*	*69*	*20*
Peak-Hour Factor, PHF	*0.91*	*0.91*	*0.91*	*0.91*	*0.91*	*0.91*
Hourly Flow Rate, HFR (veh/h)	*20*	*1*	*24*	*0*	*0*	*0*
Percent Heavy Vehicles	*3*	--	--	*50*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*1*	*1*	*0*	*0*	*2*	*0*
Configuration	*L*		*TR*	*LT*		*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*19*	*1*	*22*	*0*	*0*	*0*
Peak-Hour Factor, PHF	*0.91*	*0.91*	*0.91*	*0.91*	*0.91*	*0.91*
Hourly Flow Rate, HFR (veh/h)	*4*	*75*	*21*	*27*	*112*	*0*
Percent Heavy Vehicles	*9*	*0*	*7*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*	*LT*		*LTR*			*LTR*	
v (veh/h)	*27*	*4*		*0*			*45*	
C (m) (veh/h)	*1488*	*1186*					*791*	
v/c	*0.02*	*0.00*					*0.06*	
95% queue length	*0.06*	*0.01*					*0.18*	
Control Delay (s/veh)	*7.5*	*8.0*					*9.8*	
LOS	*A*	*A*					*A*	
Approach Delay (s/veh)	--	--					*9.8*	
Approach LOS	--	--					*A*	

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DELAY 2.12

LOS A

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst		Intersection	*US-89 / SR-20*
Agency/Co.	*Fehr & Peers*	Jurisdiction	*Panguitch, UT*
Date Performed	*7/19/2007*	Analysis Year	*2007*
Analysis Time Period	*8:00 - 9:00*		

Project Description *06-721 Coal Hollow EIS*

East/West Street: *SR-20*	North/South Street: *US-89*
Intersection Orientation: *East-West*	Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*5*		*31*			
Peak-Hour Factor, PHF	*0.84*	*1.00*	*0.84*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*5*	*0*	*36*	*0*	*0*	*0*
Percent Heavy Vehicles	*18*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*1*	*0*	*1*	*0*	*0*	*0*
Configuration	*L*		*R*			
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*34*	*32*			*18*	*4*
Peak-Hour Factor, PHF	*0.84*	*0.84*	*1.00*	*1.00*	*0.84*	*0.84*
Hourly Flow Rate, HFR (veh/h)	*40*	*38*	*0*	*0*	*21*	*4*
Percent Heavy Vehicles	*19*	*23*	*0*	*0*	*24*	*50*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*1*	*1*	*0*	*0*	*1*	*1*
Configuration	*L*	*T*			*T*	*R*

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*		*L*	*T*			*T*	*R*
v (veh/h)	*5*		*40*	*38*			*21*	*4*
C (m) (veh/h)	*1524*		*923*	*842*			*802*	*960*
v/c	*0.00*		*0.04*	*0.05*			*0.03*	*0.00*
95% queue length	*0.01*		*0.14*	*0.14*			*0.08*	*0.01*
Control Delay (s/veh)	*7.4*		*9.1*	*9.5*			*9.6*	*8.8*
LOS	*A*		*A*	*A*			*A*	*A*
Approach Delay (s/veh)	--	--	*9.3*			*9.5*		
Approach LOS	--	--	*A*			*A*		

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DELAY 8.05

LOS A

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst		Intersection	*US-89 / SR-20*
Agency/Co.	*Fehr & Peers*	Jurisdiction	*Panguitch, UT*
Date Performed	*7/19/2007*	Analysis Year	*2007*
Analysis Time Period	*16:00 - 17:00*		

Project Description *06-721 Coal Hollow EIS*

East/West Street: *SR-20* | North/South Street: *US-89*

Intersection Orientation: *East-West* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*17*		*54*			
Peak-Hour Factor, PHF	*0.95*	*1.00*	*0.95*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*17*	*0*	*56*	*0*	*0*	*0*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*1*	*0*	*1*	*0*	*0*	*0*
Configuration	*L*		*R*			
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*70*	*45*			*41*	*6*
Peak-Hour Factor, PHF	*0.95*	*0.95*	*1.00*	*1.00*	*0.95*	*0.95*
Hourly Flow Rate, HFR (veh/h)	*73*	*47*	*0*	*0*	*43*	*6*
Percent Heavy Vehicles	*13*	*13*	*0*	*0*	*16*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*1*	*1*	*0*	*0*	*1*	*1*
Configuration	*L*	*T*			*T*	*R*

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*		*L*	*T*			*T*	*R*
v (veh/h)	*17*		*73*	*47*			*43*	*6*
C (m) (veh/h)	*1636*		*861*	*828*			*766*	*1091*
v/c	*0.01*		*0.08*	*0.06*			*0.06*	*0.01*
95% queue length	*0.03*		*0.28*	*0.18*			*0.18*	*0.02*
Control Delay (s/veh)	*7.2*		*9.6*	*9.6*			*10.0*	*8.3*
LOS	*A*		*A*	*A*			*A*	*A*
Approach Delay (s/veh)	--	--	*9.6*			*9.8*		
Approach LOS	--	--	*A*			*A*		

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DELAY 7.53

LOS A

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*Bjornstad*	Intersection	*I-15 / SR-20 NB*
Agency/Co.	*Fehr & Peers*	Jurisdiction	*Iron County, UT*
Date Performed	*7/19/2007*	Analysis Year	*2007*
Analysis Time Period	*8:00 - 9:00*		

Project Description *06-721 Coal Hollow EIS*

East/West Street: *SR-20* | North/South Street: *I-15*

Intersection Orientation: *East-West* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*1*	*27*			*15*	*15*
Peak-Hour Factor, PHF	*0.85*	*0.85*	*0.91*	*0.91*	*0.85*	*0.85*
Hourly Flow Rate, HFR (veh/h)	*1*	*31*	*0*	*0*	*17*	*17*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LT*					*TR*
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*0*	*1*	*19*			
Peak-Hour Factor, PHF	*0.85*	*0.85*	*0.85*	*0.91*	*0.91*	*0.91*
Hourly Flow Rate, HFR (veh/h)	*0*	*1*	*22*	*0*	*0*	*0*
Percent Heavy Vehicles	*0*	*0*	*4*	*50*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*0*	*0*
Configuration		*LTR*				

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*			*LTR*				
v (veh/h)	*1*			*23*				
C (m) (veh/h)	*1591*			*1026*				
v/c	*0.00*			*0.02*				
95% queue length	*0.00*			*0.07*				
Control Delay (s/veh)	*7.3*			*8.6*				
LOS	*A*			*A*				
Approach Delay (s/veh)	--	--	*8.6*					
Approach LOS	--	--	*A*					

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DELAY 2.63
LOS A

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*Bjornstad*	Intersection	*I-15 / SR-20 SB*
Agency/Co.	*Fehr & Peers*	Jurisdiction	*Iron County, UT*
Date Performed	*7/19/2007*	Analysis Year	*2007*
Analysis Time Period	*8:00 - 9:00*		

Project Description *06-721 Coal Hollow EIS*

East/West Street: *SR-20* | North/South Street: *I-15*

Intersection Orientation: *East-West* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*1*	*0*	*15*	*0*	
Peak-Hour Factor, PHF	*0.85*	*0.85*	*0.85*	*0.85*	*0.85*	*0.85*
Hourly Flow Rate, HFR (veh/h)	*0*	*1*	*0*	*17*	*0*	*0*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration			*TR*	*LT*		
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*27*	*2*	*2*
Peak-Hour Factor, PHF	*0.85*	*0.85*	*0.85*	*0.85*	*0.85*	*0.85*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*31*	*2*	*2*
Percent Heavy Vehicles	*0*	*0*	*4*	*27*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*1*	*0*
Configuration					*LTR*	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*LT*					*LTR*	
v (veh/h)		*17*					*35*	
C (m) (veh/h)		*1635*					*913*	
v/c		*0.01*					*0.04*	
95% queue length		*0.03*					*0.12*	
Control Delay (s/veh)		*7.2*					*9.1*	
LOS		*A*					*A*	
Approach Delay (s/veh)	--	--				*9.1*		
Approach LOS	--	--				*A*		

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DELAY 9.38
LOS A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99		1.00	0.99	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85		1.00	0.89	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1805	3471	1442	1787	3471	1615	1529	1566		1800	1667	
Flt Permitted	0.48	1.00	1.00	0.36	1.00	1.00	0.76	1.00		0.68	1.00	
Satd. Flow (perm)	903	3471	1442	673	3471	1615	1215	1566		1291	1667	
Volume (vph)	2	390	85	63	295	4	50	1	100	9	1	3
Peak-hour factor, PHF	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Adj. Flow (vph)	2	453	99	73	343	5	58	1	116	10	1	3
RTOR Reduction (vph)	0	0	77	0	0	4	0	39	0	0	1	0
Lane Group Flow (vph)	2	453	22	73	343	1	58	78	0	10	3	0
Confl. Peds. (#/hr)							1		1	5		5
Heavy Vehicles (%)	0%	4%	12%	1%	4%	0%	18%	0%	2%	0%	0%	0%
Turn Type	Perm		Perm	Perm		Perm	Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8		8	2			6		
Actuated Green, G (s)	13.8	13.8	13.8	13.8	13.8	13.8	44.2	44.2		44.2	44.2	
Effective Green, g (s)	15.8	15.8	15.8	15.8	15.8	15.8	46.2	46.2		46.2	46.2	
Actuated g/C Ratio	0.23	0.23	0.23	0.23	0.23	0.23	0.66	0.66		0.66	0.66	
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	204	783	325	152	783	365	802	1034		852	1100	
v/s Ratio Prot		c0.13			0.10			c0.05			0.00	
v/s Ratio Perm	0.00		0.02	0.11		0.00	0.05			0.01		
v/c Ratio	0.01	0.58	0.07	0.48	0.44	0.00	0.07	0.08		0.01	0.00	
Uniform Delay, d1	21.0	24.1	21.3	23.5	23.3	21.0	4.2	4.3		4.1	4.1	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.0	1.0	0.1	2.4	0.4	0.0	0.2	0.1		0.0	0.0	
Delay (s)	21.0	25.2	21.4	25.9	23.7	21.0	4.4	4.4		4.1	4.1	
Level of Service	C	C	C	C	C	C	A	A		A	A	
Approach Delay (s)		24.5			24.0			4.4			4.1	
Approach LOS		C			C			A			A	

Intersection Summary			
HCM Average Control Delay	21.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.20		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	49.3%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor		0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes		1.00	1.00	1.00	1.00	1.00	1.00	0.99		1.00	1.00	
Flpb, ped/bikes		1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt		1.00	0.85	1.00	1.00	0.85	1.00	0.85		1.00	0.95	
Flt Protected		1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		3574	1538	1770	3539	1615	1668	1582		1805	1805	
Flt Permitted		1.00	1.00	0.37	1.00	1.00	0.76	1.00		0.68	1.00	
Satd. Flow (perm)		3574	1538	687	3539	1615	1327	1582		1292	1805	
Volume (vph)	0	449	127	109	538	11	65	2	111	7	2	1
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	0	478	135	116	572	12	69	2	118	7	2	1
RTOR Reduction (vph)	0	0	99	0	0	9	0	45	0	0	0	0
Lane Group Flow (vph)	0	478	36	116	572	3	69	75	0	7	3	0
Confl. Peds. (#/hr)							3		3			
Heavy Vehicles (%)	0%	1%	5%	2%	2%	0%	8%	0%	1%	0%	0%	0%
Turn Type	Perm		Perm	Perm		Perm	Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8		8	2			6		
Actuated Green, G (s)		16.8	16.8	16.8	16.8	16.8	41.2	41.2		41.2	41.2	
Effective Green, g (s)		18.8	18.8	18.8	18.8	18.8	43.2	43.2		43.2	43.2	
Actuated g/C Ratio		0.27	0.27	0.27	0.27	0.27	0.62	0.62		0.62	0.62	
Clearance Time (s)		6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	
Vehicle Extension (s)		3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		960	413	185	950	434	819	976		797	1114	
v/s Ratio Prot		0.13			0.16			c0.08			0.00	
v/s Ratio Perm			0.09	c0.17		0.01	0.05			0.01		
v/c Ratio		0.50	0.09	0.63	0.60	0.01	0.08	0.08		0.01	0.00	
Uniform Delay, d1		21.6	19.2	22.5	22.3	18.8	5.4	5.4		5.2	5.1	
Progression Factor		1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2		0.4	0.1	6.5	1.1	0.0	0.2	0.2		0.0	0.0	
Delay (s)		22.0	19.3	29.0	23.4	18.8	5.6	5.5		5.2	5.1	
Level of Service		C	B	C	C	B	A	A		A	A	
Approach Delay (s)		21.4			24.3			5.6			5.2	
Approach LOS		C			C			A			A	

Intersection Summary			
HCM Average Control Delay	20.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.28		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	53.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

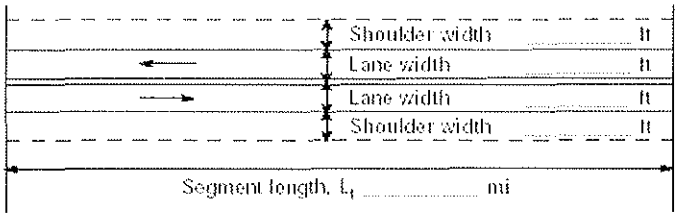
Existing + Project Conditions

DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*Bjornstad*	Highway / Direction of Travel	*US-89*
Agency or Company	*Fehr & Peers*	From/To	*Alton / SR-14*
Date Performed	*7/24/2007*	Jurisdiction	*Kane County, UT*
Analysis Time Period	*Weekday Average with Trucks*	Analysis Year	*2007*

Project Description: *06-721 Coal Hollow EIS*

Input Data



Class I highway ☐ Class II highway

Terrain ☐ Level ☐ Rolling

Grade Length *1.60* mi Up/down *3.0*

Peak-hour factor, PHF *0.85*

No-passing zone *20%*

% Trucks and Buses , P_T *22 %*

% Recreational vehicles, P_R *11%*

Access points/ *mi* *1*

Analysis direction vol., V_d *144*veh/h

Opposing direction vol., V_o *120*veh/h

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 20-9 or 20-15)	*6.1*	*6.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9 or 20-17)	*1.4*	*1.4*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.462*	*0.462*
Grade adjustment factor [1], f_G (Exhibit 20-7 or 20-13)	*1.00*	*0.99*
Directional flow rate[2], v_i(pc/h) $v_i=V_f/(PHF*f_{HV}*f_G)$	*367*	*310*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field measured speed[3], S_{FM}	*mi/h*	Base free-flow speed[3], $BFFS_{FM}$	*65.0 mi/h*
Observed volume[3], V_f	veh/h	Adj. for lane width and shoulder width,[3] f_{LS}(Exh 20-5)	*2.6 mi/h*
Free-flow speed, FFS_d $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points[3], f_A (Exhibit 20-5)	*0.3 mi/h*
Adjustment for no-passing zones, f_{np} (Exhibit 20-19)	*1.7 mi/h*	Free-flow speed, FFS_d $(FSS=BFFS-f_{LS}-f_A)$	*62.2 mi/h*
		Average travel speed, $ATS=FFS-0.00776v_p-f_{np}$	*55.2 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*1.000*	*1.000*
Grade adjustment factor[1], f_G (Exhibit 20-8 or 20-14)	*1.00*	*1.00*
Directional flow rate[2], $v_i(pc/h)=V_f/(PHF*f_{HV}*f_G)$	*169*	*141*
Base percent time-spent-following[4], $BPTSF(\%)=100(1-e^{av_d^b})$	*18.6*	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	*34.9*	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$	*34.5*	

Level of Service and Other Performance Measures

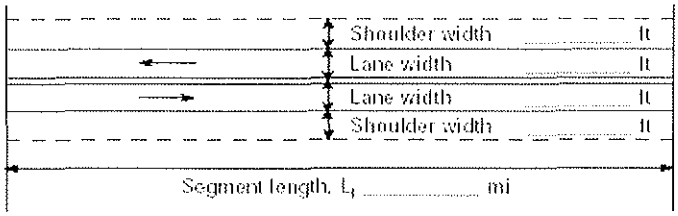
Level of service, LOS (Exhibit 20-3 or 20-4)	*A*
Volume to capacity ratio, $v/c=V_p/1{,}700$	*0.22*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)$=0.25L_t(V/PHF)$	*68*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)$=V*L_t$	*230*
Peak 15-min total travel time, TT_{15}(veh-h)$=VMT_{15}/ATS$	*1.2*

DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*Bjornstad*	Highway / Direction of Travel	*US-89*
Agency or Company	*Fehr & Peers*	From/To	*Alton / SR-14*
Date Performed	*7/30/2007*	Jurisdiction	*Kane County, UT*
Analysis Time Period	*Weekend with Trucks*	Analysis Year	*2007*

Project Description: *06-721 Coal Hollow EIS*

Input Data



Analysis direction vol., V_d *174* veh/h

Opposing direction vol., V_o *141* veh/h

☐ Class I highway ☐ Class II highway

Terrain ☐ Level ☐ Rolling

Grade Length *1.60* mi Up/down *3.0*

Peak-hour factor, PHF *0.85*

No-passing zone *20%*

% Trucks and Buses , P_T *28 %*

% Recreational vehicles, P_R *17%*

Access points/ *mi* *1*

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 20-9 or 20-15)	*6.1*	*6.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9 or 20-17)	*1.4*	*1.4*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.401*	*0.401*
Grade adjustment factor [1], f_G (Exhibit 20-7 or 20-13)	*1.00*	*0.99*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV}*f_G)$	*511*	*420*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field measured speed[3], S_{FM}	*mi/h*	Base free-flow speed[3], $BFFS_{FM}$	*65.0 mi/h*
Observed volume[3], V_f	veh/h	Adj. for lane width and shoulder width,[3] f_{LS}(Exh 20-5)	*2.6 mi/h*
Free-flow speed, FFS_d $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points[3], f_A (Exhibit 20-5)	*0.3 mi/h*
Adjustment for no-passing zones, f_{np} (Exhibit 20-19)	*1.5 mi/h*	Free-flow speed, FFS_d $(FSS=BFFS-f_{LS}-f_A)$	*62.2 mi/h*
		Average travel speed, $ATS=FFS-0.00776v_p-f_{np}$	*53.5 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*1.000*	*1.000*
Grade adjustment factor[1], f_G (Exhibit 20-8 or 20-14)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h)$=V_i/(PHF*f_{HV}*f_G)$	*205*	*166*
Base percent time-spent-following[4], $BPTSF(\%)=100(1-e^{av_d^b})$	*22.0*	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	*37.3*	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$	*38.7*	

Level of Service and Other Performance Measures

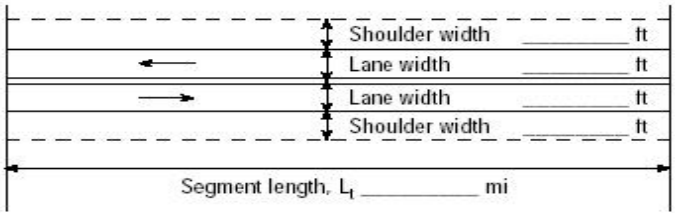
Level of service, LOS (Exhibit 20-3 or 20-4)	*B*
Volume to capacity ratio, $v/c=V_p/1{,}700$	*0.30*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)$=0.25L_t(V/PHF)$	*82*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)$=V*L_t$	*278*
Peak 15-min total travel time, TT_{15}(veh-h)$=VMT_{15}/ATS$	*1.5*

DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*Bjornstad*	Highway / Direction of Travel	*US-89*
Agency or Company	*Fehr & Peers*	From/To	*SR-14 / Hatch*
Date Performed	*7/24/2007*	Jurisdiction	*Garfield County, Utah*
Analysis Time Period	*Weekday Average with Trucks*	Analysis Year	*2007*

Project Description: *06-721 Coal Hollow EIS*

Input Data



Analysis direction vol., V_d *144*veh/h

Opposing direction vol., V_o *120*veh/h

☑ Class I highway ☐ Class II highway

Terrain ☑ Level ☐ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.85*

No-passing zone *30*%

% Trucks and Buses , P_T *22* %

% Recreational vehicles, P_R *11*%

Access points/ *mi* *1*

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 20-9 or 20-15)	*1.7*	*1.7*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9 or 20-17)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.867*	*0.867*
Grade adjustment factor [1], f_G (Exhibit 20-7 or 20-13)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV}*f_G)$	*196*	*163*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field measured speed[3], S_{FM}	*mi/h*	Base free-flow speed[3], $BFFS_{FM}$	*65.0 mi/h*
Observed volume[3], V_f	veh/h	Adj. for lane width and shoulder width,[3] f_{LS}(Exh 20-5)	*1.3 mi/h*
Free-flow speed, FFS_d $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points[3], f_A (Exhibit 20-5)	*0.3 mi/h*
Adjustment for no-passing zones, f_{np} (Exhibit 20-19)	*2.2 mi/h*	Free-flow speed, FFS_d $(FSS=BFFS-f_{LS}-f_A)$	*63.5 mi/h*
		Average travel speed, $ATS=FFS-0.00776v_p-f_{np}$	*58.4 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 20-10 or 20-16)	*1.1*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.978*	*0.978*
Grade adjustment factor[1], f_G (Exhibit 20-8 or 20-14)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h)=$V_i/(PHF*f_{HV}*f_G)$	*173*	*144*
Base percent time-spent-following[4], $BPTSF(\%)=100(1-e^{av_d^b})$	*19.0*	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	*41.2*	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$	*41.5*	

Level of Service and Other Performance Measures

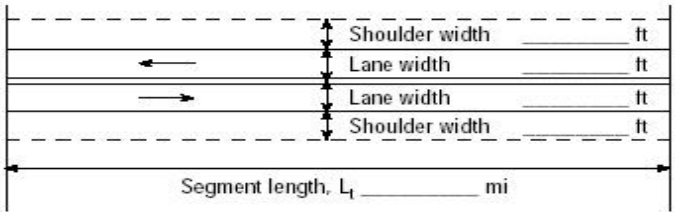
Level of service, LOS (Exhibit 20-3 or 20-4)	*B*
Volume to capacity ratio, $v/c=V_p/1{,}700$	*0.12*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)=$0.25L_t(V/PHF)$	*496*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=$V*L_t$	*1685*
Peak 15-min total travel time, TT_{15}(veh-h)=VMT_{15}/ATS	*8.5*

DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*Bjornstad*	Highway / Direction of Travel	*US-89*
Agency or Company	*Fehr & Peers*	From/To	*SR-14 / Hatch*
Date Performed	*7/24/2007*	Jurisdiction	*Garfield County, Utah*
Analysis Time Period	*Weekend with Trucks*	Analysis Year	*2007*

Project Description: *06-721 Coal Hollow EIS*

Input Data



Analysis direction vol., V_d *174* veh/h

Opposing direction vol., V_o *141* veh/h

☑ Class I highway ☐ Class II highway

Terrain ☑ Level ☐ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.85*

No-passing zone *30%*

% Trucks and Buses , P_T *28* %

% Recreational vehicles, P_R *17%*

Access points/ *mi* *1*

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 20-9 or 20-15)	*1.7*	*1.7*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9 or 20-17)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.836*	*0.836*
Grade adjustment factor [1], f_G (Exhibit 20-7 or 20-13)	*1.00*	*1.00*
Directional flow rate[2], $v_i(pc/h)$ $v_i=V_i/(PHF*f_{HV}*f_G)$	*245*	*198*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field measured speed[3], S_{FM}	*mi/h*	Base free-flow speed[3], $BFFS_{FM}$	*65.0 mi/h*
Observed volume[3], V_f	veh/h	Adj. for lane width and shoulder width,[3] f_{LS}(Exh 20-5)	*1.3 mi/h*
Free-flow speed, FFS_d $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points[3], f_A (Exhibit 20-5)	*0.3 mi/h*
Adjustment for no-passing zones, f_{np} (Exhibit 20-19)	*2.6 mi/h*	Free-flow speed, FFS_d $(FSS=BFFS-f_{LS}-f_A)$	*63.5 mi/h*
		Average travel speed, $ATS=FFS-0.00776v_p-f_{np}$	*57.4 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 20-10 or 20-16)	*1.1*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.973*	*0.973*
Grade adjustment factor[1], f_G (Exhibit 20-8 or 20-14)	*1.00*	*1.00*
Directional flow rate[2], $v_i(pc/h)=V_i/(PHF*f_{HV}*f_G)$	*210*	*171*
Base percent time-spent-following[4], $BPTSF(\%)=100(1-e^{av_d^b})$	*22.5*	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	*43.3*	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$	*46.3*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 or 20-4)	*B*
Volume to capacity ratio, $v/c=V_p/1{,}700$	*0.14*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)$=0.25L_t(V/PHF)$	*599*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)$=V*L_t$	*2036*
Peak 15-min total travel time, TT_{15}(veh-h)$=VMT_{15}/ATS$	*10.4*

HIGHPLAN 2002 Conceptual Planning Analysis

Description/File Information

Filename	HP_preview.xml	**Date Prepared**	7/31/2007		
Program	HIGHPLAN	**Version**	1.2.0		
Analyst	JB	**Agency**	FehrandPeers	**District**	Hatch, UT
Road Name	US-89	**From/To**	Hatch		
Analysis Type	Segment	**Peak Direction**	Northbound	**Study Period**	K100
User Notes	Weekday Average W/ TRUCK				

Facility Data

Roadway Variables				Traffic Variables			
Area Type	Rural developed	**# Thru Lanes**	2	**AADT**	3004	**% Heavy Vehicles**	22
Class	3	**Terrain**	Level	**K**	.0879	**Base Capacity**	1700
Posted Speed	40	**Median**	No	**D**	.52	**Local Adj. Factor**	.92
Free Flow Speed	45	**Left Turn Lanes**	No	**PHF**	.85	**Adjusted Capacity**	1014
Pass Lane Spacing	N/A	**% NPZ**	100				

LOS Results

v/c Ratio	0.17	**Density**	N/A	**PTSF**	91.00	**ATS**	37.00	**% FFS**	83.0	**LOS**	C

Service Volume Tables

	A	B	C	D	E
Lanes	**Hourly Volume In Peak Direction**				
1	0	120	340	510	650
2					
3					
4					
Lanes	**Hourly Volume In Both Directions**				
2	0	230	660	980	1250
4					
6					
8					
Lanes	**Annual Average Daily Traffic**				
2	0	2600	7500	11100	14200
4					
6					
8					
Lanes	**Maximum v/c Ratio**				
1	0.00	0.15	0.37	0.55	0.71
2					
3					
4					

HIGHPLAN 2002 Conceptual Planning Analysis

Description/File Information

Filename	HP_preview.xml	**Date Prepared**	7/31/2007		
Program	HIGHPLAN	**Version**	1.2.0		
Analyst	JB	**Agency**	FehrandPeers	**District**	Hatch, UT
Road Name	US-89	**From/To**	Hatch		
Analysis Type	Segment	**Peak Direction**	Northbound	**Study Period**	K100
User Notes	Weekend with Trucks				

Facility Data

Roadway Variables				Traffic Variables			
Area Type	Rural developed	**# Thru Lanes**	2	**AADT**	3266	**% Heavy Vehicles**	28
Class	3	**Terrain**	Level	**K**	.0964	**Base Capacity**	1700
Posted Speed	40	**Median**	No	**D**	.5306	**Local Adj. Factor**	.92
Free Flow Speed	45	**Left Turn Lanes**	No	**PHF**	.85	**Adjusted Capacity**	988
Pass Lane Spacing	N/A	**% NPZ**	100				

LOS Results

v/c Ratio	0.18	**Density**	N/A	**PTSF**	97.00	**ATS**	37.00	**% FFS**	82.0	**LOS**	C

Service Volume Tables

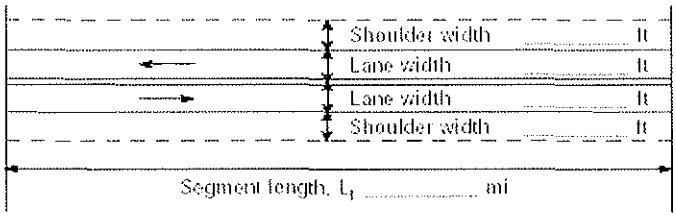
	A	B	C	D	E
Lanes	**Hourly Volume In Peak Direction**				
1	0	110	340	510	660
2					
3					
4					
Lanes	**Hourly Volume In Both Directions**				
2	0	210	650	970	1240
4					
6					
8					
Lanes	**Annual Average Daily Traffic**				
2	0	2200	6700	10100	12900
4					
6					
8					
Lanes	**Maximum v/c Ratio**				
1	0.00	0.14	0.37	0.56	0.71
2					
3					
4					

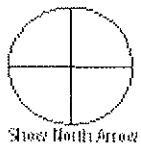
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*Bjornstad*	Highway / Direction of Travel	*US-89*
Agency or Company	*Fehr & Peers*	From/To	*Hatch / SR-12*
Date Performed	*7/30/2007*	Jurisdiction	*Garfield Couty, UT*
Analysis Time Period	*Weekday Average with Trucks*	Analysis Year	*2007*

Project Description: *06-721 Coal Hollow EIS*

Input Data





☐ Class I highway ☐ Class II highway

Terrain ☐ Level ☐ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.87*

No-passing zone *35%*

% Trucks and Buses , P_T *25 %*

% Recreational vehicles, P_R *17%*

Access points/ *mi* *1*

Analysis direction vol., V_d *145*veh/h

Opposing direction vol., V_o *134*veh/h

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 20-9 or 20-15)	*1.7*	*1.7*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9 or 20-17)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.851*	*0.851*
Grade adjustment factor [1], f_G (Exhibit 20-7 or 20-13)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV}*f_G)$	*196*	*181*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field measured speed[3], S_{FM}	*mi/h*	Base free-flow speed[3], $BFFS_{FM}$	*65.0 mi/h*
Observed volume[3], V_f	veh/h	Adj. for lane width and shoulder width,[3] f_{LS}(Exh 20-5)	*1.3 mi/h*
Free-flow speed, FFS_d $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points[3], f_A (Exhibit 20-5)	*0.3 mi/h*
Adjustment for no-passing zones, f_{np} (Exhibit 20-19)	*2.7 mi/h*	Free-flow speed, FFS_d (FSS=BFFS-f_{LS}-f_A)	*63.5 mi/h*
		Average travel speed, ATS=FFS-0.00776v_p-f_{np}	*57.8 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 20-10 or 20-16)	*1.1*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.976*	*0.976*
Grade adjustment factor[1], f_G (Exhibit 20-8 or 20-14)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h)=$V_i/(PHF*f_{HV}*f_G)$	*171*	*158*
Base percent time-spent-following[4], $BPTSF(\%)=100(1-e^{av_d^b})$	*18.8*	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	*46.4*	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$	*41.1*	

Level of Service and Other Performance Measures

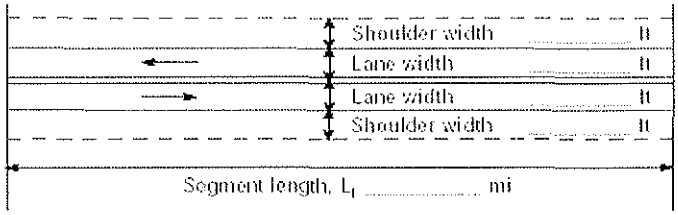
Level of service, LOS (Exhibit 20-3 or 20-4)	*B*
Volume to capacity ratio, v/c=V_p/ 1,700	*0.12*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)=0.25L_t(V/PHF)	*325*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=V*L_t	*1131*
Peak 15-min total travel time, TT_{15}(veh-h)=VMT_{15}/ATS	*5.6*

DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*Bjornstad*	Highway / Direction of Travel	*US-89*
Agency or Company	*Fehr & Peers*	From/To	*Hatch / SR-12*
Date Performed	*7/24/2007*	Jurisdiction	*Garfield Couty, UT*
Analysis Time Period	*Weekend with Trucks*	Analysis Year	*2007*

Project Description: *06-721 Coal Hollow EIS*

Input Data



Analysis direction vol., V_d *153* veh/h

Opposing direction vol., V_o *140* veh/h

☐ Class I highway ☐ Class II highway

Terrain ☐ Level ☐ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.85*

No-passing zone *35%*

% Trucks and Buses , P_T *19 %*

% Recreational vehicles, P_R *20%*

Access points/ *mi* *1*

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 20-9 or 20-15)	*1.7*	*1.7*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9 or 20-17)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.883*	*0.883*
Grade adjustment factor [1], f_G (Exhibit 20-7 or 20-13)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV}*f_G)$	*204*	*187*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field measured speed[3], S_{FM}	*mi/h*	Base free-flow speed[3], $BFFS_{FM}$	*65.0 mi/h*
Observed volume[3], V_f	veh/h	Adj. for lane width and shoulder width,[3] f_{LS}(Exh 20-5)	*1.3 mi/h*
Free-flow speed, FFS_d $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points[3], f_A (Exhibit 20-5)	*0.3 mi/h*
Adjustment for no-passing zones, f_{np} (Exhibit 20-19)	*2.8 mi/h*	Free-flow speed, FFS_d (FSS=BFFS-f_{LS}-f_A)	*63.5 mi/h*
		Average travel speed, ATS=FFS-0.00776v_p-f_{np}	*57.7 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 20-10 or 20-16)	*1.1*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.981*	*0.981*
Grade adjustment factor[1], f_G (Exhibit 20-8 or 20-14)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h)=$V_i/(PHF*f_{HV}*f_G)$	*183*	*168*
Base percent time-spent-following[4], $BPTSF(\%)=100(1-e^{av_d^b})$	*20.0*	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	*46.9*	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$	*42.4*	

Level of Service and Other Performance Measures

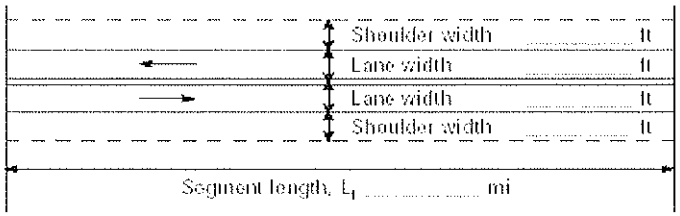
Level of service, LOS (Exhibit 20-3 or 20-4)	*B*
Volume to capacity ratio, v/c=V_p/ 1,700	*0.12*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)=0.25L_t(V/PHF)	*351*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=V*L_t	*1193*
Peak 15-min total travel time, TT_{15}(veh-h)=VMT_{15}/ATS	*6.1*

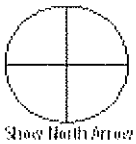
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		*Site Information*	
Analyst	*Bjornstad*	Highway / Direction of Travel	*US-89*
Agency or Company	*Fehr & Peers*	From/To	*SR-12 / Panguitch*
Date Performed	*7/24/2007*	Jurisdiction	*Garfield Couty, UT*
Analysis Time Period	*Weekday Average with Trucks*	Analysis Year	*2007*

Project Description: *06-721 Coal Hollow EIS*

Input Data





Class I highway ☐ Class II highway ☐

Terrain ☐ Level ☐ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.87*

No-passing zone *5%*

% Trucks and Buses , P_T *25 %*

% Recreational vehicles, P_R *17%*

Access points/ *mi* *2*

Analysis direction vol., V_d *145*veh/h

Opposing direction vol., V_o *134*veh/h

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 20-9 or 20-15)	*1.7*	*1.7*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9 or 20-17)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.851*	*0.851*
Grade adjustment factor [1], f_G (Exhibit 20-7 or 20-13)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV}*f_G)$	*196*	*181*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field measured speed[3], S_{FM}	*mi/h*	Base free-flow speed[3], $BFFS_{FM}$	*65.0 mi/h*
Observed volume[3], V_f	veh/h	Adj. for lane width and shoulder width,[3] f_{LS}(Exh 20-5)	*1.3 mi/h*
Free-flow speed, FFS_d $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points[3], f_A (Exhibit 20-5)	*0.5 mi/h*
Adjustment for no-passing zones, f_{np} (Exhibit 20-19)	*1.9 mi/h*	Free-flow speed, FFS_d $(FSS=BFFS-f_{LS}-f_A)$	*63.2 mi/h*
		Average travel speed, $ATS=FFS-0.00776v_p-f_{np}$	*58.4 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 20-10 or 20-16)	*1.1*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.976*	*0.976*
Grade adjustment factor[1], f_G (Exhibit 20-8 or 20-14)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h)=$V_i/(PHF*f_{HV}*f_G)$	*171*	*158*
Base percent time-spent-following[4], $BPTSF(\%)=100(1-e^{av_d^b})$	*18.8*	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	*19.3*	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$	*28.1*	

Level of Service and Other Performance Measures

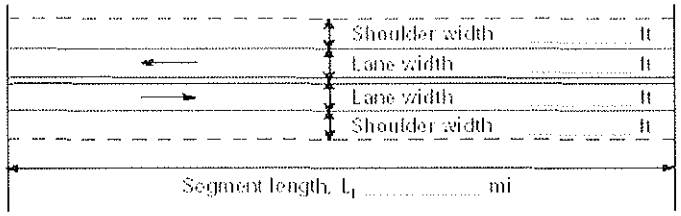
Level of service, LOS (Exhibit 20-3 or 20-4)	*A*
Volume to capacity ratio, $v/c=V_p/1,700$	*0.12*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)=$0.25L_t(V/PHF)$	*237*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=$V*L_t$	*826*
Peak 15-min total travel time, TT_{15}(veh-h)=VMT_{15}/ATS	*4.1*

DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		*Site Information*	
Analyst	*Bjornstad*	Highway / Direction of Travel	*US-89*
Agency or Company	*Fehr & Peers*	From/To	*SR-12 / Panguitch*
Date Performed	*7/24/2007*	Jurisdiction	*Garfield Couty, UT*
Analysis Time Period	*Weekend with Trucks*	Analysis Year	*2007*

Project Description: *06-721 Coal Hollow EIS*

Input Data



☐ Class I highway ☐ Class II highway

Terrain ☐ Level ☐ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.85*

No-passing zone *5%*

% Trucks and Buses , P_T *19 %*

% Recreational vehicles, P_R *20%*

Access points/ *mi* *2*

Analysis direction vol., V_d *153*veh/h

Opposing direction vol., V_o *140*veh/h

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 20-9 or 20-15)	*1.7*	*1.7*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9 or 20-17)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.883*	*0.883*
Grade adjustment factor [1], f_G (Exhibit 20-7 or 20-13)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV}*f_G)$	*204*	*187*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field measured speed[3], S_{FM}	*mi/h*	Base free-flow speed[3], $BFFS_{FM}$	*65.0 mi/h*
Observed volume[3], V_f	veh/h	Adj. for lane width and shoulder width,[3] f_{LS}(Exh 20-5)	*1.3 mi/h*
Free-flow speed, FFS_d $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points[3], f_A (Exhibit 20-5)	*0.5 mi/h*
Adjustment for no-passing zones, f_{np} (Exhibit 20-19)	*1.9 mi/h*	Free-flow speed, FFS_d $(FSS=BFFS-f_{LS}-f_A)$	*63.2 mi/h*
		Average travel speed, $ATS=FFS-0.00776v_p-f_{np}$	*58.2 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 20-10 or 20-16)	*1.1*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.981*	*0.981*
Grade adjustment factor[1], f_G (Exhibit 20-8 or 20-14)	*1.00*	*1.00*
Directional flow rate[2], $v_i(pc/h)=V_i/(PHF*f_{HV}*f_G)$	*183*	*168*
Base percent time-spent-following[4], $BPTSF(\%)=100(1-e^{av_d^b})$	*20.0*	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	*20.1*	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$	*29.6*	

Level of Service and Other Performance Measures

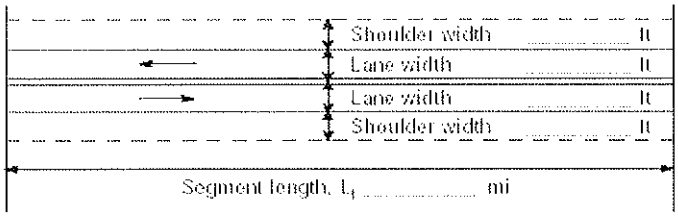
Level of service, LOS (Exhibit 20-3 or 20-4)	*A*
Volume to capacity ratio, $v/c=V_p/1{,}700$	*0.12*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)$=0.25L_t(V/PHF)$	*256*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)$=V*L_t$	*872*
Peak 15-min total travel time, TT_{15}(veh-h)$=VMT_{15}/ATS$	*4.4*

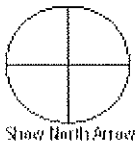
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*Bjornstad*	Highway / Direction of Travel	*US-89*
Agency or Company	*Fehr & Peers*	From/To	*Panguitch / SR-20*
Date Performed	*7/30/2007*	Jurisdiction	*Garfield Couty, UT*
Analysis Time Period	*Weekday Average with Trucks*	Analysis Year	*2007*

Project Description: *06-721 Coal Hollow EIS*

Input Data





☐ Class I highway ☐ Class II highway

Terrain ☐ Level ☐ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.86*

No-passing zone *15%*

% Trucks and Buses , P_T *30 %*

% Recreational vehicles, P_R *11%*

Access points/ *mi* *3*

Analysis direction vol., V_d *114*veh/h

Opposing direction vol., V_o *119*veh/h

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 20-9 or 20-15)	*1.7*	*1.7*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9 or 20-17)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.826*	*0.826*
Grade adjustment factor [1], f_G (Exhibit 20-7 or 20-13)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV}*f_G)$	*160*	*167*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field measured speed[3], S_{FM}	*mi/h*	Base free-flow speed[3], $BFFS_{FM}$	*65.0 mi/h*
Observed volume[3], V_f	veh/h	Adj. for lane width and shoulder width,[3] f_{LS}(Exh 20-5)	*1.3 mi/h*
Free-flow speed, FFS_d $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points[3], f_A (Exhibit 20-5)	*0.8 mi/h*
Adjustment for no-passing zones, f_{np} (Exhibit 20-19)	*1.7 mi/h*	Free-flow speed, FFS_d $(FSS=BFFS-f_{LS}-f_A)$	*63.0 mi/h*
		Average travel speed, $ATS=FFS-0.00776v_p-f_{np}$	*58.7 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 20-10 or 20-16)	*1.1*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.971*	*0.971*
Grade adjustment factor[1], f_G (Exhibit 20-8 or 20-14)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h)$=V_i/(PHF*f_{HV}*f_G)$	*137*	*143*
Base percent time-spent-following[4], $BPTSF(\%)=100(1-e^{av_d^b})$	*15.5*	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	*28.4*	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$	*30.0*	

Level of Service and Other Performance Measures

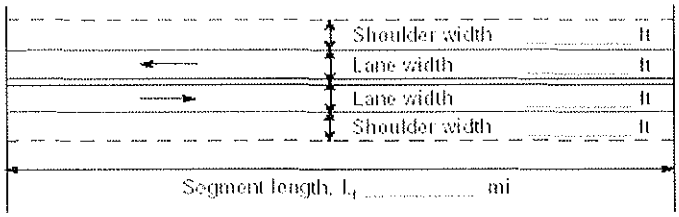
Level of service, LOS (Exhibit 20-3 or 20-4)	*A*
Volume to capacity ratio, $v/c=V_p/1{,}700$	*0.09*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)$=0.25L_t(V/PHF)$	*312*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)$=V*L_t$	*1072*
Peak 15-min total travel time, TT_{15}(veh-h)$=VMT_{15}/ATS$	*5.3*

DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*Bjornstad*	Highway / Direction of Travel	*US-89*
Agency or Company	*Fehr & Peers*	From/To	*Panguitch / SR-20*
Date Performed	*7/24/2007*	Jurisdiction	*Garfield Couty, UT*
Analysis Time Period	*Weekend with Trucks*	Analysis Year	*2007*

Project Description: *06-721 Coal Hollow EIS*

Input Data



☐ Class I highway ☐ Class II highway

Terrain ☐ Level ☐ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.94*

No-passing zone *15%*

% Trucks and Buses , P_T *38 %*

% Recreational vehicles, P_R *13%*

Access points/ *mi* *3*

Analysis direction vol., V_d *161*veh/h

Opposing direction vol., V_o *120*veh/h

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 20-9 or 20-15)	*1.7*	*1.7*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9 or 20-17)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.790*	*0.790*
Grade adjustment factor [1], f_G (Exhibit 20-7 or 20-13)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV}*f_G)$	*217*	*162*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field measured speed[3], S_{FM}	*mi/h*	Base free-flow speed[3], $BFFS_{FM}$	*65.0 mi/h*
Observed volume[3], V_f	veh/h	Adj. for lane width and shoulder width,[3] f_{LS}(Exh 20-5)	*1.3 mi/h*
Free-flow speed, FFS_d $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points[3], f_A (Exhibit 20-5)	*0.8 mi/h*
Adjustment for no-passing zones, f_{np} (Exhibit 20-19)	*1.6 mi/h*	Free-flow speed, FFS_d ($FSS=BFFS-f_{LS}-f_A$)	*63.0 mi/h*
		Average travel speed, $ATS=FFS-0.00776v_p-f_{np}$	*58.4 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 20-10 or 20-16)	*1.1*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.963*	*0.963*
Grade adjustment factor[1], f_G (Exhibit 20-8 or 20-14)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h)=$V_i/(PHF*f_{HV}*f_G)$	*178*	*133*
Base percent time-spent-following[4], $BPTSF(\%)=100(1-e^{av_d^b})$	*19.5*	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	*29.0*	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$	*31.9*	

Level of Service and Other Performance Measures

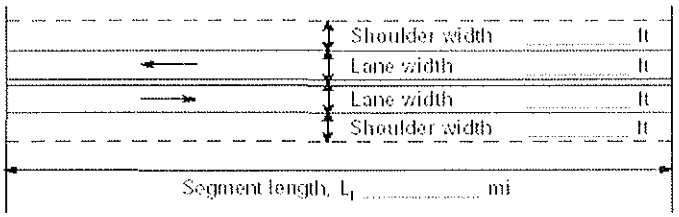
Level of service, LOS (Exhibit 20-3 or 20-4)	*A*
Volume to capacity ratio, $v/c=V_p/1{,}700$	*0.13*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)=$0.25L_t(V/PHF)$	*402*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=$V*L_t$	*1513*
Peak 15-min total travel time, TT_{15}(veh-h)=VMT_{15}/ATS	*6.9*

DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*Bjornstad*	Highway / Direction of Travel	*SR-20*
Agency or Company	*Fehr & Peers*	From/To	*US-89 / Upslope*
Date Performed	*7/24/2007*	Jurisdiction	*Iron County, UT*
Analysis Time Period	*Weekday Average with Trucks*	Analysis Year	*2007*

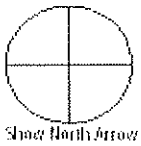
Project Description: *06-721 Coal Hollow EIS*

Input Data



Analysis direction vol., V_d *80*veh/h

Opposing direction vol., V_o *89*veh/h



Class I highway ☐ Class II highway ☐

Terrain ☐ Level ☐ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.85*

No-passing zone *45%*

% Trucks and Buses , P_T *33 %*

% Recreational vehicles, P_R *13%*

Access points/ *mi* *0*

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 20-9 or 20-15)	*1.7*	*1.7*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9 or 20-17)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.812*	*0.812*
Grade adjustment factor [1], f_G (Exhibit 20-7 or 20-13)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV}*f_G)$	*116*	*129*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field measured speed[3], S_{FM}	*mi/h*	Base free-flow speed[3], $BFFS_{FM}$	*50.0 mi/h*
Observed volume[3], V_f	veh/h	Adj. for lane width and shoulder width,[3] f_{LS}(Exh 20-5)	*1.3 mi/h*
Free-flow speed, FFS_d $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points[3], f_A (Exhibit 20-5)	*0.0 mi/h*
Adjustment for no-passing zones, f_{np} (Exhibit 20-19)	*1.3 mi/h*	Free-flow speed, FFS_d ($FSS=BFFS-f_{LS}-f_A$)	*48.7 mi/h*
		Average travel speed, $ATS=FFS-0.00776v_p-f_{np}$	*45.5 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 20-10 or 20-16)	*1.1*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.968*	*0.968*
Grade adjustment factor[1], f_G (Exhibit 20-8 or 20-14)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h)=$V_i/(PHF*f_{HV}*f_G)$	*97*	*108*
Base percent time-spent-following[4], $BPTSF(\%)=100(1-e^{av_d^b})$	*11.3*	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	*43.6*	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$	*34.3*	

Level of Service and Other Performance Measures

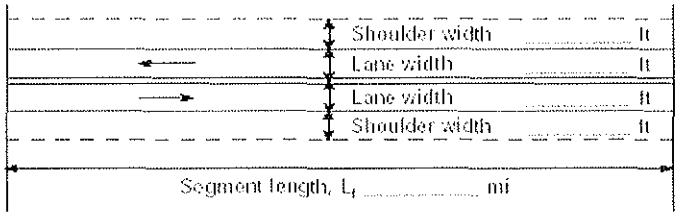
Level of service, LOS (Exhibit 20-3 or 20-4)	*C*
Volume to capacity ratio, $v/c=V_p/1{,}700$	*0.07*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)=$0.25L_t(V/PHF)$	*200*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=$V*L_t$	*680*
Peak 15-min total travel time, TT_{15}(veh-h)=VMT_{15}/ATS	*4.4*

DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*Bjornstad*	Highway / Direction of Travel	*SR-20*
Agency or Company	*Fehr & Peers*	From/To	*US-89 / Upslope*
Date Performed	*7/24/2007*	Jurisdiction	*Iron County, UT*
Analysis Time Period	*Weekend with Trucks*	Analysis Year	*2007*

Project Description: *06-721 Coal Hollow EIS*

Input Data



Analysis direction vol., V_d *121*veh/h

Opposing direction vol., V_o *89*veh/h

☐ Class I highway ☐ Class II highway

Terrain ☐ Level ☐ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.85*

No-passing zone *45%*

% Trucks and Buses , P_T *31 %*

% Recreational vehicles, P_R *13%*

Access points/ *mi* *0*

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 20-9 or 20-15)	*1.7*	*1.7*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9 or 20-17)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.822*	*0.822*
Grade adjustment factor [1], f_G (Exhibit 20-7 or 20-13)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV}*f_G)$	*173*	*127*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field measured speed[3], S_{FM}	*mi/h*	Base free-flow speed[3], $BFFS_{FM}$	*50.0 mi/h*
Observed volume[3], V_f	veh/h	Adj. for lane width and shoulder width,[3] f_{LS}(Exh 20-5)	*1.3 mi/h*
Free-flow speed, FFS_d $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points[3], f_A (Exhibit 20-5)	*0.0 mi/h*
Adjustment for no-passing zones, f_{np} (Exhibit 20-19)	*1.3 mi/h*	Free-flow speed, FFS_d (FSS=BFFS-f_{LS}-f_A)	*48.7 mi/h*
		Average travel speed, ATS=FFS-0.00776v_p-f_{np}	*45.1 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 20-10 or 20-16)	*1.1*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.970*	*0.970*
Grade adjustment factor[1], f_G (Exhibit 20-8 or 20-14)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h)=$V_i/(PHF*f_{HV}*f_G)$	*147*	*108*
Base percent time-spent-following[4], $BPTSF(\%)=100(1-e^{av_d^b})$	*16.5*	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	*45.5*	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$	*35.7*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 or 20-4)	*C*
Volume to capacity ratio, v/c=V_p/ 1,700	*0.10*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)=0.25L_t(V/PHF)	*302*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=V*L_t	*1029*
Peak 15-min total travel time, TT_{15}(veh-h)=VMT_{15}/ATS	*6.7*

2

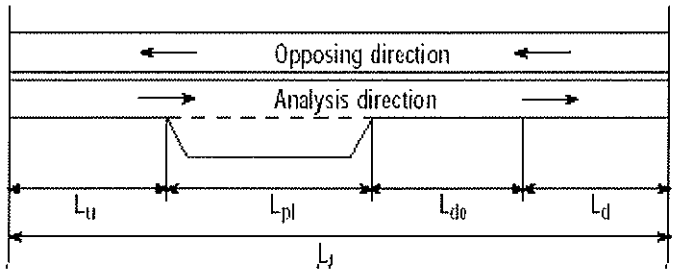
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET WITH PASSING LANE WORKSHEET

General Information		***Site Information***	
Analyst	*Bjornstad*	Highway of Travel	*SR-20*
Agency or Company	*Fehr & Peers*	From/To	*Upslope / Summit*
Date Performed	*7/24/2007*	Jurisdiction	*Iron County, UT*
Analysis Time Period	*Weekday Average with Trucks*	Analysis Year	*2007*

Project Description: *06-721 Coal Hollow EIS*

Input Data

☐ Class I highway ☑ Class II highway



Show North Arrow

Total length of analysis segment, L_t (*mi*)	*2.3*
Length of two-lane highway upstream of the passing lane, L_u (*mi*)	*0.0*
Length of passing lane including tapers , L_{pl} (*mi*)	*2.2*
Average travel speed, ATS_d (from Directional Two-Lane Highway Segment Worksheet)	*35.2*
Percent time-spent-following, $PTSF_d$ (from Directional Two-Lane Highway Segment Worksheet)	*20.3*
Level of service[1], LOS_d (from Directional Two-Lane Highway Segment Worksheet)	*A*
Average Travel Speed	
Downstream length of two-lane highway within effective length of passing lane for average travel speed, L_{de} (*mi*) (Exhibit 20-23)	*1.70*
Length of two-lane highway downstream of effective length of the passing lane for avg travel speed, L_d (*mi*) $L_d=L_t-(L_u+L_{pl}+L_{de})$	*-1.60*
Adj. factor for the effect of passing lane on average speed, f_{pl} (Exhibit 20-24)	*1.10*
Average travel speed including passing lane[2], $ATS_{pl} = (ATS_d * L_t) / (L_u+L_d+(L_{pl}/f_{pl})+ (2L_{de}/(1+f_{pl})))$	*38.7*
Percent Time-Spent-Following	
Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, L_{de} (*mi*)(Exhibit 20-23)	*13.00*
Length of two-lane highway downstream of effective length of the passing lane for percent-time-following, L_d (*mi*)$=L_t-(L_u+L_{pl}+L_{de})$	*-12.90*
Adj. factor for the effect of passing lane on percent time-spent-following, f_{pl}(Exhibit 20-24)	*0.58*
Percent time-spent-following including passing lane[3], $PTSF_{pl}$(%) $PTSF_{pl}= PTSF_d[L_u+L_d+f_{pl}L_{pl}+((1+f_{pl})/2)L_{de}]/L_t$	*11.8*

2

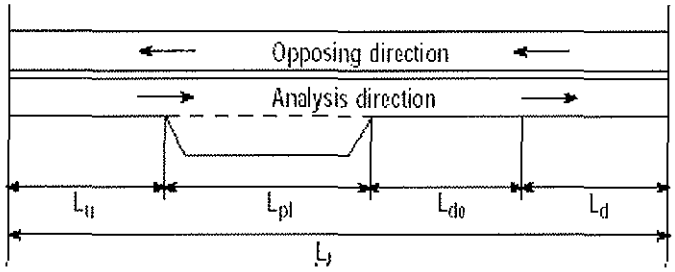
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET WITH PASSING LANE WORKSHEET

General Information		***Site Information***	
Analyst	*Bjornstad*	Highway of Travel	*SR-20*
Agency or Company	*Fehr & Peers*	From/To	*Upslope / Summit*
Date Performed	*7/30/2007*	Jurisdiction	*Iron County, UT*
Analysis Time Period	*Weekend with Trucks*	Analysis Year	*2007*

Project Description: *06-721 Coal Hollow EIS*

Input Data

☑ Class I highway ☑ Class II highway



Show North Arrow

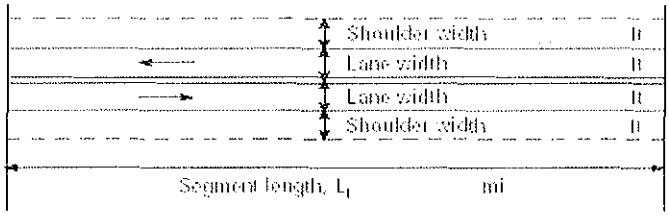
Total length of analysis segment, L_t (*mi*)	*2.3*
Length of two-lane highway upstream of the passing lane, L_u (*mi*)	*0.0*
Length of passing lane including tapers , L_{pl} (*mi*)	*2.0*
Average travel speed, ATS_d (from Directional Two-Lane Highway Segment Worksheet)	*33.6*
Percent time-spent-following, $PTSF_d$ (from Directional Two-Lane Highway Segment Worksheet)	*25.4*
Level of service[1], LOS_d (from Directional Two-Lane Highway Segment Worksheet)	*A*
Average Travel Speed	
Downstream length of two-lane highway within effective length of passing lane for average travel speed, L_{de} (*mi*) (Exhibit 20-23)	*1.70*
Length of two-lane highway downstream of effective length of the passing lane for avg travel speed, L_d (*mi*) $L_d=L_t-(L_u+L_{pl}+L_{de})$	*-1.40*
Adj. factor for the effect of passing lane on average speed, f_{pl} (Exhibit 20-24)	*1.11*
Average travel speed including passing lane[2], $ATS_{pl} = (ATS_d * L_t) / (L_u+L_d+(L_{pl}/f_{pl})+ (2L_{de}/(1+f_{pl})))$	*37.3*
Percent Time-Spent-Following	
Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, L_{de} (*mi*)(Exhibit 20-23)	*13.00*
Length of two-lane highway downstream of effective length of the passing lane for percent-time-following, L_d (*mi*)$=L_t-(L_u+ L_{pl}+ L_{de})$	*-12.70*
Adj. factor for the effect of passing lane on percent time-spent-following, f_{pl}(Exhibit 20-24)	*0.58*
Percent time-spent-following including passing lane[3], $PTSF_{pl}$(%) $PTSF_{pl}= PTSF_d[L_u+L_d+f_{pl}L_{pl}+((1+f_{pl})/2)L_{de}]/L_t$	*14.8*

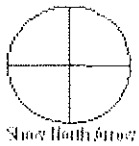
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*Bjornstad*	Highway / Direction of Travel	*SR-20*
Agency or Company	*Fehr & Peers*	From/To	*Summit / Downslope*
Date Performed	*7/30/2007*	Jurisdiction	*Iron County, UT*
Analysis Time Period	*Weekday Average with Trucks*	Analysis Year	*2007*

Project Description: *06-721 Coal Hollow EIS*

Input Data





■ Class I highway ■ Class II highway

Terrain ■ Level ■ Rolling

Grade Length *1.30* mi Up/down *7.1*

Peak-hour factor, PHF *0.85*

No-passing zone *100%*

% Trucks and Buses , P_T *33 %*

% Recreational vehicles, P_R *13%*

Access points/ *mi* *1*

Analysis direction vol., V_d *80*veh/h

Opposing direction vol., V_o *89*veh/h

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 20-9 or 20-15)	*12.9*	*12.9*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9 or 20-17)	*1.6*	*1.6*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.200*	*0.200*
Grade adjustment factor [1], f_G (Exhibit 20-7 or 20-13)	*0.91*	*1.00*
Directional flow rate [2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV}*f_G)$	*518*	*524*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field measured speed [3], S_{FM}	*mi/h*	Base free-flow speed [3], $BFFS_{FM}$	*60.0 mi/h*
Observed volume [3], V_f	veh/h	Adj. for lane width and shoulder width, [3] f_{LS}(Exh 20-5)	*1.3 mi/h*
Free-flow speed, FFS_d $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points [3], f_A (Exhibit 20-5)	*0.3 mi/h*
Adjustment for no-passing zones, f_{np} (Exhibit 20-19)	*2.3 mi/h*	Free-flow speed, FFS_d (FSS=BFFS-f_{LS}-f_A)	*58.5 mi/h*
		Average travel speed, ATS=FFS-0.00776v_p-f_{np}	*48.1 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 20-10 or 20-16)	*2.8*	*2.8*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.627*	*0.627*
Grade adjustment factor [1], f_G (Exhibit 20-8 or 20-14)	*1.00*	*1.00*
Directional flow rate [2], v_i(pc/h)=$V_i/(PHF*f_{HV}*f_G)$	*150*	*167*
Base percent time-spent-following [4], $BPTSF(\%)=100(1-e^{av_d^b})$	*16.8*	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	*55.1*	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$	*42.8*	

Level of Service and Other Performance Measures

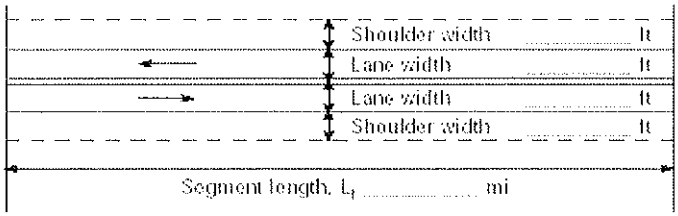
Level of service, LOS (Exhibit 20-3 or 20-4)	*C*
Volume to capacity ratio, v/c=V_p/ 1,700	*0.30*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)=0.25L_t(V/PHF)	*31*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=V*L_t	*104*
Peak 15-min total travel time, TT_{15}(veh-h)=VMT_{15}/ATS	*0.6*

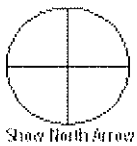
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*Bjornstad*	Highway / Direction of Travel	*SR-20*
Agency or Company	*Fehr & Peers*	From/To	*Summit / Downslope*
Date Performed	*7/24/2007*	Jurisdiction	*Iron County, UT*
Analysis Time Period	*Weekend with Trucks*	Analysis Year	*2007*

Project Description: *06-721 Coal Hollow EIS*

Input Data





☐ Class I highway ☐ Class II highway

Terrain ☐ Level ☐ Rolling

Grade Length *1.30* mi Up/down *7.1*

Peak-hour factor, PHF *0.85*

No-passing zone *100%*

% Trucks and Buses , P_T *32 %*

% Recreational vehicles, P_R *13%*

Access points/ *mi* *1*

Analysis direction vol., V_d *121*veh/h

Opposing direction vol., V_o *89*veh/h

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 20-9 or 20-15)	*12.9*	*12.9*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9 or 20-17)	*1.6*	*1.6*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.205*	*0.205*
Grade adjustment factor [1], f_G (Exhibit 20-7 or 20-13)	*1.00*	*0.91*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV}*f_G)$	*696*	*562*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field measured speed[3], S_{FM}	*mi/h*	Base free-flow speed[3], $BFFS_{FM}$	*60.0 mi/h*
Observed volume[3], V_f	veh/h	Adj. for lane width and shoulder width,[3] f_{LS}(Exh 20-5)	*1.3 mi/h*
Free-flow speed, FFS_d $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points[3], f_A (Exhibit 20-5)	*0.3 mi/h*
Adjustment for no-passing zones, f_{np} (Exhibit 20-19)	*2.1 mi/h*	Free-flow speed, FFS_d (FSS=BFFS-f_{LS}-f_A)	*58.5 mi/h*
		Average travel speed, ATS=FFS-0.00776v_p-f_{np}	*46.5 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 20-10 or 20-16)	*2.8*	*2.8*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.635*	*0.635*
Grade adjustment factor[1], f_G (Exhibit 20-8 or 20-14)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h)=$V_i/(PHF*f_{HV}*f_G)$	*224*	*165*
Base percent time-spent-following[4], BPTSF(%)=100(1-$e^{av_d^b}$)	*23.7*	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	*58.8*	
Percent time-spent-following, PTSF(%)=BPTSF+f_{np}	*48.7*	

Level of Service and Other Performance Measures

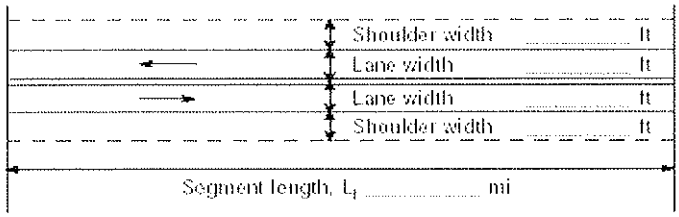
Level of service, LOS (Exhibit 20-3 or 20-4)	*C*
Volume to capacity ratio, v/c=V_p/ 1,700	*0.41*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)=0.25L_t(V/PHF)	*46*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=V*L_t	*157*
Peak 15-min total travel time, TT_{15}(veh-h)=VMT_{15}/ATS	*1.0*

DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*Bjornstad*	Highway / Direction of Travel	*SR-20*
Agency or Company	*Fehr & Peers*	From/To	*Downslope / I-15*
Date Performed	*7/30/2007*	Jurisdiction	*Iron County, UT*
Analysis Time Period	*Weekday average with Trucks*	Analysis Year	*2007*

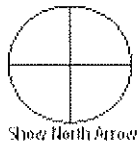
Project Description: *06-721 Coal Hollow EIS*

Input Data



Analysis direction vol., V_d *80* veh/h

Opposing direction vol., V_o *89* veh/h



Class I highway Class II highway

Terrain Level Rolling

Grade Length *4.00* mi Up/down *3.4*

Peak-hour factor, PHF *0.85*

No-passing zone *70%*

% Trucks and Buses , P_T *33 %*

% Recreational vehicles, P_R *13%*

Access points/ *mi* *1*

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 20-9 or 20-15)	*9.1*	*9.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9 or 20-17)	*1.5*	*1.5*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.268*	*0.268*
Grade adjustment factor [1], f_G (Exhibit 20-7 or 20-13)	*1.00*	*0.94*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV}*f_G)$	*352*	*416*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field measured speed[3], S_{FM}	*mi/h*	Base free-flow speed[3], $BFFS_{FM}$	*60.0 mi/h*
Observed volume[3], V_f	veh/h	Adj. for lane width and shoulder width,[3] f_{LS}(Exh 20-5)	*1.3 mi/h*
Free-flow speed, FFS_d $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points[3], f_A (Exhibit 20-5)	*0.3 mi/h*
Adjustment for no-passing zones, f_{np} (Exhibit 20-19)	*2.5 mi/h*	Free-flow speed, FFS_d ($FSS=BFFS-f_{LS}-f_A$)	*58.5 mi/h*
		Average travel speed, $ATS=FFS-0.00776v_p-f_{np}$	*50.0 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 20-10 or 20-16)	*1.5*	*1.5*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.858*	*0.858*
Grade adjustment factor[1], f_G (Exhibit 20-8 or 20-14)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h)=$V_i/(PHF*f_{HV}*f_G)$	*110*	*122*
Base percent time-spent-following[4], $BPTSF(\%)=100(1-e^{av_d^b})$	*12.7*	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	*52.1*	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$	*40.1*	

Level of Service and Other Performance Measures

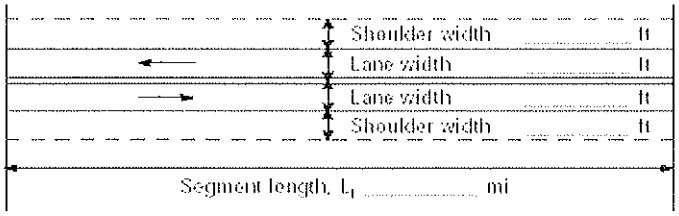
Level of service, LOS (Exhibit 20-3 or 20-4)	*C*
Volume to capacity ratio, $v/c=V_p/1{,}700$	*0.21*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)=$0.25L_t(V/PHF)$	*184*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=$V*L_t$	*624*
Peak 15-min total travel time, TT_{15}(veh-h)=VMT_{15}/ATS	*3.7*

DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*Bjornstad*	Highway / Direction of Travel	*SR-20*
Agency or Company	*Fehr & Peers*	From/To	*Downslope / I-15*
Date Performed	*7/24/2007*	Jurisdiction	*Iron County, UT*
Analysis Time Period	*Weekend with Trucks*	Analysis Year	*2007*

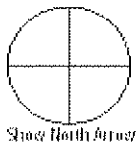
Project Description: *06-721 Coal Hollow EIS*

Input Data



Analysis direction vol., V_d *121* veh/h

Opposing direction vol., V_o *89* veh/h



☐ Class I highway ☐ Class II highway

Terrain ☐ Level ☐ Rolling

Grade Length *4.00* mi Up/down *3.4*

Peak-hour factor, PHF *0.85*

No-passing zone *70%*

% Trucks and Buses , P_T *31 %*

% Recreational vehicles, P_R *13%*

Access points/ *mi* *1*

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 20-9 or 20-15)	*9.1*	*9.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9 or 20-17)	*1.5*	*1.5*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.280*	*0.280*
Grade adjustment factor [1], f_G (Exhibit 20-7 or 20-13)	*1.00*	*0.94*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV}*f_G)$	*509*	*398*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field measured speed[3], S_{FM}	*mi/h*	Base free-flow speed[3], $BFFS_{FM}$	*60.0 mi/h*
Observed volume[3], V_f	veh/h	Adj. for lane width and shoulder width,[3] f_{LS}(Exh 20-5)	*1.3 mi/h*
Free-flow speed, FFS_d $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points[3], f_A (Exhibit 20-5)	*0.3 mi/h*
Adjustment for no-passing zones, f_{np} (Exhibit 20-19)	*2.6 mi/h*	Free-flow speed, FFS_d $(FSS=BFFS-f_{LS}-f_A)$	*58.5 mi/h*
		Average travel speed, $ATS=FFS-0.00776v_p-f_{np}$	*48.8 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 20-10 or 20-16)	*1.5*	*1.5*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.866*	*0.866*
Grade adjustment factor[1], f_G (Exhibit 20-8 or 20-14)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h)$=V_i/(PHF*f_{HV}*f_G)$	*164*	*121*
Base percent time-spent-following[4], $BPTSF(\%)=100(1-e^{av_d^b})$	*18.1*	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	*53.6*	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$	*40.9*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 or 20-4)	*C*
Volume to capacity ratio, $v/c=V_p/1{,}700$	*0.30*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)$=0.25L_t(V/PHF)$	*278*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)$=V*L_t$	*944*
Peak 15-min total travel time, TT_{15}(veh-h)$=VMT_{15}/ATS$	*5.7*

ALL-WAY STOP CONTROL ANALYSIS

General Information

Analyst	*Bjornstad*
Agency/Co.	*Fehr & Peers*
Date Performed	*7/30/2007*
Analysis Time Period	*8:00 - 9:00*

Site Information

Intersection	*US-89 / Main Street*
Jurisdiction	*Panguitch, UT*
Analysis Year	*2007 with Trucks*

Project ID *06-721 Coal Hollow EIS*

East/West Street: *US-89 / Center Street* North/South Street: *SR-143 / US-89*

Volume Adjustments and Site Characteristics

Approach	Eastbound			Westbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	*6*	*20*	*3*	*18*	*12*	*74*
%Thrus Left Lane						

Approach	Northbound			Southbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	*4*	*37*	*38*	*75*	*23*	*9*
%Thrus Left Lane						

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Configuration	*LT*	*R*	*LT*	*R*	*LT*	*R*	*L*	*TR*
PHF	*0.88*	*0.88*	*0.88*	*0.88*	*0.88*	*0.88*	*0.88*	*0.88*
Flow Rate (veh/h)	*28*	*3*	*33*	*84*	*46*	*43*	*85*	36
% Heavy Vehicles	*0*	*0*	*6*	*23*	*5*	*0*	*27*	*0*
No. Lanes	*2*		*2*		*2*		*2*	
Geometry Group	*5*		*5*		*5*		*5*	
Duration, T	*0.25*							

Saturation Headway Adjustment Worksheet

Prop. Left-Turns	*0.2*	*0.0*	*0.6*	*0.0*	*0.1*	*0.0*	*1.0*	*0.0*
Prop. Right-Turns	*0.0*	*1.0*	*0.0*	*1.0*	*0.0*	*1.0*	*0.0*	*0.3*
Prop. Heavy Vehicle	*0.0*	*0.0*	*0.1*	*0.2*	*0.0*	*0.0*	*0.3*	*0.0*
hLT-adj	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*
hRT-adj	*-0.7*	*-0.7*	*-0.7*	*-0.7*	*-0.7*	*-0.7*	*-0.7*	*-0.7*
hHV-adj	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*	*1.7*
hadj, computed	*0.1*	*-0.7*	*0.4*	*-0.3*	*0.1*	*-0.7*	*1.0*	*-0.2*

Departure Headway and Service Time

hd, initial value (s)	*3.20*	*3.20*	*3.20*	*3.20*	*3.20*	*3.20*	*3.20*	*3.20*
x, initial	*0.02*	*0.00*	*0.03*	*0.07*	*0.04*	*0.04*	*0.08*	*0.03*
hd, final value (s)	*5.25*	*4.44*	*5.47*	*4.75*	*5.11*	*4.28*	*5.90*	*4.75*
x, final value	*0.04*	*0.00*	*0.05*	*0.11*	*0.07*	*0.05*	*0.14*	*0.05*
Move-up time, m (s)	*2.3*		*2.3*		*2.3*		*2.3*	
Service Time, t_s (s)	*2.9*	*2.1*	*3.2*	*2.5*	*2.8*	*2.0*	*3.6*	*2.4*

Capacity and Level of Service

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Capacity (veh/h)	*278*	*253*	*283*	*334*	*296*	*293*	*335*	*286*
Delay (s/veh)	*8.17*	*7.16*	*8.46*	*8.05*	*8.17*	*7.21*	*9.55*	*7.68*
LOS	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*
Approach: Delay (s/veh)	*8.07*		*8.16*		*7.71*		*8.99*	
LOS	*A*		*A*		*A*		*A*	
Intersection Delay (s/veh)	*8.32*							
Intersection LOS	*A*							

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ALL-WAY STOP CONTROL ANALYSIS

General Information

Analyst	Bjornstad
Agency/Co.	Fehr & Peers
Date Performed	7/30/2007
Analysis Time Period	16:15 - 17:15

Site Information

Intersection	US-89 / Main Street
Jurisdiction	Panguitch, UT
Analysis Year	2007 with Trucks

Project ID 06-721 Coal Hollow EIS

East/West Street: US-89 / Center Street | North/South Street: SR-143 / US-89

Volume Adjustments and Site Characteristics

Approach	Eastbound			Westbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	17	34	9	41	35	147
%Thrus Left Lane						

Approach	Northbound			Southbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	7	51	19	115	40	27
%Thrus Left Lane						

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Configuration	LT	R	LT	R	LT	R	L	TR
PHF	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Flow Rate (veh/h)	58	10	89	172	67	22	135	78
% Heavy Vehicles	4	7	6	19	5	6	19	4
No. Lanes	2		2		2		2	
Geometry Group	5		5		5		5	
Duration, T	0.25							

Saturation Headway Adjustment Worksheet

Prop. Left-Turns	0.3	0.0	0.5	0.0	0.1	0.0	1.0	0.0
Prop. Right-Turns	0.0	1.0	0.0	1.0	0.0	1.0	0.0	0.4
Prop. Heavy Vehicle	0.0	0.1	0.1	0.2	0.0	0.1	0.2	0.0
hLT-adj	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
hRT-adj	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7
hHV-adj	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
hadj, computed	0.2	-0.6	0.4	-0.4	0.1	-0.6	0.8	-0.2

Departure Headway and Service Time

hd, initial value (s)	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20
x, initial	0.05	0.01	0.08	0.15	0.06	0.02	0.12	0.07
hd, final value (s)	5.85	5.04	5.78	5.03	5.75	5.00	6.27	5.23
x, final value	0.09	0.01	0.14	0.24	0.11	0.03	0.23	0.11
Move-up time, m (s)	2.3		2.3		2.3		2.3	
Service Time, t_s (s)	3.6	2.7	3.5	2.7	3.4	2.7	4.0	2.9

Capacity and Level of Service

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Capacity (veh/h)	308	260	339	422	317	272	385	328
Delay (s/veh)	9.16	7.81	9.45	9.32	9.13	7.86	10.88	8.60
LOS	A	A	A	A	A	A	B	A
Approach: Delay (s/veh)	8.96		9.36		8.82		10.04	
LOS	A		A		A		B	
Intersection Delay (s/veh)	9.47							
Intersection LOS	A							

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*Bjornstad*	Intersection	*US-89 / SR-12*
Agency/Co.	*Fehr & Peers*	Jurisdiction	*Panguitch, UT*
Date Performed	*7/19/2007*	Analysis Year	*2007 with Trucks*
Analysis Time Period	*8:00 - 9:00*		

Project Description *06-721 Coal Hollow EIS*

East/West Street: *SR-12*	North/South Street: *US-89*
Intersection Orientation: *North-South*	Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*40*	*24*	*45*	*34*	
Peak-Hour Factor, PHF	*1.00*	*0.85*	*0.85*	*0.85*	*0.85*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*43*	*0*	*37*
Percent Heavy Vehicles	*0*	--	--	*25*	--	--
Median Type	*Undivided*					
RT Channelized			*1*			*0*
Lanes	*0*	*1*	*1*	*1*	*1*	*0*
Configuration		*T*	*R*	*L*	*T*	
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*37*		*32*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*0.85*	*1.00*	*0.85*
Hourly Flow Rate, HFR (veh/h)	*52*	*39*	*0*	*0*	*47*	*28*
Percent Heavy Vehicles	*0*	*0*	*0*	*21*	*0*	*10*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*1*
Lanes	*0*	*0*	*0*	*1*	*0*	*1*
Configuration				*L*		*R*

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*L*	*L*		*R*			
v (veh/h)		*52*	*43*		*37*			
C (m) (veh/h)		*1425*	*730*		*1000*			
v/c		*0.04*	*0.06*		*0.04*			
95% queue length		*0.11*	*0.19*		*0.12*			
Control Delay (s/veh)		*7.6*	*10.2*		*8.7*			
LOS		*A*	*B*		*A*			
Approach Delay (s/veh)	--	--	*9.5*					
Approach LOS	--	--	*A*					

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LOS A

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*Bjornstad*	Intersection	*US-89 / SR-12*
Agency/Co.	*Fehr & Peers*	Jurisdiction	*Panguitch, UT*
Date Performed	*7/19/2007*	Analysis Year	*2007 with Trucks*
Analysis Time Period	*16:00 - 17:00*		

Project Description *06-721 Coal Hollow EIS*

East/West Street: *SR-12* | North/South Street: *US-89*

Intersection Orientation: *North-South* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*82*	*64*	*35*	*50*	
Peak-Hour Factor, PHF	*1.00*	*0.89*	*0.89*	*0.89*	*0.89*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*68*	*0*	*69*
Percent Heavy Vehicles	*0*	--	--	*25*	--	--
Median Type	*Undivided*					
RT Channelized			*1*			*0*
Lanes	*0*	*1*	*1*	*1*	*1*	*0*
Configuration		*T*	*R*	*L*	*T*	
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*61*		*62*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*0.89*	*1.00*	*0.89*
Hourly Flow Rate, HFR (veh/h)	*39*	*56*	*0*	*0*	*92*	*71*
Percent Heavy Vehicles	*0*	*0*	*0*	*13*	*0*	*4*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*1*
Lanes	*0*	*0*	*0*	*1*	*0*	*1*
Configuration				*L*		*R*

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*L*	*L*		*R*			
v (veh/h)		*39*	*68*		*69*			
C (m) (veh/h)		*1370*	*717*		*960*			
v/c		*0.03*	*0.09*		*0.07*			
95% queue length		*0.09*	*0.31*		*0.23*			
Control Delay (s/veh)		*7.7*	*10.5*		*9.0*			
LOS		*A*	*B*		*A*			
Approach Delay (s/veh)	--	--	*9.8*					
Approach LOS	--	--	*A*					

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LOS A

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*Bjornstad*	Intersection	*US-89 / SR-14*
Agency/Co.	*Fehr & Peers*	Jurisdiction	*Panguitch, UT*
Date Performed	*7/19/2007*	Analysis Year	*2007 with Trucks*
Analysis Time Period	*8:00 - 9:00*		

Project Description *06-721 Coal Hollow EIS*

East/West Street: *SR-14* | North/South Street: *US-89*

Intersection Orientation: *North-South* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*25*	*47*	*1*	*2*	*51*	*13*
Peak-Hour Factor, PHF	*0.85*	*0.85*	*0.85*	*0.85*	*0.85*	*0.85*
Hourly Flow Rate, HFR (veh/h)	*29*	*55*	*1*	*2*	*59*	*15*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*1*	*1*	*0*	*0*	*2*	*0*
Configuration	*L*		*TR*	*LT*		*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*15*	*3*	*15*	*0*	*1*	*3*
Peak-Hour Factor, PHF	*0.85*	*0.85*	*0.85*	*0.85*	*0.85*	*0.85*
Hourly Flow Rate, HFR (veh/h)	*17*	*3*	*17*	*0*	*1*	*3*
Percent Heavy Vehicles	*6*	*0*	*5*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*	*LT*		*LTR*			*LTR*	
v (veh/h)	*29*	*2*		*4*			*37*	
C (m) (veh/h)	*1538*	*1562*		*903*			*837*	
v/c	*0.02*	*0.00*		*0.00*			*0.04*	
95% queue length	*0.06*	*0.00*		*0.01*			*0.14*	
Control Delay (s/veh)	*7.4*	*7.3*		*9.0*			*9.5*	
LOS	*A*	*A*		*A*			*A*	
Approach Delay (s/veh)	--	--	*9.0*			*9.5*		
Approach LOS	--	--	*A*			*A*		

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LOS A

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*Bjornstad*	Intersection	*US-89 / SR-14*
Agency/Co.	*Fehr & Peers*	Jurisdiction	*Panguitch, UT*
Date Performed	*7/19/2007*	Analysis Year	*2007 with Trucks*
Analysis Time Period	*16:00 - 17:00*		

Project Description *06-721 Coal Hollow EIS*

East/West Street: *SR-14*	North/South Street: *US-89*
Intersection Orientation: *North-South*	Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*25*	*109*	*0*	*4*	*76*	*20*
Peak-Hour Factor, PHF	*0.91*	*0.91*	*0.91*	*0.91*	*0.91*	*0.91*
Hourly Flow Rate, HFR (veh/h)	*20*	*1*	*24*	*0*	*0*	*0*
Percent Heavy Vehicles	*3*	--	--	*50*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*1*	*1*	*0*	*0*	*2*	*0*
Configuration	*L*		*TR*	*LT*		*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*19*	*1*	*22*	*0*	*0*	*0*
Peak-Hour Factor, PHF	*0.91*	*0.91*	*0.91*	*0.91*	*0.91*	*0.91*
Hourly Flow Rate, HFR (veh/h)	*4*	*83*	*21*	*27*	*119*	*0*
Percent Heavy Vehicles	*9*	*0*	*7*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*	*LT*		*LTR*			*LTR*	
v (veh/h)	*27*	*4*		*0*			*45*	
C (m) (veh/h)	*1478*	*1177*					*778*	
v/c	*0.02*	*0.00*					*0.06*	
95% queue length	*0.06*	*0.01*					*0.18*	
Control Delay (s/veh)	*7.5*	*8.1*					*9.9*	
LOS	*A*	*A*					*A*	
Approach Delay (s/veh)	--	--					*9.9*	
Approach LOS	--	--					*A*	

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DELAY 2.47
LOS A

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*Bjornstad*	Intersection	*US-89 / SR-20*
Agency/Co.	*Fehr & Peers*	Jurisdiction	*Panguitch, UT*
Date Performed	*7/19/2007*	Analysis Year	*2007 with Trucks*
Analysis Time Period	*8:00 - 9:00*		

Project Description *06-721 Coal Hollow EIS*

East/West Street: *SR-20* | North/South Street: *US-89*

Intersection Orientation: *East-West* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*5*		*38*			
Peak-Hour Factor, PHF	*0.84*	*1.00*	*0.84*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*5*	*0*	*45*	*0*	*0*	*0*
Percent Heavy Vehicles	*18*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*1*	*0*	*1*	*0*	*0*	*0*
Configuration	*L*		*R*			
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*41*	*32*			*18*	*4*
Peak-Hour Factor, PHF	*0.84*	*0.84*	*1.00*	*1.00*	*0.84*	*0.84*
Hourly Flow Rate, HFR (veh/h)	*48*	*38*	*0*	*0*	*21*	*4*
Percent Heavy Vehicles	*32*	*23*	*0*	*0*	*24*	*50*
Percent Grade (%)	*0*			*0*		
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*1*	*1*	*0*	*0*	*1*	*1*
Configuration	*L*	*T*			*T*	*R*

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*		*L*	*T*			*T*	*R*
v (veh/h)	*5*		*48*	*38*			*21*	*4*
C (m) (veh/h)	*1524*		*894*	*842*			*792*	*960*
v/c	*0.00*		*0.05*	*0.05*			*0.03*	*0.00*
95% queue length	*0.01*		*0.17*	*0.14*			*0.08*	*0.01*
Control Delay (s/veh)	*7.4*		*9.3*	*9.5*			*9.7*	*8.8*
LOS	*A*		*A*	*A*			*A*	*A*
Approach Delay (s/veh)	--	--	*9.4*			*9.5*		
Approach LOS	--	--	*A*			*A*		

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DELAY 8.15

LOS A

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*Bjornstad*	Intersection	*US-89 / SR-20*
Agency/Co.	*Fehr & Peers*	Jurisdiction	*Panguitch, UT*
Date Performed	*7/19/2007*	Analysis Year	*2007 with Trucks*
Analysis Time Period	*16:00 - 17:00*		

Project Description *06-721 Coal Hollow EIS*

East/West Street: *SR-20*	North/South Street: *US-89*
Intersection Orientation: *East-West*	Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*17*		*61*			
Peak-Hour Factor, PHF	*0.95*	*1.00*	*0.95*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*17*	*0*	*64*	*0*	*0*	*0*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*1*	*0*	*1*	*0*	*0*	*0*
Configuration	*L*		*R*			
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*77*	*45*			*41*	*6*
Peak-Hour Factor, PHF	*0.95*	*0.95*	*1.00*	*1.00*	*0.95*	*0.95*
Hourly Flow Rate, HFR (veh/h)	*81*	*47*	*0*	*0*	*43*	*6*
Percent Heavy Vehicles	*21*	*13*	*0*	*0*	*16*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*1*	*1*	*0*	*0*	*1*	*1*
Configuration	*L*	*T*			*T*	*R*

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*		*L*	*T*			*T*	*R*
v (veh/h)	*17*		*81*	*47*			*43*	*6*
C (m) (veh/h)	*1636*		*843*	*828*			*758*	*1091*
v/c	*0.01*		*0.10*	*0.06*			*0.06*	*0.01*
95% queue length	*0.03*		*0.32*	*0.18*			*0.18*	*0.02*
Control Delay (s/veh)	*7.2*		*9.7*	*9.6*			*10.0*	*8.3*
LOS	*A*		*A*	*A*			*B*	*A*
Approach Delay (s/veh)	--	--	*9.7*			*9.8*		
Approach LOS	--	--	*A*			*A*		

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DELAY 7.45
LOS A

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*Bjornstad*	Intersection	*I-15 / SR-20 NB*
Agency/Co.	*Fehr & Peers*	Jurisdiction	*Iron County, UT*
Date Performed	*7/19/2007*	Analysis Year	*2007 with Trucks*
Analysis Time Period	*8:00 - 9:00*		

Project Description *06-721 Coal Hollow EIS*

East/West Street: *SR-20* | North/South Street: *I-15*

Intersection Orientation: *East-West* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*1*	*34*			*15*	*15*
Peak-Hour Factor, PHF	*0.85*	*0.85*	*0.91*	*0.91*	*0.85*	*0.85*
Hourly Flow Rate, HFR (veh/h)	*1*	*39*	*0*	*0*	*17*	*17*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LT*					*TR*
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*0*	*1*	*26*			
Peak-Hour Factor, PHF	*0.85*	*0.85*	*0.85*	*0.91*	*0.91*	*0.91*
Hourly Flow Rate, HFR (veh/h)	*0*	*1*	*30*	*0*	*0*	*0*
Percent Heavy Vehicles	*0*	*0*	*4*	*50*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*0*	*0*
Configuration		*LTR*				

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*			*LTR*				
v (veh/h)	*1*			*31*				
C (m) (veh/h)	*1591*			*1019*				
v/c	*0.00*			*0.03*				
95% queue length	*0.00*			*0.09*				
Control Delay (s/veh)	*7.3*			*8.6*				
LOS	*A*			*A*				
Approach Delay (s/veh)	--	--	*8.6*					
Approach LOS	--	--	*A*					

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DELAY 2.98

LOS A

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*Bjornstad*	Intersection	*I-15 / SR-20 SB*
Agency/Co.	*Fehr & Peers*	Jurisdiction	*Iron County, UT*
Date Performed	*7/19/2007*	Analysis Year	*2007 with Trucks*
Analysis Time Period	*8:00 - 9:00*		

Project Description *06-721 Coal Hollow EIS*

East/West Street: *SR-20* | North/South Street: *I-15*

Intersection Orientation: *East-West* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*1*	*0*	*22*	*0*	
Peak-Hour Factor, PHF	*0.85*	*0.85*	*0.85*	*0.85*	*0.85*	*0.85*
Hourly Flow Rate, HFR (veh/h)	*0*	*1*	*0*	*25*	*0*	*0*
Percent Heavy Vehicles	*0*	--	--	*32*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration			*TR*	*LT*		
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*27*	*2*	*2*
Peak-Hour Factor, PHF	*0.85*	*0.85*	*0.85*	*0.85*	*0.85*	*0.85*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*31*	*2*	*2*
Percent Heavy Vehicles	*0*	*0*	*4*	*27*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*1*	*0*
Configuration					*LTR*	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*LT*					*LTR*	
v (veh/h)		*25*					*35*	
C (m) (veh/h)		*1446*					*888*	
v/c		*0.02*					*0.04*	
95% queue length		*0.05*					*0.12*	
Control Delay (s/veh)		*7.5*					*9.2*	
LOS		*A*					*A*	
Approach Delay (s/veh)	--	--					*9.2*	
Approach LOS	--	--					*A*	

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DELAY 9.44
LOS A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99		1.00	0.99	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85		1.00	0.89	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1805	3406	1442	1787	3471	1615	1366	1566		1800	1667	
Flt Permitted	0.48	1.00	1.00	0.36	1.00	1.00	0.76	1.00		0.68	1.00	
Satd. Flow (perm)	904	3406	1442	676	3471	1615	1086	1566		1291	1667	
Volume (vph)	2	390	85	63	295	4	50	1	100	9	1	3
Peak-hour factor, PHF	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Adj. Flow (vph)	2	453	99	73	343	5	58	1	116	10	1	3
RTOR Reduction (vph)	0	0	77	0	0	4	0	40	0	0	1	0
Lane Group Flow (vph)	2	453	22	73	343	1	58	77	0	10	3	0
Confl. Peds. (#/hr)							1		1	5		5
Heavy Vehicles (%)	0%	6%	12%	1%	4%	0%	32%	0%	2%	0%	0%	0%
Turn Type	Perm		Perm	Perm		Perm	Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8		8	2			6		
Actuated Green, G (s)	13.9	13.9	13.9	13.9	13.9	13.9	44.1	44.1		44.1	44.1	
Effective Green, g (s)	15.9	15.9	15.9	15.9	15.9	15.9	46.1	46.1		46.1	46.1	
Actuated g/C Ratio	0.23	0.23	0.23	0.23	0.23	0.23	0.66	0.66		0.66	0.66	
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	205	774	328	154	788	367	715	1031		850	1098	
v/s Ratio Prot		c0.13			0.10			c0.07			0.00	
v/s Ratio Perm	0.00		0.07	0.11		0.00	0.05			0.01		
v/c Ratio	0.01	0.59	0.07	0.47	0.44	0.00	0.08	0.08		0.01	0.00	
Uniform Delay, d1	21.0	24.1	21.2	23.4	23.2	20.9	4.3	4.3		4.1	4.1	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.0	1.1	0.1	2.3	0.4	0.0	0.2	0.1		0.0	0.0	
Delay (s)	21.0	25.2	21.3	25.7	23.6	20.9	4.5	4.4		4.1	4.1	
Level of Service	C	C	C	C	C	C	A	A		A	A	
Approach Delay (s)		24.5			23.9			4.5			4.1	
Approach LOS		C			C			A			A	

Intersection Summary			
HCM Average Control Delay	21.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.23		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	49.3%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor		0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes		1.00	1.00	1.00	1.00	1.00	1.00	0.99		1.00	1.00	
Flpb, ped/bikes		1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt		1.00	0.85	1.00	1.00	0.85	1.00	0.85		1.00	0.95	
Flt Protected		1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		3505	1538	1770	3539	1615	1526	1582		1805	1805	
Flt Permitted		1.00	1.00	0.36	1.00	1.00	0.76	1.00		0.68	1.00	
Satd. Flow (perm)		3505	1538	678	3539	1615	1214	1582		1292	1805	
Volume (vph)	0	456	127	109	538	11	72	2	111	7	2	1
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	0	485	135	116	572	12	77	2	118	7	2	1
RTOR Reduction (vph)	0	0	99	0	0	9	0	45	0	0	0	0
Lane Group Flow (vph)	0	485	36	116	572	3	77	75	0	7	3	0
Confl. Peds. (#/hr)							3		3			
Heavy Vehicles (%)	0%	3%	5%	2%	2%	0%	18%	0%	1%	0%	0%	0%
Turn Type	Perm		Perm	Perm		Perm	Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8		8	2			6		
Actuated Green, G (s)		16.9	16.9	16.9	16.9	16.9	41.1	41.1		41.1	41.1	
Effective Green, g (s)		18.9	18.9	18.9	18.9	18.9	43.1	43.1		43.1	43.1	
Actuated g/C Ratio		0.27	0.27	0.27	0.27	0.27	0.62	0.62		0.62	0.62	
Clearance Time (s)		6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	
Vehicle Extension (s)		3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		946	415	183	956	436	747	974		796	1111	
v/s Ratio Prot		0.14			0.16			c0.08			0.00	
v/s Ratio Perm			0.09	c0.17		0.01	0.06			0.01		
v/c Ratio		0.51	0.09	0.63	0.60	0.01	0.10	0.08		0.01	0.00	
Uniform Delay, d1		21.6	19.1	22.5	22.2	18.7	5.5	5.4		5.2	5.2	
Progression Factor		1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2		0.5	0.1	7.0	1.0	0.0	0.3	0.2		0.0	0.0	
Delay (s)		22.1	19.2	29.5	23.3	18.7	5.8	5.6		5.2	5.2	
Level of Service		C	B	C	C	B	A	A		A	A	
Approach Delay (s)		21.5			24.2			5.7			5.2	
Approach LOS		C			C			A			A	

Intersection Summary			
HCM Average Control Delay	20.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.28		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	53.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

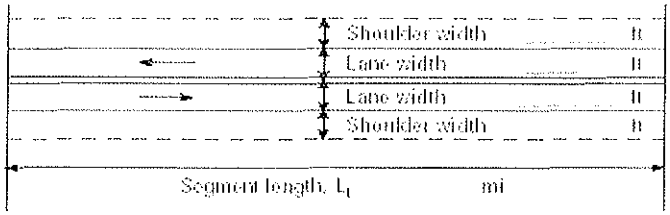
Future Conditions

DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*Stinger*	Highway / Direction of Travel	*US-89*
Agency or Company	*Fehr & Peers*	From/To	*Alton / SR-14*
Date Performed	*9/12/2007*	Jurisdiction	*Kane County, UT*
Analysis Time Period	*Weekday Average*	Analysis Year	*2020*

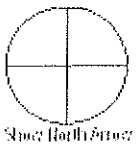
Project Description: *06-721 Coal Hollow EIS*

Input Data



Analysis direction vol., V_d *201* veh/h

Opposing direction vol., V_o *166* veh/h



Class I highway ■ Class II highway

Terrain ■ Level ■ Rolling

Grade Length *1.60* mi Up/down *3.0*

Peak-hour factor, PHF *0.85*

No-passing zone *20%*

% Trucks and Buses , P_T *22 %*

% Recreational vehicles, P_R *11%*

Access points/ *mi* *1*

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 20-9 or 20-15)	*6.1*	*6.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9 or 20-17)	*1.4*	*1.4*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.462*	*0.462*
Grade adjustment factor [1], f_G (Exhibit 20-7 or 20-13)	*0.99*	*1.00*
Directional flow rate [2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV}*f_G)$	*519*	*423*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field measured speed [3], S_{FM}	*mi/h*	Base free-flow speed [3], $BFFS_{FM}$	*65.0 mi/h*
Observed volume [3], V_f	veh/h	Adj. for lane width and shoulder width, [3] f_{LS}(Exh 20-5)	*2.6 mi/h*
Free-flow speed, FFS_d $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points [3], f_A (Exhibit 20-5)	*0.3 mi/h*
Adjustment for no-passing zones, f_{np} (Exhibit 20-19)	*1.5 mi/h*	Free-flow speed, FFS_d $(FSS=BFFS-f_{LS}-f_A)$	*62.1 mi/h*
		Average travel speed, $ATS=FFS-0.00776v_p-f_{np}$	*53.3 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 20-10 or 20-16)	*1.0*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*1.000*	*0.978*
Grade adjustment factor [1], f_G (Exhibit 20-8 or 20-14)	*1.00*	*1.00*
Directional flow rate [2], v_i(pc/h)=$V_i/(PHF*f_{HV}*f_G)$	*236*	*200*
Base percent time-spent-following [4], $BPTSF(\%)=100(1-e^{av_d^b})$	*24.8*	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	*38.8*	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$	*45.8*	

Level of Service and Other Performance Measures

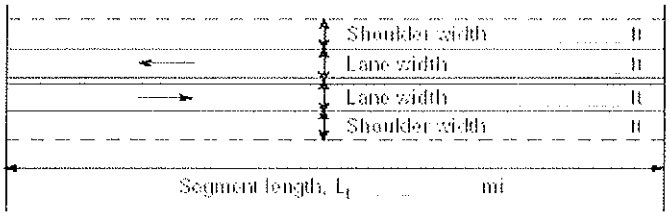
Level of service, LOS (Exhibit 20-3 or 20-4)	*B*
Volume to capacity ratio, $v/c=V_p/1,700$	*0.31*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)=$0.25L_t(V/PHF)$	*95*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=$V*L_t$	*322*
Peak 15-min total travel time, TT_{15}(veh-h)=VMT_{15}/ATS	*1.8*

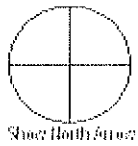
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*Stinger*	Highway / Direction of Travel	*US-89*
Agency or Company	*Fehr & Peers*	From/To	*Alton / SR-14*
Date Performed	*9/12/2007*	Jurisdiction	*Kane County, UT*
Analysis Time Period	*Weekend*	Analysis Year	*2020*

Project Description: *06-721 Coal Hollow EIS*

Input Data





Class I highway ■ Class II highway

Terrain ■ Level ■ Rolling

Grade Length *1.60* mi Up/down *3.0*

Peak-hour factor, PHF *0.85*

No-passing zone *20%*

% Trucks and Buses , P_T *25 %*

% Recreational vehicles, P_R *18%*

Access points/ *mi* *1*

Analysis direction vol., V_d *246*veh/h

Opposing direction vol., V_o *197*veh/h

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 20-9 or 20-15)	*6.1*	*6.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9 or 20-17)	*1.4*	*1.4*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.426*	*0.426*
Grade adjustment factor [1], f_G (Exhibit 20-7 or 20-13)	*1.00*	*0.99*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV}*f_G)$	*679*	*552*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field measured speed[3], S_{FM}	*mi/h*	Base free-flow speed[3], $BFFS_{FM}$	*65.0 mi/h*
Observed volume[3], V_f	veh/h	Adj. for lane width and shoulder width,[3] f_{LS}(Exh 20-5)	*2.6 mi/h*
Free-flow speed, FFS_d $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points[3], f_A (Exhibit 20-5)	*0.3 mi/h*
Adjustment for no-passing zones, f_{np} (Exhibit 20-19)	*1.3 mi/h*	Free-flow speed, FFS_d $(FSS=BFFS-f_{LS}-f_A)$	*62.2 mi/h*
		Average travel speed, $ATS=FFS-0.00776v_p-f_{np}$	*51.3 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*1.000*	*1.000*
Grade adjustment factor[1], f_G (Exhibit 20-8 or 20-14)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h)=$V_i/(PHF*f_{HV}*f_G)$	*289*	*232*
Base percent time-spent-following[4], $BPTSF(\%)=100(1-e^{av_d^b})$	*30.4*	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	*37.9*	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$	*51.4*	

Level of Service and Other Performance Measures

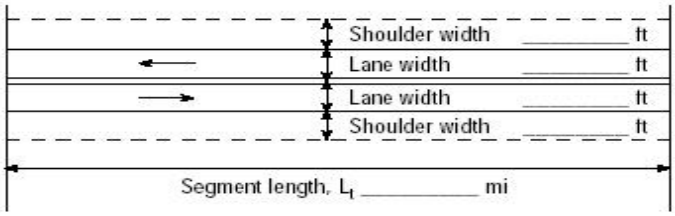
Level of service, LOS (Exhibit 20-3 or 20-4)	*C*
Volume to capacity ratio, $v/c=V_p/1{,}700$	*0.40*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)=$0.25L_t(V/PHF)$	*116*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=$V*L_t$	*394*
Peak 15-min total travel time, TT_{15}(veh-h)=VMT_{15}/ATS	*2.3*

DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*Stinger*	Highway / Direction of Travel	*US-89*
Agency or Company	*Fehr & Peers*	From/To	*SR-14 / Hatch*
Date Performed	*9/12/2007*	Jurisdiction	*Garfield County, Utah*
Analysis Time Period	*Weekday Average*	Analysis Year	*2020*

Project Description: *06-721 Coal Hollow EIS*

Input Data



Analysis direction vol., V_d *201*veh/h

Opposing direction vol., V_o *166*veh/h

☑ Class I highway ☐ Class II highway

Terrain ☑ Level ☐ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.85*

No-passing zone *30%*

% Trucks and Buses , P_T *18 %*

% Recreational vehicles, P_R *12%*

Access points/ *mi* *1*

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 20-9 or 20-15)	*1.7*	*1.7*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9 or 20-17)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.888*	*0.888*
Grade adjustment factor [1], f_G (Exhibit 20-7 or 20-13)	*1.00*	*1.00*
Directional flow rate[2], $v_i(pc/h)$ $v_i=V_i/(PHF*f_{HV}*f_G)$	*266*	*220*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field measured speed[3], S_{FM}	*mi/h*	Base free-flow speed[3], $BFFS_{FM}$	*65.0 mi/h*
Observed volume[3], V_f	veh/h	Adj. for lane width and shoulder width,[3] f_{LS}(Exh 20-5)	*1.3 mi/h*
Free-flow speed, FFS_d $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points[3], f_A (Exhibit 20-5)	*0.3 mi/h*
Adjustment for no-passing zones, f_{np} (Exhibit 20-19)	*2.6 mi/h*	Free-flow speed, FFS_d $(FSS=BFFS-f_{LS}-f_A)$	*63.5 mi/h*
		Average travel speed, $ATS=FFS-0.00776v_p-f_{np}$	*57.1 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 20-10 or 20-16)	*1.1*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.982*	*0.982*
Grade adjustment factor[1], f_G (Exhibit 20-8 or 20-14)	*1.00*	*1.00*
Directional flow rate[2], $v_i(pc/h)=V_i/(PHF*f_{HV}*f_G)$	*241*	*199*
Base percent time-spent-following[4], $BPTSF(\%)=100(1-e^{av_d^b})$	*25.2*	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	*44.2*	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$	*49.4*	

Level of Service and Other Performance Measures

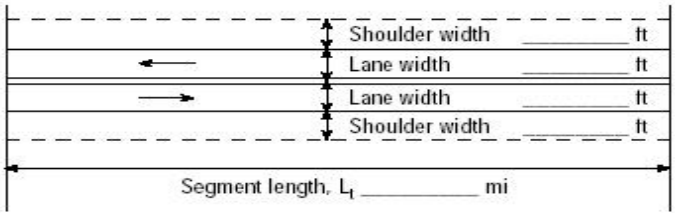
Level of service, LOS (Exhibit 20-3 or 20-4)	*B*
Volume to capacity ratio, $v/c=V_p/1{,}700$	*0.16*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)$=0.25L_t(V/PHF)$	*692*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)$=V*L_t$	*2352*
Peak 15-min total travel time, TT_{15}(veh-h)$=VMT_{15}/ATS$	*12.1*

DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*Stinger*	Highway / Direction of Travel	*US-89*
Agency or Company	*Fehr & Peers*	From/To	*SR-14 / Hatch*
Date Performed	*9/12/2007*	Jurisdiction	*Garfield County, Utah*
Analysis Time Period	*Weekend*	Analysis Year	*2020*

Project Description: *06-721 Coal Hollow EIS*

Input Data



Analysis direction vol., V_d *246*veh/h

Opposing direction vol., V_o *197*veh/h

☑ Class I highway ☐ Class II highway

Terrain ☑ Level ☐ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.85*

No-passing zone *30*%

% Trucks and Buses , P_T *25* %

% Recreational vehicles, P_R *18*%

Access points/ *mi* *1*

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 20-9 or 20-15)	*1.2*	*1.7*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9 or 20-17)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.952*	*0.851*
Grade adjustment factor [1], f_G (Exhibit 20-7 or 20-13)	*1.00*	*1.00*
Directional flow rate[2], $v_i(pc/h)$ $v_i=V_i/(PHF*f_{HV}*f_G)$	*304*	*272*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field measured speed[3], S_{FM}	*mi/h*	Base free-flow speed[3], $BFFS_{FM}$	*65.0 mi/h*
Observed volume[3], V_f	veh/h	Adj. for lane width and shoulder width,[3] f_{LS}(Exh 20-5)	*1.3 mi/h*
Free-flow speed, FFS_d $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points[3], f_A (Exhibit 20-5)	*0.3 mi/h*
Adjustment for no-passing zones, f_{np} (Exhibit 20-19)	*2.4 mi/h*	Free-flow speed, FFS_d $(FSS=BFFS-f_{LS}-f_A)$	*63.5 mi/h*
		Average travel speed, $ATS=FFS-0.00776v_p-f_{np}$	*56.6 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 20-10 or 20-16)	*1.1*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.976*	*0.976*
Grade adjustment factor[1], f_G (Exhibit 20-8 or 20-14)	*1.00*	*1.00*
Directional flow rate[2], $v_i(pc/h)=V_i/(PHF*f_{HV}*f_G)$	*297*	*238*
Base percent time-spent-following[4], $BPTSF(\%)=100(1-e^{av_d^b})$	*31.2*	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	*42.5*	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$	*54.8*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 or 20-4)	*C*
Volume to capacity ratio, $v/c=V_p/1{,}700$	*0.18*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)$=0.25L_t(V/PHF)$	*847*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)$=V*L_t$	*2878*
Peak 15-min total travel time, TT_{15}(veh-h)$=VMT_{15}/ATS$	*15.0*

HIGHPLAN 2002 Conceptual Planning Analysis

Description/File Information

Filename	HP_preview.xml	**Date Prepared**	9/12/2007		
Program	HIGHPLAN	**Version**	1.2.0		
Analyst	PS	**Agency**	FP	**District**	Hatch, UT
Road Name	US-89	**From/To**	Hatch		
Analysis Type	Segment	**Peak Direction**	Northbound	**Study Period**	K100
User Notes	2020 Weekday Average				

Facility Data

Roadway Variables				Traffic Variables			
Area Type	Rural developed	**# Thru Lanes**	2	**AADT**	3388	**% Heavy Vehicles**	18
Class	3	**Terrain**	Level	**K**	.0937	**Base Capacity**	1700
Posted Speed	40	**Median**	No	**D**	.526	**Local Adj. Factor**	.92
Free Flow Speed	45	**Left Turn Lanes**	No	**PHF**	.85	**Adjusted Capacity**	1148
Pass Lane Spacing	N/A	**% NPZ**	100				

LOS Results

v/c Ratio	0.16	**Density**	N/A	**PTSF**	95.00	**ATS**	37.00	**% FFS**	83.0	**LOS**	C

Service Volume Tables

	A	B	C	D	E
Lanes	**Hourly Volume In Peak Direction**				
1	0	130	380	570	740
2					
3					
4					
Lanes	**Hourly Volume In Both Directions**				
2	0	250	730	1090	1400
4					
6					
8					
Lanes	**Annual Average Daily Traffic**				
2	0	2700	7800	11600	14900
4					
6					
8					
Lanes	**Maximum v/c Ratio**				
1	0.00	0.14	0.37	0.55	0.71
2					
3					
4					

HIGHPLAN 2002 Conceptual Planning Analysis

Description/File Information

Filename	HP_preview.xml	**Date Prepared**	9/12/2007		
Program	HIGHPLAN	**Version**	1.2.0		
Analyst	PS	**Agency**	FP	**District**	Hatch, UT
Road Name	US-89	**From/To**	Hatch		
Analysis Type	Segment	**Peak Direction**	Northbound	**Study Period**	K100
User Notes	2020 Weekend				

Facility Data

Roadway Variables				Traffic Variables			
Area Type	Rural developed	**# Thru Lanes**	2	**AADT**	3721	**% Heavy Vehicles**	25
Class	3	**Terrain**	Level	**K**	.10273	**Base Capacity**	1700
Posted Speed	40	**Median**	No	**D**	.534	**Local Adj. Factor**	.92
Free Flow Speed	45	**Left Turn Lanes**	No	**PHF**	.85	**Adjusted Capacity**	1112
Pass Lane Spacing	N/A	**% NPZ**	100				

LOS Results

v/c Ratio	0.20	**Density**	N/A	**PTSF**	99.00	**ATS**	37.00	**% FFS**	81.0	**LOS**	C

Service Volume Tables

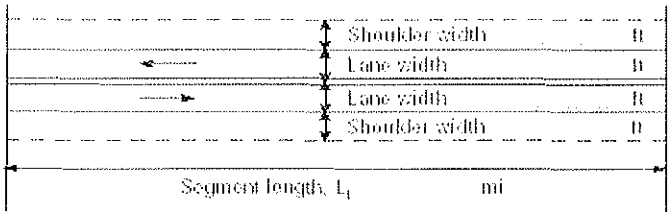
	A	B	C	D	E
Lanes	**Hourly Volume In Peak Direction**				
1	0	130	380	580	740
2					
3					
4					
Lanes	**Hourly Volume In Both Directions**				
2	0	250	720	1080	1390
4					
6					
8					
Lanes	**Annual Average Daily Traffic**				
2	0	2400	7000	10500	13500
4					
6					
8					
Lanes	**Maximum v/c Ratio**				
1	0.00	0.15	0.37	0.56	0.71
2					
3					
4					

DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*Stinger*	Highway / Direction of Travel	*US-89*
Agency or Company	*Fehr & Peers*	From/To	*Hatch / SR-12*
Date Performed	*9/12/2007*	Jurisdiction	*Garfield Couty, UT*
Analysis Time Period	*Weekday Average*	Analysis Year	*2020*

Project Description: *06-721 Coal Hollow EIS*

Input Data



Analysis direction vol., V_d *175* veh/h

Opposing direction vol., V_o *161* veh/h

Class I highway ■ Class II highway

Terrain ■ Level ■ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.87*

No-passing zone *35%*

% Trucks and Buses , P_T *21 %*

% Recreational vehicles, P_R *18%*

Access points/ *mi* *1*

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 20-9 or 20-15)	*1.7*	*1.7*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9 or 20-17)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.872*	*0.872*
Grade adjustment factor [1], f_G (Exhibit 20-7 or 20-13)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV}*f_G)$	*231*	*212*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field measured speed[3], S_{FM}	*mi/h*	Base free-flow speed[3], $BFFS_{FM}$	*65.0 mi/h*
Observed volume[3], V_f	veh/h	Adj. for lane width and shoulder width,[3] f_{LS}(Exh 20-5)	*1.3 mi/h*
Free-flow speed, FFS_d $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points[3], f_A (Exhibit 20-5)	*0.3 mi/h*
Adjustment for no-passing zones, f_{np} (Exhibit 20-19)	*2.9 mi/h*	Free-flow speed, FFS_d $(FSS=BFFS-f_{LS}-f_A)$	*63.5 mi/h*
		Average travel speed, $ATS=FFS-0.00776v_p-f_{np}$	*57.2 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 20-10 or 20-16)	*1.1*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.979*	*0.979*
Grade adjustment factor[1], f_G (Exhibit 20-8 or 20-14)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h)=$V_i/(PHF*f_{HV}*f_G)$	*205*	*189*
Base percent time-spent-following[4], $BPTSF(\%)=100(1-e^{av_d^b})$	*22.0*	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	*49.0*	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$	*47.5*	

Level of Service and Other Performance Measures

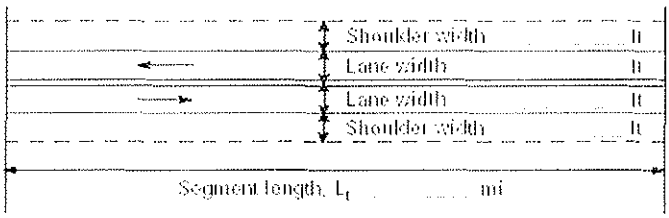
Level of service, LOS (Exhibit 20-3 or 20-4)	*B*
Volume to capacity ratio, $v/c=V_p/1{,}700$	*0.14*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)=$0.25L_t(V/PHF)$	*392*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=$V*L_t$	*1365*
Peak 15-min total travel time, TT_{15}(veh-h)=VMT_{15}/ATS	*6.9*

DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*Stinger*	Highway / Direction of Travel	*US-89*
Agency or Company	*Fehr & Peers*	From/To	*Hatch / SR-12*
Date Performed	*9/12/2007*	Jurisdiction	*Garfield Couty, UT*
Analysis Time Period	*Weekend*	Analysis Year	*2020*

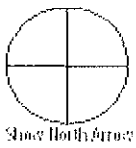
Project Description: *06-721 Coal Hollow EIS*

Input Data



Analysis direction vol., V_d *185*veh/h

Opposing direction vol., V_o *169*veh/h



■ Class I highway ■ Class II highway

Terrain ■ Level ■ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.85*

No-passing zone *35%*

% Trucks and Buses , P_T *15 %*

% Recreational vehicles, P_R *21%*

Access points/ *mi* *1*

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 20-9 or 20-15)	*1.7*	*1.7*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9 or 20-17)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.905*	*0.905*
Grade adjustment factor [1], f_G (Exhibit 20-7 or 20-13)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV}*f_G)$	*240*	*220*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field measured speed[3], S_{FM}	*mi/h*	Base free-flow speed[3], $BFFS_{FM}$	*65.0 mi/h*
Observed volume[3], V_f	veh/h	Adj. for lane width and shoulder width,[3] f_{LS}(Exh 20-5)	*1.3 mi/h*
Free-flow speed, FFS_d $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points[3], f_A (Exhibit 20-5)	*0.3 mi/h*
Adjustment for no-passing zones, f_{np} (Exhibit 20-19)	*2.8 mi/h*	Free-flow speed, FFS_d $(FSS=BFFS-f_{LS}-f_A)$	*63.5 mi/h*
		Average travel speed, $ATS=FFS-0.00776v_p-f_{np}$	*57.1 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 20-10 or 20-16)	*1.1*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.985*	*0.985*
Grade adjustment factor[1], f_G (Exhibit 20-8 or 20-14)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h)=$V_i/(PHF*f_{HV}*f_G)$	*221*	*202*
Base percent time-spent-following[4], $BPTSF(\%)=100(1-e^{av_d^b})$	*23.5*	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	*48.7*	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$	*49.0*	

Level of Service and Other Performance Measures

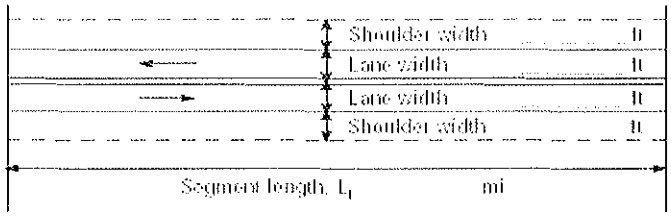
Level of service, LOS (Exhibit 20-3 or 20-4)	*B*
Volume to capacity ratio, $v/c=V_p/1,700$	*0.14*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)=$0.25L_t(V/PHF)$	*424*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=$V*L_t$	*1443*
Peak 15-min total travel time, TT_{15}(veh-h)=VMT_{15}/ATS	*7.4*

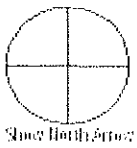
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*Stinger*	Highway / Direction of Travel	*US-89*
Agency or Company	*Fehr & Peers*	From/To	*SR-12 / Panguitch*
Date Performed	*9/12/2007*	Jurisdiction	*Garfield Couty, UT*
Analysis Time Period	*Weekday Average*	Analysis Year	*2020*

Project Description: *06-721 Coal Hollow EIS*

Input Data





Class I highway ■ Class II highway ■

Terrain ■ Level ■ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.87*

No-passing zone *5%*

% Trucks and Buses , P_T *21 %*

% Recreational vehicles, P_R *18%*

Access points/ *mi* *2*

Analysis direction vol., V_d *173*veh/h

Opposing direction vol., V_o *159*veh/h

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 20-9 or 20-15)	*1.7*	*1.7*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9 or 20-17)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.872*	*0.872*
Grade adjustment factor [1], f_G (Exhibit 20-7 or 20-13)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV}*f_G)$	*228*	*210*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field measured speed[3], S_{FM}	*mi/h*	Base free-flow speed[3], $BFFS_{FM}$	*65.0 mi/h*
Observed volume[3], V_f	veh/h	Adj. for lane width and shoulder width,[3] f_{LS}(Exh 20-5)	*1.3 mi/h*
Free-flow speed, FFS_d $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points[3], f_A (Exhibit 20-5)	*0.5 mi/h*
Adjustment for no-passing zones, f_{np} (Exhibit 20-19)	*2.1 mi/h*	Free-flow speed, FFS_d (FSS=BFFS-f_{LS}-f_A)	*63.2 mi/h*
		Average travel speed, ATS=FFS-0.00776v_p-f_{np}	*57.7 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 20-10 or 20-16)	*1.1*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.979*	*0.979*
Grade adjustment factor[1], f_G (Exhibit 20-8 or 20-14)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h)=$V_i/(PHF*f_{HV}*f_G)$	*203*	*187*
Base percent time-spent-following[4], $BPTSF(\%)=100(1-e^{av_d^b})$	*21.8*	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	*21.5*	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$	*33.0*	

Level of Service and Other Performance Measures

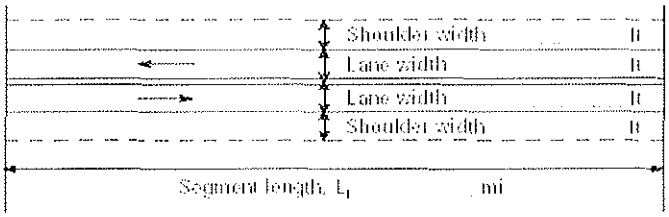
Level of service, LOS (Exhibit 20-3 or 20-4)	*A*
Volume to capacity ratio, v/c=V_p/ 1,700	*0.13*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)=0.25L_t(V/PHF)	*283*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=V*L_t	*986*
Peak 15-min total travel time, TT_{15}(veh-h)=VMT_{15}/ATS	*4.9*

DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*Stinger*	Highway / Direction of Travel	*US-89*
Agency or Company	*Fehr & Peers*	From/To	*SR-12 / Panguitch*
Date Performed	*9/12/2007*	Jurisdiction	*Garfield Couty, UT*
Analysis Time Period	*Weekend*	Analysis Year	*2020*

Project Description: *06-721 Coal Hollow EIS*

Input Data



Analysis direction vol., V_d *183* veh/h

Opposing direction vol., V_o *166* veh/h

■ Class I highway ■ Class II highway

Terrain ■ Level ■ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.85*

No-passing zone *5%*

% Trucks and Buses , P_T *15 %*

% Recreational vehicles, P_R *21%*

Access points/ *mi* *2*

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 20-9 or 20-15)	*1.7*	*1.7*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9 or 20-17)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.905*	*0.905*
Grade adjustment factor [1], f_G (Exhibit 20-7 or 20-13)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV}*f_G)$	*238*	*216*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field measured speed[3], S_{FM}	*mi/h*	Base free-flow speed[3], $BFFS_{FM}$	*65.0 mi/h*
Observed volume[3], V_f	veh/h	Adj. for lane width and shoulder width,[3] f_{LS}(Exh 20-5)	*1.3 mi/h*
Free-flow speed, FFS_d $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points[3], f_A (Exhibit 20-5)	*0.5 mi/h*
Adjustment for no-passing zones, f_{np} (Exhibit 20-19)	*2.0 mi/h*	Free-flow speed, FFS_d $(FSS=BFFS-f_{LS}-f_A)$	*63.2 mi/h*
		Average travel speed, $ATS=FFS-0.00776v_p-f_{np}$	*57.6 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 20-10 or 20-16)	*1.1*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.985*	*0.985*
Grade adjustment factor[1], f_G (Exhibit 20-8 or 20-14)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h)=$V_i/(PHF*f_{HV}*f_G)$	*219*	*198*
Base percent time-spent-following[4], $BPTSF(\%)=100(1-e^{av_d^b})$	*23.3*	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	*21.9*	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$	*34.8*	

Level of Service and Other Performance Measures

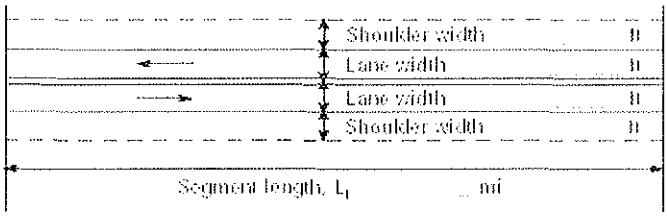
Level of service, LOS (Exhibit 20-3 or 20-4)	*A*
Volume to capacity ratio, $v/c=V_p/1{,}700$	*0.14*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)=$0.25L_t(V/PHF)$	*307*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=$V*L_t$	*1043*
Peak 15-min total travel time, TT_{15}(veh-h)=VMT_{15}/ATS	*5.3*

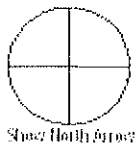
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		*Site Information*	
Analyst	*Stinger*	Highway / Direction of Travel	*US-89*
Agency or Company	*Fehr & Peers*	From/To	*Panguitch / SR-20*
Date Performed	*9/12/2007*	Jurisdiction	*Garfield Couty, UT*
Analysis Time Period	*Weekday Average*	Analysis Year	*2020*

Project Description: *06-721 Coal Hollow EIS*

Input Data





Class I highway ■ Class II highway ■

Terrain ■ Level ■ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.86*

No-passing zone *15%*

% Trucks and Buses , P_T *25 %*

% Recreational vehicles, P_R *12%*

Access points/ *mi* *3*

Analysis direction vol., V_d *132*veh/h

Opposing direction vol., V_o *138*veh/h

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 20-9 or 20-15)	*1.7*	*1.7*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9 or 20-17)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.851*	*0.851*
Grade adjustment factor [1], f_G (Exhibit 20-7 or 20-13)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV}*f_G)$	*180*	*189*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field measured speed[3], S_{FM}	*mi/h*	Base free-flow speed[3], $BFFS_{FM}$	*65.0 mi/h*
Observed volume[3], V_f	veh/h	Adj. for lane width and shoulder width,[3] f_{LS}(Exh 20-5)	*1.3 mi/h*
Free-flow speed, FFS_d $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points[3], f_A (Exhibit 20-5)	*0.8 mi/h*
Adjustment for no-passing zones, f_{np} (Exhibit 20-19)	*2.0 mi/h*	Free-flow speed, FFS_d (FSS=BFFS-f_{LS}-f_A)	*63.0 mi/h*
		Average travel speed, ATS=FFS-0.00776v_p-f_{np}	*58.1 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 20-10 or 20-16)	*1.1*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.976*	*0.976*
Grade adjustment factor[1], f_G (Exhibit 20-8 or 20-14)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h)=$V_i/(PHF*f_{HV}*f_G)$	*157*	*164*
Base percent time-spent-following[4], $BPTSF(\%)=100(1-e^{av_d^b})$	*17.4*	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	*29.9*	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$	*32.0*	

Level of Service and Other Performance Measures

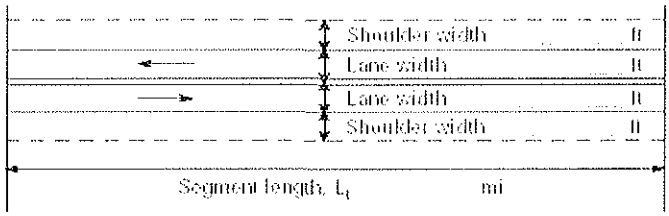
Level of service, LOS (Exhibit 20-3 or 20-4)	*A*
Volume to capacity ratio, v/c=V_p/ 1,700	*0.11*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)=0.25L_t(V/PHF)	*361*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=V*L_t	*1241*
Peak 15-min total travel time, TT_{15}(veh-h)=VMT_{15}/ATS	*6.2*

DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*Stinger*	Highway / Direction of Travel	*US-89*
Agency or Company	*Fehr & Peers*	From/To	*Panguitch / SR-20*
Date Performed	*9/12/2007*	Jurisdiction	*Garfield Couty, UT*
Analysis Time Period	*Weekend*	Analysis Year	*2020*

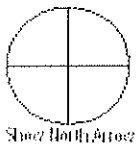
Project Description: *06-721 Coal Hollow EIS*

Input Data



Analysis direction vol., V_d *189* veh/h

Opposing direction vol., V_o *139* veh/h



Class I highway ■ Class II highway ■

Terrain ■ Level ■ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.94*

No-passing zone *15%*

% Trucks and Buses , P_T *36 %*

% Recreational vehicles, P_R *14%*

Access points/ *mi* *3*

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 20-9 or 20-15)	*1.7*	*1.7*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9 or 20-17)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.799*	*0.799*
Grade adjustment factor [1], f_G (Exhibit 20-7 or 20-13)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV}*f_G)$	*252*	*185*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field measured speed[3], S_{FM}	*mi/h*	Base free-flow speed[3], $BFFS_{FM}$	*65.0 mi/h*
Observed volume[3], V_f	veh/h	Adj. for lane width and shoulder width,[3] f_{LS}(Exh 20-5)	*1.3 mi/h*
Free-flow speed, FFS_d $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points[3], f_A (Exhibit 20-5)	*0.8 mi/h*
Adjustment for no-passing zones, f_{np} (Exhibit 20-19)	*1.9 mi/h*	Free-flow speed, FFS_d $(FSS=BFFS-f_{LS}-f_A)$	*63.0 mi/h*
		Average travel speed, $ATS=FFS-0.00776v_p-f_{np}$	*57.7 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 20-10 or 20-16)	*1.1*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.965*	*0.965*
Grade adjustment factor[1], f_G (Exhibit 20-8 or 20-14)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h)=$V_i/(PHF*f_{HV}*f_G)$	*208*	*153*
Base percent time-spent-following[4], $BPTSF(\%)=100(1-e^{av_d^b})$	*22.3*	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	*30.6*	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$	*39.9*	

Level of Service and Other Performance Measures

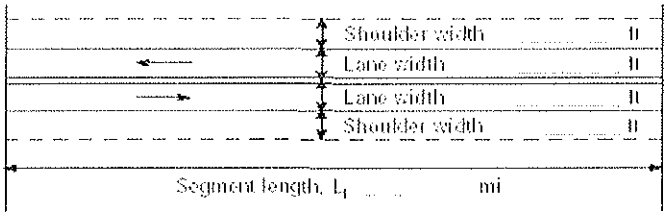
Level of service, LOS (Exhibit 20-3 or 20-4)	*B*
Volume to capacity ratio, $v/c=V_p/1,700$	*0.15*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)=$0.25L_t(V/PHF)$	*472*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=$V*L_t$	*1777*
Peak 15-min total travel time, TT_{15}(veh-h)=VMT_{15}/ATS	*8.2*

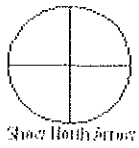
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*Stinger*	Highway / Direction of Travel	*SR-20*
Agency or Company	*Fehr & Peers*	From/To	*US-89 / Upslope*
Date Performed	*9/12/2007*	Jurisdiction	*Iron County, UT*
Analysis Time Period	*Weekday Average*	Analysis Year	*2020*

Project Description: *06-721 Coal Hollow EIS*

Input Data





Class I highway ■ Class II highway

Terrain ■ Level ■ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.85*

No-passing zone *45%*

% Trucks and Buses , P_T *27 %*

% Recreational vehicles, P_R *14%*

Access points/ *mi* *0*

Analysis direction vol., V_d *107*veh/h

Opposing direction vol., V_o *121*veh/h

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 20-9 or 20-15)	*1.7*	*1.7*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9 or 20-17)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.841*	*0.841*
Grade adjustment factor [1], f_G (Exhibit 20-7 or 20-13)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV}*f_G)$	*150*	*169*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field measured speed[3], S_{FM}	*mi/h*	Base free-flow speed[3], $BFFS_{FM}$	*50.0 mi/h*
Observed volume[3], V_f	veh/h	Adj. for lane width and shoulder width,[3] f_{LS}(Exh 20-5)	*1.3 mi/h*
Free-flow speed, FFS_d $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points[3], f_A (Exhibit 20-5)	*0.0 mi/h*
Adjustment for no-passing zones, f_{np} (Exhibit 20-19)	*1.8 mi/h*	Free-flow speed, FFS_d $(FSS=BFFS-f_{LS}-f_A)$	*48.7 mi/h*
		Average travel speed, $ATS=FFS-0.00776v_p-f_{np}$	*44.4 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 20-10 or 20-16)	*1.1*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.974*	*0.974*
Grade adjustment factor[1], f_G (Exhibit 20-8 or 20-14)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h)=$V_i/(PHF*f_{HV}*f_G)$	*129*	*146*
Base percent time-spent-following[4], $BPTSF(\%)=100(1-e^{av_d^b})$	*14.6*	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	*44.8*	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$	*35.7*	

Level of Service and Other Performance Measures

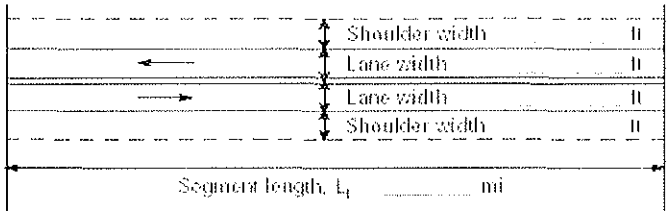
Level of service, LOS (Exhibit 20-3 or 20-4)	*D*
Volume to capacity ratio, v/c=V_p/ 1,700	*0.09*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)=$0.25L_t(V/PHF)$	*267*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=$V*L_t$	*910*
Peak 15-min total travel time, TT_{15}(veh-h)=VMT_{15}/ATS	*6.0*

DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*Stinger*	Highway / Direction of Travel	*SR-20*
Agency or Company	*Fehr & Peers*	From/To	*US-89 / Upslope*
Date Performed	*9/12/2007*	Jurisdiction	*Iron County, UT*
Analysis Time Period	*Weekend*	Analysis Year	*2020*

Project Description: *06-721 Coal Hollow EIS*

Input Data



Class I highway ■ Class II highway

Terrain ■ Level ■ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.85*

No-passing zone *45%*

% Trucks and Buses , P_T *27 %*

% Recreational vehicles, P_R *14%*

Access points/ *mi* *0*

Analysis direction vol., V_d *168*veh/h

Opposing direction vol., V_o *121*veh/h

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 20-9 or 20-15)	*1.7*	*1.7*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9 or 20-17)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.841*	*0.841*
Grade adjustment factor [1], f_G (Exhibit 20-7 or 20-13)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV}*f_G)$	*235*	*169*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field measured speed[3], S_{FM}	*mi/h*	Base free-flow speed[3], $BFFS_{FM}$	*50.0 mi/h*
Observed volume[3], V_f	veh/h	Adj. for lane width and shoulder width,[3] f_{LS}(Exh 20-5)	*1.3 mi/h*
Free-flow speed, FFS_d $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points[3], f_A (Exhibit 20-5)	*0.0 mi/h*
Adjustment for no-passing zones, f_{np} (Exhibit 20-19)	*1.8 mi/h*	Free-flow speed, FFS_d (FSS=BFFS-f_{LS}-f_A)	*48.7 mi/h*
		Average travel speed, ATS=FFS-0.00776v_p-f_{np}	*43.7 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 20-10 or 20-16)	*1.1*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.974*	*0.974*
Grade adjustment factor[1], f_G (Exhibit 20-8 or 20-14)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h)=$V_i/(PHF*f_{HV}*f_G)$	*203*	*146*
Base percent time-spent-following[4], $BPTSF(\%)=100(1-e^{av_d^b})$	*21.8*	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	*47.5*	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$	*49.5*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 or 20-4)	*D*
Volume to capacity ratio, v/c=V_p/ 1,700	*0.14*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)=0.25L_t(V/PHF)	*420*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=V*L_t	*1428*
Peak 15-min total travel time, TT_{15}(veh-h)=VMT_{15}/ATS	*9.6*

2

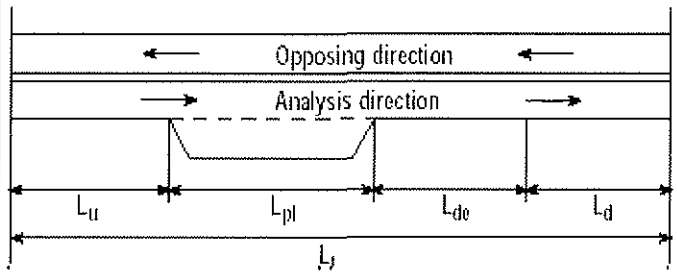
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET WITH PASSING LANE WORKSHEET

General Information		***Site Information***	
Analyst	*Stinger*	Highway of Travel	*SR-20*
Agency or Company	*Fehr & Peers*	From/To	*Upslope / Summit*
Date Performed	*9/12/2007*	Jurisdiction	*Iron County, UT*
Analysis Time Period	*Weekday Average*	Analysis Year	*2020*

Project Description: *06-721 Coal Hollow EIS*

Input Data

☐ Class I highway ☑ Class II highway



Total length of analysis segment, L_t (*mi*)	*2.3*
Length of two-lane highway upstream of the passing lane, L_u (*mi*)	*0.0*
Length of passing lane including tapers , L_{pl} (*mi*)	*2.2*
Average travel speed, ATS_d (from Directional Two-Lane Highway Segment Worksheet)	*34.1*
Percent time-spent-following, $PTSF_d$ (from Directional Two-Lane Highway Segment Worksheet)	*24.5*
Level of service[1], LOS_d (from Directional Two-Lane Highway Segment Worksheet)	*A*
Average Travel Speed	
Downstream length of two-lane highway within effective length of passing lane for average travel speed, L_{de} (*mi*) (Exhibit 20-23)	*1.70*
Length of two-lane highway downstream of effective length of the passing lane for avg travel speed, L_d (*mi*) $L_d=L_t-(L_u+L_{pl}+L_{de})$	*-1.60*
Adj. factor for the effect of passing lane on average speed, f_{pl} (Exhibit 20-24)	*1.10*
Average travel speed including passing lane[2], $ATS_{pl} = (ATS_d * L_t) / (L_u+L_d+(L_{pl}/f_{pl})+ (2L_{de}/(1+f_{pl}))$)	*37.5*
Percent Time-Spent-Following	
Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, L_{de} (*mi*)(Exhibit 20-23)	*13.00*
Length of two-lane highway downstream of effective length of the passing lane for percent-time-following, L_d (*mi*)$=L_t-(L_u+L_{pl}+L_{de})$	*-12.90*
Adj. factor for the effect of passing lane on percent time-spent-following, f_{pl}(Exhibit 20-24)	*0.58*
Percent time-spent-following including passing lane[3], $PTSF_{pl}$(%) $PTSF_{pl}= PTSF_d[L_u+L_d+f_{pl}L_{pl}+((1+f_{pl})/2)L_{de}]/L_t$	*14.2*

2

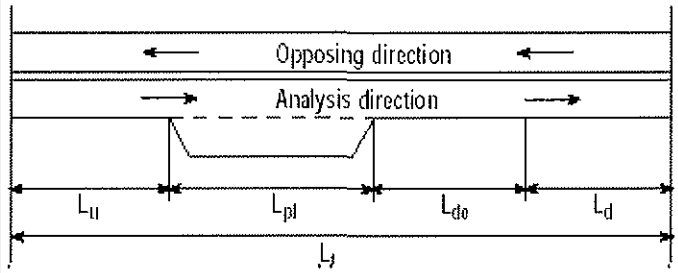
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET WITH PASSING LANE WORKSHEET

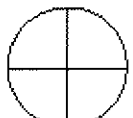
General Information		***Site Information***	
Analyst	*Stinger*	Highway of Travel	*SR-20*
Agency or Company	*Fehr & Peers*	From/To	*Upslope / Summit*
Date Performed	*9/12/2007*	Jurisdiction	*Iron County, UT*
Analysis Time Period	*Weekend*	Analysis Year	*2020*

Project Description: *06-721 Coal Hollow EIS*

Input Data

☐ Class I highway ☑ Class II highway




Show North Arrow

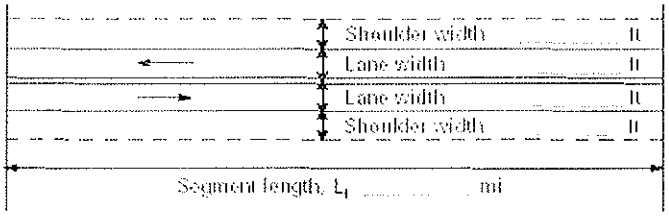
Total length of analysis segment, L_t (*mi*)	*2.3*
Length of two-lane highway upstream of the passing lane, L_u (*mi*)	*0.0*
Length of passing lane including tapers , L_{pl} (*mi*)	*2.0*
Average travel speed, ATS_d (from Directional Two-Lane Highway Segment Worksheet)	*31.6*
Percent time-spent-following, $PTSF_d$ (from Directional Two-Lane Highway Segment Worksheet)	*31.9*
Level of service[1], LOS_d (from Directional Two-Lane Highway Segment Worksheet)	*A*
Average Travel Speed	
Downstream length of two-lane highway within effective length of passing lane for average travel speed, L_{de} (*mi*) (Exhibit 20-23)	*1.70*
Length of two-lane highway downstream of effective length of the passing lane for avg travel speed, L_d (*mi*) $L_d=L_t-(L_u+L_{pl}+L_{de})$	*-1.40*
Adj. factor for the effect of passing lane on average speed, f_{pl} (Exhibit 20-24)	*1.11*
Average travel speed including passing lane[2], $ATS_{pl} = (ATS_d * L_t) / (L_u+L_d+(L_{pl}/f_{pl})+ (2L_{de}/(1+f_{pl}))$)	*35.0*
Percent Time-Spent-Following	
Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, L_{de} (*mi*)(Exhibit 20-23)	*11.87*
Length of two-lane highway downstream of effective length of the passing lane for percent-time-following, L_d (*mi*)$=L_t-(L_u+L_{pl}+L_{de})$	*-11.57*
Adj. factor for the effect of passing lane on percent time-spent-following, f_{pl}(Exhibit 20-24)	*0.58*
Percent time-spent-following including passing lane[3], $PTSF_{pl}$(%) $PTSF_{pl}= PTSF_d[L_u+L_d+f_{pl}L_{pl}+\{(1+f_{pl})/2\}L_{de}]/L_t$	*18.5*

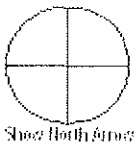
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*Stinger*	Highway / Direction of Travel	*SR-20*
Agency or Company	*Fehr & Peers*	From/To	*Summit / Downslope*
Date Performed	*9/12/2007*	Jurisdiction	*Iron County, UT*
Analysis Time Period	*Weekday Average*	Analysis Year	*2020*

Project Description: *06-721 Coal Hollow EIS*

Input Data





Class I highway ■ Class II highway

Terrain ■ Level ■ Rolling

Grade Length *1.30* mi Up/down *7.1*

Peak-hour factor, PHF *0.85*

No-passing zone *100%*

% Trucks and Buses , P_T *27 %*

% Recreational vehicles, P_R *14%*

Access points/ *mi* *1*

Analysis direction vol., V_d *107*veh/h

Opposing direction vol., V_o *121*veh/h

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 20-9 or 20-15)	*12.9*	*12.9*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9 or 20-17)	*1.6*	*1.6*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.233*	*0.233*
Grade adjustment factor [1], f_G (Exhibit 20-7 or 20-13)	*1.00*	*0.91*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV}*f_G)$	*541*	*672*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field measured speed[3], S_{FM}	*mi/h*	Base free-flow speed[3], $BFFS_{FM}$	*60.0 mi/h*
Observed volume[3], V_f	veh/h	Adj. for lane width and shoulder width,[3] f_{LS}(Exh 20-5)	*1.3 mi/h*
Free-flow speed, FFS_d $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points[3], f_A (Exhibit 20-5)	*0.3 mi/h*
Adjustment for no-passing zones, f_{np} (Exhibit 20-19)	*1.8 mi/h*	Free-flow speed, FFS_d $(FSS=BFFS-f_{LS}-f_A)$	*58.5 mi/h*
		Average travel speed, $ATS=FFS-0.00776v_p-f_{np}$	*47.3 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 20-10 or 20-16)	*2.8*	*2.8*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.673*	*0.673*
Grade adjustment factor[1], f_G (Exhibit 20-8 or 20-14)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h)$=V_i/(PHF*f_{HV}*f_G)$	*187*	*212*
Base percent time-spent-following[4], $BPTSF(\%)=100(1-e^{av_d^b})$	*20.7*	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	*60.1*	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$	*48.8*	

Level of Service and Other Performance Measures

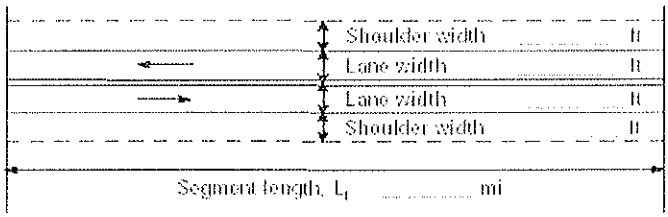
Level of service, LOS (Exhibit 20-3 or 20-4)	*C*
Volume to capacity ratio, $v/c=V_p/1{,}700$	*0.32*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)$=0.25L_t(V/PHF)$	*41*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)$=V*L_t$	*139*
Peak 15-min total travel time, TT_{15}(veh-h)$=VMT_{15}/ATS$	*0.9*

DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*Stinger*	Highway / Direction of Travel	*SR-20*
Agency or Company	*Fehr & Peers*	From/To	*Summit / Downslope*
Date Performed	*9/12/2007*	Jurisdiction	*Iron County, UT*
Analysis Time Period	*Weekend*	Analysis Year	*2020*

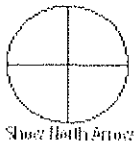
Project Description: *06-721 Coal Hollow EIS*

Input Data



Analysis direction vol., V_d *168* veh/h

Opposing direction vol., V_o *121* veh/h



Class I highway ■ Class II highway

Terrain ■ Level ■ Rolling

Grade Length *1.30* mi Up/down *7.1*

Peak-hour factor, PHF *0.85*

No-passing zone *100%*

% Trucks and Buses , P_T *27 %*

% Recreational vehicles, P_R *14%*

Access points/ *mi* *1*

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 20-9 or 20-15)	*12.9*	*12.9*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9 or 20-17)	*1.6*	*1.6*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.233*	*0.233*
Grade adjustment factor [1], f_G (Exhibit 20-7 or 20-13)	*1.00*	*0.91*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV}*f_G)$	*849*	*672*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field measured speed[3], S_{FM}	*mi/h*	Base free-flow speed[3], $BFFS_{FM}$	*60.0 mi/h*
Observed volume[3], V_f	veh/h	Adj. for lane width and shoulder width,[3] f_{LS}(Exh 20-5)	*1.3 mi/h*
Free-flow speed, FFS_d $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points[3], f_A (Exhibit 20-5)	*0.3 mi/h*
Adjustment for no-passing zones, f_{np} (Exhibit 20-19)	*1.8 mi/h*	Free-flow speed, FFS_d $(FSS=BFFS-f_{LS}-f_A)$	*58.5 mi/h*
		Average travel speed, $ATS=FFS-0.00776v_p-f_{np}$	*44.9 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 20-10 or 20-16)	*2.8*	*2.8*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.673*	*0.673*
Grade adjustment factor[1], f_G (Exhibit 20-8 or 20-14)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h)=$V_i/(PHF*f_{HV}*f_G)$	*294*	*212*
Base percent time-spent-following[4], $BPTSF(\%)=100(1-e^{av_d^b})$	*30.2*	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	*56.5*	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$	*63.0*	

Level of Service and Other Performance Measures

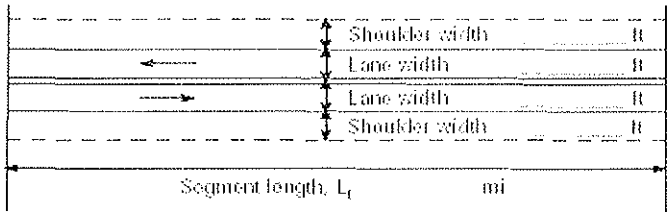
Level of service, LOS (Exhibit 20-3 or 20-4)	*D*
Volume to capacity ratio, $v/c=V_p/1{,}700$	*0.50*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)=$0.25L_t(V/PHF)$	*64*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=$V*L_t$	*218*
Peak 15-min total travel time, TT_{15}(veh-h)=VMT_{15}/ATS	*1.4*

DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*Stinger*	Highway / Direction of Travel	*SR-20*
Agency or Company	*Fehr & Peers*	From/To	*Downslope / I-15*
Date Performed	*7/24/2007*	Jurisdiction	*Iron County, UT*
Analysis Time Period	*Weekday average*	Analysis Year	*2020*

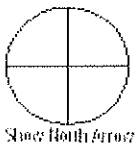
Project Description: *06-721 Coal Hollow EIS*

Input Data



Analysis direction vol., V_d *107* veh/h

Opposing direction vol., V_o *121* veh/h



Class I highway ■ Class II highway

Terrain ■ Level ■ Rolling

Grade Length *4.00* mi Up/down *3.4*

Peak-hour factor, PHF *0.85*

No-passing zone *70%*

% Trucks and Buses , P_T *27 %*

% Recreational vehicles, P_R *14%*

Access points/ *mi* *1*

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 20-9 or 20-15)	*9.1*	*9.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9 or 20-17)	*1.5*	*1.5*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.307*	*0.307*
Grade adjustment factor [1], f_G (Exhibit 20-7 or 20-13)	*1.00*	*0.94*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV}*f_G)$	*410*	*493*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field measured speed[3], S_{FM}	*mi/h*	Base free-flow speed[3], $BFFS_{FM}$	*60.0 mi/h*
Observed volume[3], V_f	veh/h	Adj. for lane width and shoulder width,[3] f_{LS}(Exh 20-5)	*1.3 mi/h*
Free-flow speed, FFS_d $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points[3], f_A (Exhibit 20-5)	*0.3 mi/h*
Adjustment for no-passing zones, f_{np} (Exhibit 20-19)	*2.2 mi/h*	Free-flow speed, FFS_d (FSS=BFFS-f_{LS}-f_A)	*58.5 mi/h*
		Average travel speed, $ATS=FFS-0.00776v_p-f_{np}$	*49.3 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 20-10 or 20-16)	*1.5*	*1.5*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.881*	*0.881*
Grade adjustment factor[1], f_G (Exhibit 20-8 or 20-14)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h)=$V_i/(PHF*f_{HV}*f_G)$	*143*	*162*
Base percent time-spent-following[4], $BPTSF(\%)=100(1-e^{av_d^b})$	*16.1*	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	*53.0*	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$	*40.9*	

Level of Service and Other Performance Measures

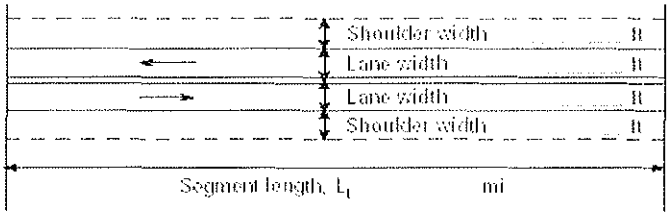
Level of service, LOS (Exhibit 20-3 or 20-4)	*C*
Volume to capacity ratio, v/c=V_p/ 1,700	*0.24*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)=$0.25L_t(V/PHF)$	*245*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=$V*L_t$	*835*
Peak 15-min total travel time, TT_{15}(veh-h)=VMT_{15}/ATS	*5.0*

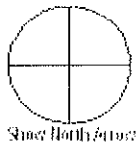
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*Stinger*	Highway / Direction of Travel	*SR-20*
Agency or Company	*Fehr & Peers*	From/To	*Downslope / I-15*
Date Performed	*9/12/2007*	Jurisdiction	*Iron County, UT*
Analysis Time Period	*Weekend*	Analysis Year	*2020*

Project Description: *06-721 Coal Hollow EIS*

Input Data





Class I highway ■ Class II highway

Terrain ■ Level ■ Rolling

Grade Length *4.00* mi Up/down *3.4*

Peak-hour factor, PHF *0.85*

No-passing zone *70%*

% Trucks and Buses , P_T *27 %*

% Recreational vehicles, P_R *14%*

Access points/ *mi* *1*

Analysis direction vol., V_d *160*veh/h

Opposing direction vol., V_o *121*veh/h

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 20-9 or 20-15)	*9.1*	*9.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9 or 20-17)	*1.5*	*1.5*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.307*	*0.307*
Grade adjustment factor [1], f_G (Exhibit 20-7 or 20-13)	*1.00*	*0.94*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV}*f_G)$	*613*	*493*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field measured speed[3], S_{FM}	*mi/h*	Base free-flow speed[3], $BFFS_{FM}$	*60.0 mi/h*
Observed volume[3], V_f	veh/h	Adj. for lane width and shoulder width,[3] f_{LS}(Exh 20-5)	*1.3 mi/h*
Free-flow speed, FFS_d $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points[3], f_A (Exhibit 20-5)	*0.3 mi/h*
Adjustment for no-passing zones, f_{np} (Exhibit 20-19)	*2.2 mi/h*	Free-flow speed, FFS_d (FSS=BFFS-f_{LS}-f_A)	*58.5 mi/h*
		Average travel speed, ATS=FFS-0.00776v_p-f_{np}	*47.7 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 20-10 or 20-16)	*1.5*	*1.5*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.881*	*0.881*
Grade adjustment factor[1], f_G (Exhibit 20-8 or 20-14)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h)=$V_i/(PHF*f_{HV}*f_G)$	*214*	*162*
Base percent time-spent-following[4], $BPTSF(\%)=100(1-e^{av_d^b})$	*22.8*	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	*56.8*	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$	*55.2*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 or 20-4)	*C*
Volume to capacity ratio, v/c=V_p/ 1,700	*0.36*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)=0.25L_t(V/PHF)	*367*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=V*L_t	*1248*
Peak 15-min total travel time, TT_{15}(veh-h)=VMT_{15}/ATS	*7.7*

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*Stinger*	Intersection	*US-89 / SR-12*
Agency/Co.	*Fehr & Peers*	Jurisdiction	*Panguitch, UT*
Date Performed	*9/11/2007*	Analysis Year	*2020*
Analysis Time Period	*8:00 - 9:00*		

Project Description *06-721 Coal Hollow EIS*

East/West Street: *SR-12*	North/South Street: *US-89*
Intersection Orientation: *North-South*	Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*41*	*31*	*56*	*34*	
Peak-Hour Factor, PHF	*1.00*	*0.85*	*0.85*	*0.85*	*0.85*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*0*	*48*	*36*	*65*	*39*	*0*
Percent Heavy Vehicles	*0*	--	--	*25*	--	--
Median Type	*Undivided*					
RT Channelized			*1*			*0*
Lanes	*0*	*1*	*1*	*1*	*1*	*0*
Configuration		*T*	*R*	*L*	*T*	
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*48*		*40*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*0.85*	*1.00*	*0.85*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*56*	*0*	*47*
Percent Heavy Vehicles	*0*	*0*	*0*	*21*	*0*	*10*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*1*
Lanes	*0*	*0*	*0*	*1*	*0*	*1*
Configuration				*L*		*R*

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*L*	*L*		*R*			
v (veh/h)		*65*	*56*		*47*			
C (m) (veh/h)		*1424*	*698*		*999*			
v/c		*0.05*	*0.08*		*0.05*			
95% queue length		*0.14*	*0.26*		*0.15*			
Control Delay (s/veh)		*7.6*	*10.6*		*8.8*			
LOS		*A*	*B*		*A*			
Approach Delay (s/veh)	--	--	*9.8*					
Approach LOS	--	--	*A*					

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DELAY 6.0
LOS A

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Stinger*
Agency/Co.	*Fehr & Peers*
Date Performed	*9/11/2007*
Analysis Time Period	*16:00 - 17:00*

Site Information

Intersection	*US-89 / SR-12*
Jurisdiction	*Panguitch, UT*
Analysis Year	*2020*

Project Description *06-721 Coal Hollow EIS*

East/West Street: *SR-12* | North/South Street: *US-89*

Intersection Orientation: *North-South* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*94*	*82*	*44*	*54*	
Peak-Hour Factor, PHF	*1.00*	*0.89*	*0.89*	*0.89*	*0.89*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*0*	*105*	*92*	*49*	*60*	*0*
Percent Heavy Vehicles	*0*	--	--	*25*	--	--
Median Type	*Undivided*					
RT Channelized			*1*			*0*
Lanes	*0*	*1*	*1*	*1*	*1*	*0*
Configuration		*T*	*R*	*L*	*T*	
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*78*		*78*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*0.89*	*1.00*	*0.89*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*87*	*0*	*87*
Percent Heavy Vehicles	*0*	*0*	*0*	*13*	*0*	*4*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*1*
Lanes	*0*	*0*	*0*	*1*	*0*	*1*
Configuration				*L*		*R*

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*L*	*L*		*R*			
v (veh/h)		*49*	*87*		*87*			
C (m) (veh/h)		*1354*	*678*		*944*			
v/c		*0.04*	*0.13*		*0.09*			
95% queue length		*0.11*	*0.44*		*0.30*			
Control Delay (s/veh)		*7.8*	*11.1*		*9.2*			
LOS		*A*	*B*		*A*			
Approach Delay (s/veh)	--	--	*10.1*					
Approach LOS	--	--	*B*					

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DELAY 5.0

LOS A

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*Stinger*	Intersection	*US-89 / SR-14*
Agency/Co.	*Fehr & Peers*	Jurisdiction	*Panguitch, UT*
Date Performed	*9/11/2007*	Analysis Year	*2020*
Analysis Time Period	*8:00 - 9:00*		

Project Description *06-721 Coal Hollow EIS*

East/West Street: *SR-14* North/South Street: *US-89*

Intersection Orientation: *North-South* Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*33*	*62*	*1*	*3*	*67*	*17*
Peak-Hour Factor, PHF	*0.85*	*0.85*	*0.85*	*0.85*	*0.85*	*0.85*
Hourly Flow Rate, HFR (veh/h)	*38*	*72*	*1*	*3*	*78*	*19*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*1*	*1*	*0*	*0*	*2*	*0*
Configuration	*L*		*TR*	*LT*		*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*19*	*4*	*20*	*0*	*1*	*4*
Peak-Hour Factor, PHF	*0.85*	*0.85*	*0.85*	*0.85*	*0.85*	*0.85*
Hourly Flow Rate, HFR (veh/h)	*22*	*4*	*23*	*0*	*1*	*4*
Percent Heavy Vehicles	*6*	*0*	*5*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*	*LT*		*LTR*			*LTR*	
v (veh/h)	*38*	*3*		*5*			*49*	
C (m) (veh/h)	*1509*	*1540*		*886*			*784*	
v/c	*0.03*	*0.00*		*0.01*			*0.06*	
95% queue length	*0.08*	*0.01*		*0.02*			*0.20*	
Control Delay (s/veh)	*7.4*	*7.3*		*9.1*			*9.9*	
LOS	*A*	*A*		*A*			*A*	
Approach Delay (s/veh)	--	--	*9.1*			*9.9*		
Approach LOS	--	--	*A*			*A*		

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DELAY 3.6
LOS A

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*Stinger*	Intersection	*US-89 / SR-14*
Agency/Co.	*Fehr & Peers*	Jurisdiction	*Panguitch, UT*
Date Performed	*9/11/2007*	Analysis Year	*2020*
Analysis Time Period	*16:00 - 17:00*		

Project Description *06-721 Coal Hollow EIS*

East/West Street: *SR-14*	North/South Street: *US-89*
Intersection Orientation: *North-South*	Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*33*	*154*	*0*	*5*	*105*	*26*
Peak-Hour Factor, PHF	*0.91*	*0.91*	*0.91*	*0.91*	*0.91*	*0.91*
Hourly Flow Rate, HFR (veh/h)	*36*	*169*	*0*	*5*	*115*	*28*
Percent Heavy Vehicles	*3*	--	--	*50*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*1*	*1*	*0*	*0*	*2*	*0*
Configuration	*L*		*TR*	*LT*		*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*25*	*1*	*29*	*0*	*0*	*0*
Peak-Hour Factor, PHF	*0.91*	*0.91*	*0.91*	*0.91*	*0.91*	*0.91*
Hourly Flow Rate, HFR (veh/h)	*27*	*1*	*31*	*0*	*0*	*0*
Percent Heavy Vehicles	*9*	*0*	*7*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*	*LT*		*LTR*			*LTR*	
v (veh/h)	*36*	*5*		*0*			*59*	
C (m) (veh/h)	*1430*	*1117*					*688*	
v/c	*0.03*	*0.00*					*0.09*	
95% queue length	*0.08*	*0.01*					*0.28*	
Control Delay (s/veh)	*7.6*	*8.2*					*10.7*	
LOS	*A*	*A*					*B*	
Approach Delay (s/veh)	--	--				*10.7*		
Approach LOS	--	--				*B*		

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DELAY 2.5

LOS A

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Stinger*
Agency/Co.	*Fehr & Peers*
Date Performed	*9/11/2007*
Analysis Time Period	*8:00 - 9:00*

Site Information

Intersection	*US-89 / SR-20*
Jurisdiction	*Panguitch, UT*
Analysis Year	*2020*

Project Description *06-721 Coal Hollow EIS*

East/West Street: *SR-20* North/South Street: *US-89*

Intersection Orientation: *East-West* Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*11*		*42*			
Peak-Hour Factor, PHF	*0.84*	*1.00*	*0.84*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*13*	*0*	*50*	*0*	*0*	*0*
Percent Heavy Vehicles	*18*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*1*	*0*	*1*	*0*	*0*	*0*
Configuration	*L*		*R*			
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*47*	*35*			*19*	*9*
Peak-Hour Factor, PHF	*0.84*	*0.84*	*1.00*	*1.00*	*0.84*	*0.84*
Hourly Flow Rate, HFR (veh/h)	*55*	*41*	*0*	*0*	*22*	*10*
Percent Heavy Vehicles	*19*	*23*	*0*	*0*	*24*	*50*
Percent Grade (%)	*0*			*0*		
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*1*	*1*	*0*	*0*	*1*	*1*
Configuration	*L*	*T*			*T*	*R*

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*		*L*	*T*			*T*	*R*
v (veh/h)	*13*		*55*	*41*			*22*	*10*
C (m) (veh/h)	*1524*		*885*	*821*			*767*	*960*
v/c	*0.01*		*0.06*	*0.05*			*0.03*	*0.01*
95% queue length	*0.03*		*0.20*	*0.16*			*0.09*	*0.03*
Control Delay (s/veh)	*7.4*		*9.3*	*9.6*			*9.8*	*8.8*
LOS	*A*		*A*	*A*			*A*	*A*
Approach Delay (s/veh)	--	--	*9.5*			*9.5*		
Approach LOS	--	--	*A*			*A*		

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DELAY 8.01

LOS A

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*Stinger*	Intersection	*US-89 / SR-20*
Agency/Co.	*Fehr & Peers*	Jurisdiction	*Panguitch, UT*
Date Performed	*9/11/2007*	Analysis Year	*2020*
Analysis Time Period	*16:00 - 17:00*		

Project Description *06-721 Coal Hollow EIS*

East/West Street: *SR-20*	North/South Street: *US-89*
Intersection Orientation: *East-West*	Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*32*		*72*			
Peak-Hour Factor, PHF	*0.95*	*1.00*	*0.95*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*33*	*0*	*75*	*0*	*0*	*0*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*1*	*0*	*1*	*0*	*0*	*0*
Configuration	*L*		*R*			
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*98*	*44*			*45*	*13*
Peak-Hour Factor, PHF	*0.95*	*0.95*	*1.00*	*1.00*	*0.95*	*0.95*
Hourly Flow Rate, HFR (veh/h)	*103*	*46*	*0*	*0*	*47*	*13*
Percent Heavy Vehicles	*13*	*13*	*0*	*0*	*16*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*1*	*1*	*0*	*0*	*1*	*1*
Configuration	*L*	*T*			*T*	*R*

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*		*L*	*T*			*T*	*R*
v (veh/h)	*33*		*103*	*46*			*47*	*13*
C (m) (veh/h)	*1636*		*795*	*788*			*710*	*1091*
v/c	*0.02*		*0.13*	*0.06*			*0.07*	*0.01*
95% queue length	*0.06*		*0.44*	*0.19*			*0.21*	*0.04*
Control Delay (s/veh)	*7.2*		*10.2*	*9.9*			*10.4*	*8.3*
LOS	*A*		*B*	*A*			*B*	*A*
Approach Delay (s/veh)	--	--	*10.1*			*10.0*		
Approach LOS	--	--	*B*			*A*		

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DELAY 7.7

LOS A

ALL-WAY STOP CONTROL ANALYSIS

General Information

Analyst	Stinger
Agency/Co.	Fehr & Peers
Date Performed	9/11/2007
Analysis Time Period	8:00 - 9:00

Site Information

Intersection	US-89 / Main Street
Jurisdiction	Panguitch, UT
Analysis Year	2020

Project ID 06-721 Coal Hollow EIS

East/West Street: US-89 / Center Street | North/South Street: SR-143 / US-89

Volume Adjustments and Site Characteristics

Approach	Eastbound			Westbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	7	26	4	23	16	83
%Thrus Left Lane						

Approach	Northbound			Southbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	5	42	48	84	26	11
%Thrus Left Lane						

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Configuration	LT	R	LT	R	LT	R	L	TR
PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Flow Rate (veh/h)	36	4	44	94	52	54	95	41
% Heavy Vehicles	0	0	6	14	5	0	18	0
No. Lanes	2		2		2		2	
Geometry Group	5		5		5		5	
Duration, T	0.25							

Saturation Headway Adjustment Worksheet

Prop. Left-Turns	0.2	0.0	0.6	0.0	0.1	0.0	1.0	0.0
Prop. Right-Turns	0.0	1.0	0.0	1.0	0.0	1.0	0.0	0.3
Prop. Heavy Vehicle	0.0	0.0	0.1	0.1	0.0	0.0	0.2	0.0
hLT-adj	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
hRT-adj	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7
hHV-adj	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
hadj, computed	0.1	-0.7	0.4	-0.5	0.1	-0.7	0.8	-0.2

Departure Headway and Service Time

hd, initial value (s)	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20
x, initial	0.03	0.00	0.04	0.08	0.05	0.05	0.08	0.04
hd, final value (s)	5.34	4.54	5.55	4.69	5.21	4.38	5.84	4.83
x, final value	0.05	0.01	0.07	0.12	0.08	0.07	0.15	0.05
Move-up time, m (s)	2.3		2.3		2.3		2.3	
Service Time, t_s (s)	3.0	2.2	3.2	2.4	2.9	2.1	3.5	2.5

Capacity and Level of Service

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Capacity (veh/h)	286	254	294	344	302	304	345	291
Delay (s/veh)	8.34	7.27	8.65	8.04	8.33	7.38	9.60	7.81
LOS	A	A	A	A	A	A	A	A
Approach: Delay (s/veh)	8.23		8.23		7.85		9.06	
LOS	A		A		A		A	
Intersection Delay (s/veh)	8.40							
Intersection LOS	A							

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ALL-WAY STOP CONTROL ANALYSIS

General Information

Analyst	Stinger
Agency/Co.	Fehr & Peers
Date Performed	9/11/2007
Analysis Time Period	16:15 - 17:15

Site Information

Intersection	US-89 / Main Street
Jurisdiction	Panguitch, UT
Analysis Year	2020

Project ID 06-721 Coal Hollow EIS

East/West Street: US-89 / Center Street | North/South Street: SR-143 / US-89

Volume Adjustments and Site Characteristics

Approach	Eastbound			Westbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	20	44	11	52	46	171
%Thrus Left Lane						

Approach	Northbound			Southbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	9	59	25	133	45	32
%Thrus Left Lane						

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Configuration	LT	R	LT	R	LT	R	L	TR
PHF	0.85	0.85	0.85	1.00	0.85	0.85	0.85	0.85
Flow Rate (veh/h)	74	12	115	171	79	29	156	89
% Heavy Vehicles	4	7	6	14	5	6	13	4
No. Lanes	2		2		2		2	
Geometry Group	5		5		5		5	
Duration, T	0.25							

Saturation Headway Adjustment Worksheet

Prop. Left-Turns	0.3	0.0	0.5	0.0	0.1	0.0	1.0	0.0
Prop. Right-Turns	0.0	1.0	0.0	1.0	0.0	1.0	0.0	0.4
Prop. Heavy Vehicle	0.0	0.1	0.1	0.1	0.0	0.1	0.1	0.0
hLT-adj	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
hRT-adj	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7
hHV-adj	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
hadj, computed	0.2	-0.6	0.4	-0.5	0.1	-0.6	0.7	-0.2

Departure Headway and Service Time

hd, initial value (s)	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20
x, initial	0.07	0.01	0.10	0.15	0.07	0.03	0.14	0.08
hd, final value (s)	6.04	5.24	5.95	5.12	5.93	5.19	6.32	5.38
x, final value	0.12	0.02	0.19	0.24	0.13	0.04	0.27	0.13
Move-up time, m (s)	2.3		2.3		2.3		2.3	
Service Time, t_s (s)	3.7	2.9	3.7	2.8	3.6	2.9	4.0	3.1

Capacity and Level of Service

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Capacity (veh/h)	324	262	365	421	329	279	406	339
Delay (s/veh)	9.60	8.03	10.05	9.46	9.52	8.11	11.39	8.90
LOS	A	A	B	A	A	A	B	A
Approach: Delay (s/veh)	9.38		9.70		9.14		10.49	
LOS	A		A		A		B	
Intersection Delay (s/veh)	9.84							
Intersection LOS	A							

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99		1.00	0.99	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85		1.00	0.89	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1805	3471	1442	1787	3471	1615	1529	1567		1800	1678	
Flt Permitted	0.45	1.00	1.00	0.34	1.00	1.00	0.75	1.00		0.65	1.00	
Satd. Flow (perm)	864	3471	1442	646	3471	1615	1212	1567		1235	1678	
Volume (vph)	3	416	124	89	319	5	74	2	141	12	2	4
Peak-hour factor, PHF	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Adj. Flow (vph)	3	484	144	103	371	6	86	2	164	14	2	5
RTOR Reduction (vph)	0	0	109	0	0	5	0	59	0	0	2	0
Lane Group Flow (vph)	3	484	35	103	371	1	86	107	0	14	5	0
Confl. Peds. (#/hr)							1		1	5		5
Heavy Vehicles (%)	0%	4%	12%	1%	4%	0%	18%	0%	2%	0%	0%	0%
Turn Type	Perm		Perm	Perm		Perm	Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8		8	2			6		
Actuated Green, G (s)	15.0	15.0	15.0	15.0	15.0	15.0	43.0	43.0		43.0	43.0	
Effective Green, g (s)	17.0	17.0	17.0	17.0	17.0	17.0	45.0	45.0		45.0	45.0	
Actuated g/C Ratio	0.24	0.24	0.24	0.24	0.24	0.24	0.64	0.64		0.64	0.64	
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	210	843	350	157	843	392	779	1007		794	1079	
v/s Ratio Prot		0.14			0.11			c0.11			0.00	
v/s Ratio Perm	0.00		0.10	c0.16		0.00	0.07			0.01		
v/c Ratio	0.01	0.57	0.10	0.66	0.44	0.00	0.11	0.11		0.02	0.00	
Uniform Delay, d1	20.1	23.3	20.6	23.9	22.5	20.1	4.8	4.8		4.5	4.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.0	1.0	0.1	9.5	0.4	0.0	0.3	0.2		0.0	0.0	
Delay (s)	20.2	24.3	20.7	33.3	22.8	20.1	5.1	5.0		4.6	4.5	
Level of Service	C	C	C	C	C	C	A	A		A	A	
Approach Delay (s)		23.4			25.1			5.0			4.5	
Approach LOS		C			C			A			A	

Intersection Summary			
HCM Average Control Delay	20.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.30		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	51.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor		0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes		1.00	1.00	1.00	1.00	1.00	1.00	0.99		1.00	1.00	
Flpb, ped/bikes		1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt		1.00	0.85	1.00	1.00	0.85	1.00	0.85		1.00	0.97	
Flt Protected		1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		3574	1538	1770	3539	1615	1668	1584		1805	1843	
Flt Permitted		1.00	1.00	0.37	1.00	1.00	0.75	1.00		0.65	1.00	
Satd. Flow (perm)		3574	1538	691	3539	1615	1325	1584		1233	1843	
Volume (vph)	0	476	183	154	587	15	97	4	157	9	4	1
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	0	506	195	164	624	16	103	4	167	10	4	1
RTOR Reduction (vph)	0	0	135	0	0	11	0	71	0	0	0	0
Lane Group Flow (vph)	0	506	60	164	624	5	103	100	0	10	5	0
Confl. Peds. (#/hr)							3		3			
Heavy Vehicles (%)	0%	1%	5%	2%	2%	0%	8%	0%	1%	0%	0%	0%
Turn Type	Perm		Perm	Perm		Perm	Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8		8	2			6		
Actuated Green, G (s)		19.6	19.6	19.6	19.6	19.6	38.4	38.4		38.4	38.4	
Effective Green, g (s)		21.6	21.6	21.6	21.6	21.6	40.4	40.4		40.4	40.4	
Actuated g/C Ratio		0.31	0.31	0.31	0.31	0.31	0.58	0.58		0.58	0.58	
Clearance Time (s)		6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	
Vehicle Extension (s)		3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		1103	475	213	1092	498	765	914		712	1064	
v/s Ratio Prot		0.14			0.18			c0.11			0.00	
v/s Ratio Perm			0.13	c0.24		0.01	0.08			0.01		
v/c Ratio		0.46	0.13	0.77	0.57	0.01	0.13	0.11		0.01	0.00	
Uniform Delay, d1		19.5	17.4	21.9	20.3	16.8	6.8	6.7		6.3	6.3	
Progression Factor		1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2		0.3	0.1	15.4	0.7	0.0	0.4	0.2		0.0	0.0	
Delay (s)		19.8	17.5	37.3	21.0	16.8	7.2	6.9		6.3	6.3	
Level of Service		B	B	D	C	B	A	A		A	A	
Approach Delay (s)		19.2			24.3			7.0			6.3	
Approach LOS		B			C			A			A	

Intersection Summary			
HCM Average Control Delay	19.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.39		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	56.7%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

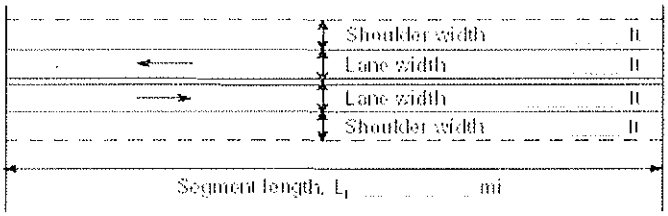
Future + Project Conditions

DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*Stinger*	Highway / Direction of Travel	*US-89*
Agency or Company	*Fehr & Peers*	From/To	*Alton / SR-14*
Date Performed	*9/12/2007*	Jurisdiction	*Kane County, UT*
Analysis Time Period	*Weekday Average*	Analysis Year	*2020+Trucks*

Project Description: *06-721 Coal Hollow EIS*

Input Data



Class I highway ■ Class II highway

Terrain ■ Level ■ Rolling

Grade Length *1.60* mi Up/down *3.0*

Peak-hour factor, PHF *0.85*

No-passing zone *20%*

% Trucks and Buses , P_T *26 %*

% Recreational vehicles, P_R *11%*

Access points/ *mi* *1*

Analysis direction vol., V_d *208*veh/h

Opposing direction vol., V_o *173*veh/h

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 20-9 or 20-15)	*6.1*	*6.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9 or 20-17)	*1.4*	*1.4*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.422*	*0.422*
Grade adjustment factor [1], f_G (Exhibit 20-7 or 20-13)	*0.99*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV}*f_G)$	*588*	*482*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field measured speed[3], S_{FM}	*mi/h*	Base free-flow speed[3], $BFFS_{FM}$	*65.0 mi/h*
Observed volume[3], V_f	veh/h	Adj. for lane width and shoulder width,[3] f_{LS}(Exh 20-5)	*2.6 mi/h*
Free-flow speed, FFS_d $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points[3], f_A (Exhibit 20-5)	*0.3 mi/h*
Adjustment for no-passing zones, f_{np} (Exhibit 20-19)	*1.4 mi/h*	Free-flow speed, FFS_d $(FSS=BFFS-f_{LS}-f_A)$	*62.1 mi/h*
		Average travel speed, $ATS=FFS-0.00776v_p-f_{np}$	*52.4 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 20-10 or 20-16)	*1.0*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*1.000*	*0.975*
Grade adjustment factor[1], f_G (Exhibit 20-8 or 20-14)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h)$=V_i/(PHF*f_{HV}*f_G)$	*245*	*209*
Base percent time-spent-following[4], $BPTSF(\%)=100(1-e^{av_d^b})$	*25.9*	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	*39.1*	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$	*47.0*	

Level of Service and Other Performance Measures

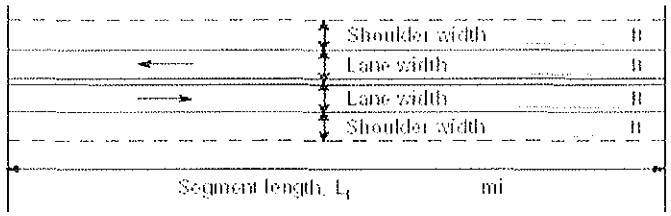
Level of service, LOS (Exhibit 20-3 or 20-4)	*B*
Volume to capacity ratio, $v/c=V_p/1,700$	*0.35*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)$=0.25L_t(V/PHF)$	*98*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)$=V*L_t$	*333*
Peak 15-min total travel time, TT_{15}(veh-h)$=VMT_{15}/ATS$	*1.9*

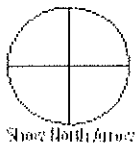
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		*Site Information*	
Analyst	*Stinger*	Highway / Direction of Travel	*US-89*
Agency or Company	*Fehr & Peers*	From/To	*Alton / SR-14*
Date Performed	*9/12/2007*	Jurisdiction	*Kane County, UT*
Analysis Time Period	*Weekend*	Analysis Year	*2020+Trucks*

Project Description: *06-721 Coal Hollow EIS*

Input Data





Class I highway ■ Class II highway ■

Terrain ■ Level ■ Rolling

Grade Length *1.60* mi Up/down *3.0*

Peak-hour factor, PHF *0.85*

No-passing zone *20%*

% Trucks and Buses , P_T *28 %*

% Recreational vehicles, P_R *18%*

Access points/ *mi* *1*

Analysis direction vol., V_d *253*veh/h

Opposing direction vol., V_o *204*veh/h

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 20-9 or 20-15)	*6.1*	*6.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9 or 20-17)	*1.4*	*1.4*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.400*	*0.400*
Grade adjustment factor [1], f_G (Exhibit 20-7 or 20-13)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV}*f_G)$	*744*	*600*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field measured speed[3], S_{FM}	*mi/h*	Base free-flow speed[3], $BFFS_{FM}$	*65.0 mi/h*
Observed volume[3], V_f	veh/h	Adj. for lane width and shoulder width,[3] f_{LS}(Exh 20-5)	*2.6 mi/h*
Free-flow speed, FFS_d $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points[3], f_A (Exhibit 20-5)	*0.3 mi/h*
Adjustment for no-passing zones, f_{np} (Exhibit 20-19)	*1.2 mi/h*	Free-flow speed, FFS_d (FSS=BFFS-f_{LS}-f_A)	*62.1 mi/h*
		Average travel speed, ATS=FFS-0.00776v_p-f_{np}	*50.4 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 20-10 or 20-16)	*1.0*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*1.000*	*0.973*
Grade adjustment factor[1], f_G (Exhibit 20-8 or 20-14)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h)=$V_i/(PHF*f_{HV}*f_G)$	*298*	*247*
Base percent time-spent-following[4], $BPTSF(\%)=100(1-e^{av_d^b})$	*31.6*	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	*38.1*	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$	*52.4*	

Level of Service and Other Performance Measures

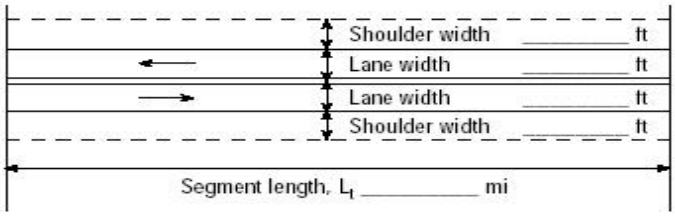
Level of service, LOS (Exhibit 20-3 or 20-4)	*C*
Volume to capacity ratio, v/c=V_p/ 1,700	*0.44*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)=0.25L_t(V/PHF)	*119*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=V*L_t	*405*
Peak 15-min total travel time, TT_{15}(veh-h)=VMT_{15}/ATS	*2.4*

DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*Stinger*	Highway / Direction of Travel	*US-89*
Agency or Company	*Fehr & Peers*	From/To	*SR-14 / Hatch*
Date Performed	*9/12/2007*	Jurisdiction	*Garfield County, Utah*
Analysis Time Period	*Weekday Average*	Analysis Year	*2020+Trucks*

Project Description: *06-721 Coal Hollow EIS*

Input Data



Analysis direction vol., V_d *208*veh/h

Opposing direction vol., V_o *173*veh/h

☑ Class I highway ☐ Class II highway

Terrain ☑ Level ☐ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.85*

No-passing zone *30*%

% Trucks and Buses , P_T *22* %

% Recreational vehicles, P_R *12*%

Access points/ *mi* *1*

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 20-9 or 20-15)	*1.7*	*1.7*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9 or 20-17)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.867*	*0.867*
Grade adjustment factor [1], f_G (Exhibit 20-7 or 20-13)	*1.00*	*1.00*
Directional flow rate[2], $v_i(pc/h)$ $v_i=V_i/(PHF*f_{HV}*f_G)$	*282*	*235*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field measured speed[3], S_{FM}	*mi/h*	Base free-flow speed[3], $BFFS_{FM}$	*65.0 mi/h*
Observed volume[3], V_f	veh/h	Adj. for lane width and shoulder width,[3] f_{LS}(Exh 20-5)	*1.3 mi/h*
Free-flow speed, FFS_d $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points[3], f_A (Exhibit 20-5)	*0.3 mi/h*
Adjustment for no-passing zones, f_{np} (Exhibit 20-19)	*2.5 mi/h*	Free-flow speed, FFS_d $(FSS=BFFS-f_{LS}-f_A)$	*63.5 mi/h*
		Average travel speed, $ATS=FFS-0.00776v_p-f_{np}$	*56.9 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 20-10 or 20-16)	*1.1*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.978*	*0.978*
Grade adjustment factor[1], f_G (Exhibit 20-8 or 20-14)	*1.00*	*1.00*
Directional flow rate[2], $v_i(pc/h)=V_i/(PHF*f_{HV}*f_G)$	*250*	*208*
Base percent time-spent-following[4], $BPTSF(\%)=100(1-e^{av_d^b})$	*26.3*	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	*43.9*	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$	*50.3*	

Level of Service and Other Performance Measures

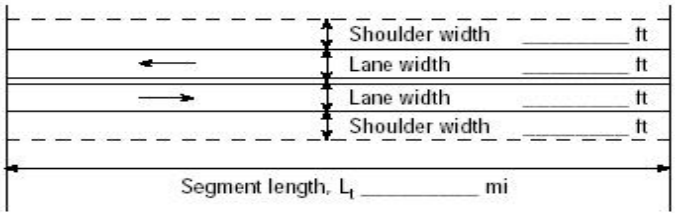
Level of service, LOS (Exhibit 20-3 or 20-4)	*C*
Volume to capacity ratio, $v/c=V_p/1{,}700$	*0.17*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)$=0.25L_t(V/PHF)$	*716*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)$=V*L_t$	*2434*
Peak 15-min total travel time, TT_{15}(veh-h)$=VMT_{15}/ATS$	*12.6*

DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*Stinger*	Highway / Direction of Travel	*US-89*
Agency or Company	*Fehr & Peers*	From/To	*SR-14 / Hatch*
Date Performed	*9/12/2007*	Jurisdiction	*Garfield County, Utah*
Analysis Time Period	*Weekend*	Analysis Year	*2020+Trucks*

Project Description: *06-721 Coal Hollow EIS*

Input Data



Analysis direction vol., V_d *253*veh/h

Opposing direction vol., V_o *205*veh/h

☑ Class I highway ☐ Class II highway

Terrain ☑ Level ☐ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.85*

No-passing zone *30*%

% Trucks and Buses , P_T *28* %

% Recreational vehicles, P_R *18*%

Access points/ *mi* *1*

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 20-9 or 20-15)	*1.2*	*1.7*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9 or 20-17)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.947*	*0.836*
Grade adjustment factor [1], f_G (Exhibit 20-7 or 20-13)	*1.00*	*1.00*
Directional flow rate[2], $v_i(pc/h)$ $v_i=V_i/(PHF*f_{HV}*f_G)$	*314*	*288*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field measured speed[3], S_{FM}	*mi/h*	Base free-flow speed[3], $BFFS_{FM}$	*65.0 mi/h*
Observed volume[3], V_f	veh/h	Adj. for lane width and shoulder width,[3] f_{LS}(Exh 20-5)	*1.3 mi/h*
Free-flow speed, FFS_d $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points[3], f_A (Exhibit 20-5)	*0.3 mi/h*
Adjustment for no-passing zones, f_{np} (Exhibit 20-19)	*2.3 mi/h*	Free-flow speed, FFS_d $(FSS=BFFS-f_{LS}-f_A)$	*63.5 mi/h*
		Average travel speed, $ATS=FFS-0.00776v_p-f_{np}$	*56.5 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 20-10 or 20-16)	*1.1*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.973*	*0.973*
Grade adjustment factor[1], f_G (Exhibit 20-8 or 20-14)	*1.00*	*1.00*
Directional flow rate[2], $v_i(pc/h)=V_i/(PHF*f_{HV}*f_G)$	*306*	*248*
Base percent time-spent-following[4], $BPTSF(\%)=100(1-e^{av_d^b})$	*32.3*	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	*42.3*	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$	*55.6*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 or 20-4)	*C*
Volume to capacity ratio, $v/c=V_p/1{,}700$	*0.18*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)$=0.25L_t(V/PHF)$	*871*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)$=V*L_t$	*2960*
Peak 15-min total travel time, TT_{15}(veh-h)$=VMT_{15}/ATS$	*15.4*

HIGHPLAN 2002 Conceptual Planning Analysis

Description/File Information

Filename	HP_preview.xml	**Date Prepared**	9/12/2007		
Program	HIGHPLAN	**Version**	1.2.0		
Analyst	PS	**Agency**	FP	**District**	Hatch, UT
Road Name	US-89	**From/To**	Hatch		
Analysis Type	Segment	**Peak Direction**	Northbound	**Study Period**	K100
User Notes	2020 Weekday Average+Trucks				

Facility Data

Roadway Variables				Traffic Variables			
Area Type	Rural developed	**# Thru Lanes**	2	**AADT**	3556	**% Heavy Vehicles**	19
Class	3	**Terrain**	Level	**K**	.0937	**Base Capacity**	1700
Posted Speed	40	**Median**	No	**D**	.526	**Local Adj. Factor**	.92
Free Flow Speed	45	**Left Turn Lanes**	No	**PHF**	.85	**Adjusted Capacity**	1143
Pass Lane Spacing	N/A	**% NPZ**	100				

LOS Results

v/c Ratio	0.17	**Density**	N/A	**PTSF**	96.00	**ATS**	37.00	**% FFS**	82.0	**LOS**	C

Service Volume Tables

	A	B	C	D	E
Lanes	**Hourly Volume In Peak Direction**				
1	0	130	380	570	740
2					
3					
4					
Lanes	**Hourly Volume In Both Directions**				
2	0	250	730	1090	1400
4					
6					
8					
Lanes	**Annual Average Daily Traffic**				
2	0	2700	7800	11600	14900
4					
6					
8					
Lanes	**Maximum v/c Ratio**				
1	0.00	0.14	0.37	0.55	0.71
2					
3					
4					

HIGHPLAN 2002 Conceptual Planning Analysis

Description/File Information

Filename	HP_preview.xml	**Date Prepared**	9/12/2007		
Program	HIGHPLAN	**Version**	1.2.0		
Analyst	PS	**Agency**	FP	**District**	Hatch, UT
Road Name	US-89	**From/To**	Hatch		
Analysis Type	Segment	**Peak Direction**	Northbound	**Study Period**	K100
User Notes	2020 Weekend+Trucks				

Facility Data

Roadway Variables				Traffic Variables			
Area Type	Rural developed	**# Thru Lanes**	2	**AADT**	3889	**% Heavy Vehicles**	26
Class	3	**Terrain**	Level	**K**	.10273	**Base Capacity**	1700
Posted Speed	40	**Median**	No	**D**	.534	**Local Adj. Factor**	.92
Free Flow Speed	45	**Left Turn Lanes**	No	**PHF**	.85	**Adjusted Capacity**	1107
Pass Lane Spacing	N/A	**% NPZ**	100				

LOS Results

v/c Ratio	0.21	**Density**	N/A	**PTSF**	99.00	**ATS**	37.00	**% FFS**	81.0	**LOS**	C

Service Volume Tables

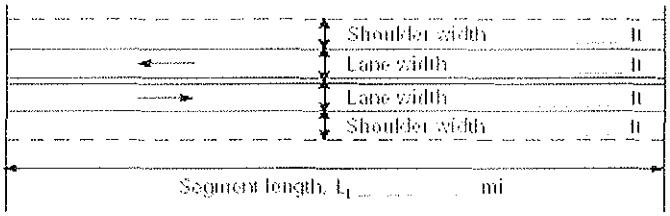
	A	B	C	D	E
Lanes	**Hourly Volume In Peak Direction**				
1	0	130	380	580	740
2					
3					
4					
Lanes	**Hourly Volume In Both Directions**				
2	0	240	720	1080	1390
4					
6					
8					
Lanes	**Annual Average Daily Traffic**				
2	0	2300	7000	10500	13500
4					
6					
8					
Lanes	**Maximum v/c Ratio**				
1	0.00	0.14	0.37	0.56	0.71
2					
3					
4					

DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*Stinger*	Highway / Direction of Travel	*US-89*
Agency or Company	*Fehr & Peers*	From/To	*Hatch / SR-12*
Date Performed	*9/12/2007*	Jurisdiction	*Garfield Couty, UT*
Analysis Time Period	*Weekday Average*	Analysis Year	*2020+Trucks*

Project Description: *06-721 Coal Hollow EIS*

Input Data



■ Class I highway ■ Class II highway

Terrain ■ Level ■ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.87*

No-passing zone *35%*

% Trucks and Buses , P_T *25 %*

% Recreational vehicles, P_R *18%*

Access points/ *mi* *1*

Analysis direction vol., V_d *182*veh/h

Opposing direction vol., V_o *168*veh/h

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 20-9 or 20-15)	*1.7*	*1.7*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9 or 20-17)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.851*	*0.851*
Grade adjustment factor [1], f_G (Exhibit 20-7 or 20-13)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV}*f_G)$	*246*	*227*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field measured speed[3], S_{FM}	*mi/h*	Base free-flow speed[3], $BFFS_{FM}$	*65.0 mi/h*
Observed volume[3], V_f	veh/h	Adj. for lane width and shoulder width,[3] f_{LS}(Exh 20-5)	*1.3 mi/h*
Free-flow speed, FFS_d $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points[3], f_A (Exhibit 20-5)	*0.3 mi/h*
Adjustment for no-passing zones, f_{np} (Exhibit 20-19)	*2.8 mi/h*	Free-flow speed, FFS_d $(FSS=BFFS-f_{LS}-f_A)$	*63.5 mi/h*
		Average travel speed, $ATS=FFS-0.00776v_p-f_{np}$	*57.0 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 20-10 or 20-16)	*1.1*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.976*	*0.976*
Grade adjustment factor[1], f_G (Exhibit 20-8 or 20-14)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h)=$V_i/(PHF*f_{HV}*f_G)$	*214*	*198*
Base percent time-spent-following[4], $BPTSF(\%)=100(1-e^{av_d^b})$	*22.8*	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	*49.8*	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$	*48.7*	

Level of Service and Other Performance Measures

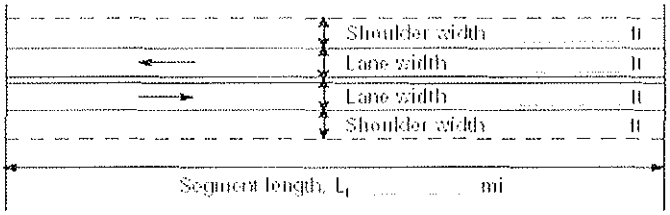
Level of service, LOS (Exhibit 20-3 or 20-4)	*B*
Volume to capacity ratio, $v/c=V_p/1,700$	*0.14*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)=$0.25L_t(V/PHF)$	*408*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=$V*L_t$	*1420*
Peak 15-min total travel time, TT_{15}(veh-h)=VMT_{15}/ATS	*7.2*

DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*Stinger*	Highway / Direction of Travel	*US-89*
Agency or Company	*Fehr & Peers*	From/To	*Hatch / SR-12*
Date Performed	*9/12/2007*	Jurisdiction	*Garfield Couty, UT*
Analysis Time Period	*Weekend*	Analysis Year	*2020+Trucks*

Project Description: *06-721 Coal Hollow EIS*

Input Data



Class I highway ■ Class II highway ■

Terrain ■ Level ■ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.85*

No-passing zone *35%*

% Trucks and Buses , P_T *19 %*

% Recreational vehicles, P_R *21%*

Access points/ *mi* *1*

Analysis direction vol., V_d *192*veh/h

Opposing direction vol., V_o *176*veh/h

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 20-9 or 20-15)	*1.7*	*1.7*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9 or 20-17)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.883*	*0.883*
Grade adjustment factor [1], f_G (Exhibit 20-7 or 20-13)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV}*f_G)$	*256*	*235*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field measured speed[3], S_{FM}	*mi/h*	Base free-flow speed[3], $BFFS_{FM}$	*65.0 mi/h*
Observed volume[3], V_f	veh/h	Adj. for lane width and shoulder width,[3] f_{LS}(Exh 20-5)	*1.3 mi/h*
Free-flow speed, FFS_d $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points[3], f_A (Exhibit 20-5)	*0.3 mi/h*
Adjustment for no-passing zones, f_{np} (Exhibit 20-19)	*2.8 mi/h*	Free-flow speed, FFS_d $(FSS=BFFS-f_{LS}-f_A)$	*63.5 mi/h*
		Average travel speed, $ATS=FFS-0.00776v_p-f_{np}$	*56.9 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 20-10 or 20-16)	*1.1*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.981*	*0.981*
Grade adjustment factor[1], f_G (Exhibit 20-8 or 20-14)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h)$=V_i/(PHF*f_{HV}*f_G)$	*230*	*211*
Base percent time-spent-following[4], $BPTSF(\%)=100(1-e^{av_d^b})$	*24.6*	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	*48.3*	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$	*49.8*	

Level of Service and Other Performance Measures

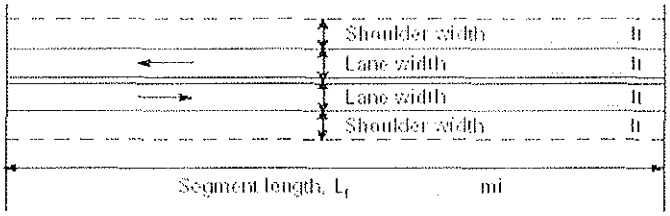
Level of service, LOS (Exhibit 20-3 or 20-4)	*B*
Volume to capacity ratio, $v/c=V_p/1{,}700$	*0.15*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)$=0.25L_t(V/PHF)$	*440*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)$=V*L_t$	*1498*
Peak 15-min total travel time, TT_{15}(veh-h)$=VMT_{15}$/ATS	*7.7*

DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*Stinger*	Highway / Direction of Travel	*US-89*
Agency or Company	*Fehr & Peers*	From/To	*SR-12 / Panguitch*
Date Performed	*9/12/2007*	Jurisdiction	*Garfield Couty, UT*
Analysis Time Period	*Weekday Average*	Analysis Year	*2020+Trucks*

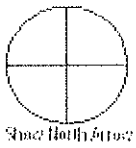
Project Description: *06-721 Coal Hollow EIS*

Input Data



Analysis direction vol., V_d *180* veh/h

Opposing direction vol., V_o *166* veh/h



■ Class I highway ■ Class II highway

Terrain ■ Level ■ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.87*

No-passing zone *5%*

% Trucks and Buses , P_T *25 %*

% Recreational vehicles, P_R *18%*

Access points/ *mi* *2*

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 20-9 or 20-15)	*1.7*	*1.7*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9 or 20-17)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.851*	*0.851*
Grade adjustment factor [1], f_G (Exhibit 20-7 or 20-13)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV}*f_G)$	*243*	*224*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field measured speed[3], S_{FM}	*mi/h*	Base free-flow speed[3], $BFFS_{FM}$	*65.0 mi/h*
Observed volume[3], V_f	veh/h	Adj. for lane width and shoulder width,[3] f_{LS}(Exh 20-5)	*1.3 mi/h*
Free-flow speed, FFS_d $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points[3], f_A (Exhibit 20-5)	*0.5 mi/h*
Adjustment for no-passing zones, f_{np} (Exhibit 20-19)	*2.0 mi/h*	Free-flow speed, FFS_d $(FSS=BFFS-f_{LS}-f_A)$	*63.2 mi/h*
		Average travel speed, $ATS=FFS-0.00776v_p-f_{np}$	*57.6 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 20-10 or 20-16)	*1.1*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.976*	*0.976*
Grade adjustment factor[1], f_G (Exhibit 20-8 or 20-14)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h)$=V_i/(PHF*f_{HV}*f_G)$	*212*	*196*
Base percent time-spent-following[4], $BPTSF(\%)=100(1-e^{av_d^b})$	*22.7*	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	*22.1*	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$	*34.1*	

Level of Service and Other Performance Measures

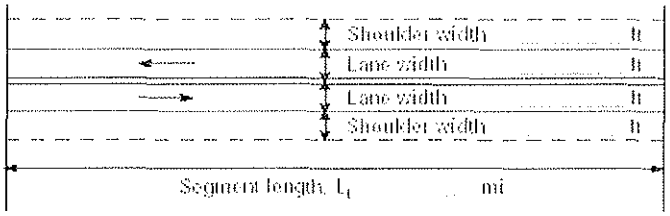
Level of service, LOS (Exhibit 20-3 or 20-4)	*A*
Volume to capacity ratio, $v/c=V_p/1{,}700$	*0.14*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)$=0.25L_t(V/PHF)$	*295*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)$=V*L_t$	*1026*
Peak 15-min total travel time, TT_{15}(veh-h)$=VMT_{15}/ATS$	*5.1*

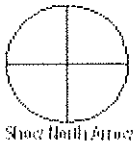
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*Stinger*	Highway / Direction of Travel	*US-89*
Agency or Company	*Fehr & Peers*	From/To	*SR-12 / Panguitch*
Date Performed	*9/12/2007*	Jurisdiction	*Garfield Couty, UT*
Analysis Time Period	*Weekend*	Analysis Year	*2020+Trucks*

Project Description: *06-721 Coal Hollow EIS*

Input Data





■ Class I highway ■ Class II highway

Terrain ■ Level ■ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.85*

No-passing zone *5%*

% Trucks and Buses , P_T *19 %*

% Recreational vehicles, P_R *21%*

Access points/ *mi* *2*

Analysis direction vol., V_d *190*veh/h

Opposing direction vol., V_o *173*veh/h

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 20-9 or 20-15)	*1.7*	*1.7*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9 or 20-17)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.883*	*0.883*
Grade adjustment factor [1], f_G (Exhibit 20-7 or 20-13)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV}*f_G)$	*253*	*231*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field measured speed[3], S_{FM}	*mi/h*	Base free-flow speed[3], $BFFS_{FM}$	*65.0 mi/h*
Observed volume[3], V_f	veh/h	Adj. for lane width and shoulder width,[3] f_{LS}(Exh 20-5)	*1.3 mi/h*
Free-flow speed, FFS_d $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points[3], f_A (Exhibit 20-5)	*0.5 mi/h*
Adjustment for no-passing zones, f_{np} (Exhibit 20-19)	*2.0 mi/h*	Free-flow speed, FFS_d $(FSS=BFFS-f_{LS}-f_A)$	*63.2 mi/h*
		Average travel speed, $ATS=FFS-0.00776v_p-f_{np}$	*57.4 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 20-10 or 20-16)	*1.1*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.981*	*0.981*
Grade adjustment factor[1], f_G (Exhibit 20-8 or 20-14)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h)=$V_i/(PHF*f_{HV}*f_G)$	*228*	*207*
Base percent time-spent-following[4], $BPTSF(\%)=100(1-e^{av_d^b})$	*24.3*	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	*21.8*	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$	*35.7*	

Level of Service and Other Performance Measures

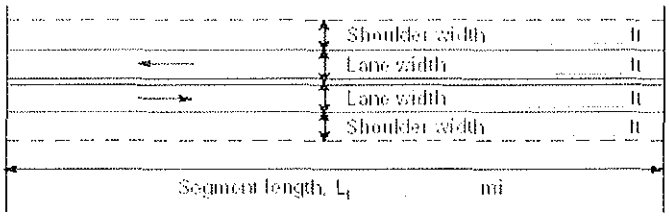
Level of service, LOS (Exhibit 20-3 or 20-4)	*B*
Volume to capacity ratio, $v/c=V_p/1{,}700$	*0.15*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)=$0.25L_t(V/PHF)$	*319*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=$V*L_t$	*1083*
Peak 15-min total travel time, TT_{15}(veh-h)=VMT_{15}/ATS	*5.6*

DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*Stinger*	Highway / Direction of Travel	*US-89*
Agency or Company	*Fehr & Peers*	From/To	*Panguitch / SR-20*
Date Performed	*9/12/2007*	Jurisdiction	*Garfield Couty, UT*
Analysis Time Period	*Weekday Average*	Analysis Year	*2020+Trucks*

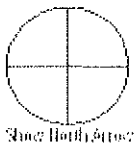
Project Description: *06-721 Coal Hollow EIS*

Input Data



Analysis direction vol., V_d *139*veh/h

Opposing direction vol., V_o *145*veh/h



■ Class I highway ■ Class II highway

Terrain ■ Level ■ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.86*

No-passing zone *15%*

% Trucks and Buses , P_T *30 %*

% Recreational vehicles, P_R *12%*

Access points/ *mi* *3*

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 20-9 or 20-15)	*1.7*	*1.7*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9 or 20-17)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.826*	*0.826*
Grade adjustment factor [1], f_G (Exhibit 20-7 or 20-13)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV}*f_G)$	*196*	*204*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field measured speed[3], S_{FM}	*mi/h*	Base free-flow speed[3], $BFFS_{FM}$	*65.0 mi/h*
Observed volume[3], V_f	veh/h	Adj. for lane width and shoulder width,[3] f_{LS}(Exh 20-5)	*1.3 mi/h*
Free-flow speed, FFS_d $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points[3], f_A (Exhibit 20-5)	*0.8 mi/h*
Adjustment for no-passing zones, f_{np} (Exhibit 20-19)	*2.1 mi/h*	Free-flow speed, FFS_d $(FSS=BFFS-f_{LS}-f_A)$	*63.0 mi/h*
		Average travel speed, $ATS=FFS-0.00776v_p-f_{np}$	*57.8 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 20-10 or 20-16)	*1.1*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.971*	*0.971*
Grade adjustment factor[1], f_G (Exhibit 20-8 or 20-14)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h)=$V_i/(PHF*f_{HV}*f_G)$	*166*	*174*
Base percent time-spent-following[4], $BPTSF(\%)=100(1-e^{av_d^b})$	*18.3*	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	*31.6*	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$	*33.8*	

Level of Service and Other Performance Measures

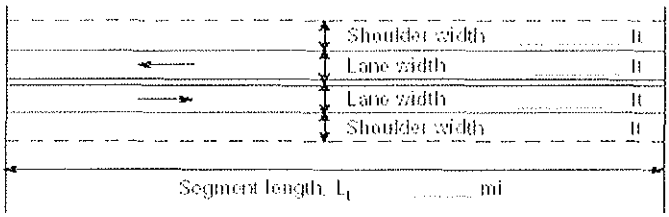
Level of service, LOS (Exhibit 20-3 or 20-4)	*A*
Volume to capacity ratio, $v/c=V_p/1{,}700$	*0.12*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)=$0.25L_t(V/PHF)$	*380*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=$V*L_t$	*1307*
Peak 15-min total travel time, TT_{15}(veh-h)=VMT_{15}/ATS	*6.6*

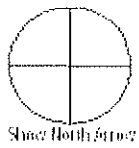
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*Stinger*	Highway / Direction of Travel	*US-89*
Agency or Company	*Fehr & Peers*	From/To	*Panguitch / SR-20*
Date Performed	*9/12/2007*	Jurisdiction	*Garfield Couty, UT*
Analysis Time Period	*Weekend*	Analysis Year	*2020+Trucks*

Project Description: *06-721 Coal Hollow EIS*

Input Data





Class I highway ■ Class II highway ■

Terrain Level ■ Rolling ■

Grade Length mi Up/down

Peak-hour factor, PHF *0.94*

No-passing zone *15%*

% Trucks and Buses , P_T *40 %*

% Recreational vehicles, P_R *14%*

Access points/ *mi* *3*

Analysis direction vol., V_d *196*veh/h

Opposing direction vol., V_o *146*veh/h

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 20-9 or 20-15)	*1.7*	*1.7*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9 or 20-17)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.781*	*0.781*
Grade adjustment factor [1], f_G (Exhibit 20-7 or 20-13)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV}*f_G)$	*267*	*199*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field measured speed[3], S_{FM}	*mi/h*	Base free-flow speed[3], $BFFS_{FM}$	*65.0 mi/h*
Observed volume[3], V_f	veh/h	Adj. for lane width and shoulder width,[3] f_{LS}(Exh 20-5)	*1.3 mi/h*
Free-flow speed, FFS_d $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points[3], f_A (Exhibit 20-5)	*0.8 mi/h*
Adjustment for no-passing zones, f_{np} (Exhibit 20-19)	*2.1 mi/h*	Free-flow speed, FFS_d $(FSS=BFFS-f_{LS}-f_A)$	*63.0 mi/h*
		Average travel speed, $ATS=FFS-0.00776v_p-f_{np}$	*57.3 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 20-10 or 20-16)	*1.1*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.962*	*0.962*
Grade adjustment factor[1], f_G (Exhibit 20-8 or 20-14)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h)$=V_i/(PHF*f_{HV}*f_G)$	*217*	*162*
Base percent time-spent-following[4], $BPTSF(\%)=100(1-e^{av_d^b})$	*23.1*	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	*31.2*	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$	*41.0*	

Level of Service and Other Performance Measures

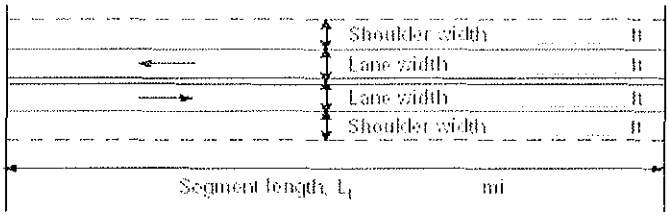
Level of service, LOS (Exhibit 20-3 or 20-4)	*B*
Volume to capacity ratio, $v/c=V_p/1{,}700$	*0.16*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)$=0.25L_t(V/PHF)$	*490*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)$=V*L_t$	*1842*
Peak 15-min total travel time, TT_{15}(veh-h)$=VMT_{15}/ATS$	*8.6*

DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		*Site Information*	
Analyst	*Stinger*	Highway / Direction of Travel	*SR-20*
Agency or Company	*Fehr & Peers*	From/To	*US-89 / Upslope*
Date Performed	*9/12/2007*	Jurisdiction	*Iron County, UT*
Analysis Time Period	*Weekday Average with Trucks*	Analysis Year	*2020+Trucks*

Project Description: *06-721 Coal Hollow EIS*

Input Data



Class I highway ■ Class II highway ■

Terrain ■ Level ■ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.85*

No-passing zone *45%*

% Trucks and Buses , P_T *32 %*

% Recreational vehicles, P_R *14%*

Access points/ *mi* *0*

Analysis direction vol., V_d *114*veh/h

Opposing direction vol., V_o *128*veh/h

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 20-9 or 20-15)	*1.7*	*1.7*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9 or 20-17)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.817*	*0.817*
Grade adjustment factor [1], f_G (Exhibit 20-7 or 20-13)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV}*f_G)$	*164*	*184*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field measured speed[3], S_{FM}	*mi/h*	Base free-flow speed[3], $BFFS_{FM}$	*50.0 mi/h*
Observed volume[3], V_f	veh/h	Adj. for lane width and shoulder width,[3] f_{LS}(Exh 20-5)	*1.3 mi/h*
Free-flow speed, FFS_d $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points[3], f_A (Exhibit 20-5)	*0.0 mi/h*
Adjustment for no-passing zones, f_{np} (Exhibit 20-19)	*2.0 mi/h*	Free-flow speed, FFS_d $(FSS=BFFS-f_{LS}-f_A)$	*48.7 mi/h*
		Average travel speed, $ATS=FFS-0.00776v_p-f_{np}$	*44.0 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 20-10 or 20-16)	*1.1*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.969*	*0.969*
Grade adjustment factor[1], f_G (Exhibit 20-8 or 20-14)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h)=$V_i/(PHF*f_{HV}*f_G)$	*138*	*155*
Base percent time-spent-following[4], $BPTSF(\%)=100(1-e^{av_d^b})$	*15.6*	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	*45.1*	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$	*36.8*	

Level of Service and Other Performance Measures

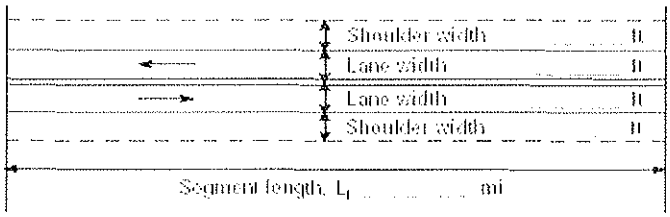
Level of service, LOS (Exhibit 20-3 or 20-4)	*D*
Volume to capacity ratio, $v/c=V_p/1,700$	*0.10*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)=$0.25L_t(V/PHF)$	*285*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=$V*L_t$	*969*
Peak 15-min total travel time, TT_{15}(veh-h)=VMT_{15}/ATS	*6.5*

DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*Stinger*	Highway / Direction of Travel	*SR-20*
Agency or Company	*Fehr & Peers*	From/To	*US-89 / Upslope*
Date Performed	*9/12/2007*	Jurisdiction	*Iron County, UT*
Analysis Time Period	*Weekend*	Analysis Year	*2020+Trucks*

Project Description: *06-721 Coal Hollow EIS*

Input Data



Class I highway ■ Class II highway ■

Terrain ■ Level ■ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.85*

No-passing zone *45%*

% Trucks and Buses , P_T *33 %*

% Recreational vehicles, P_R *14%*

Access points/ *mi* *0*

Analysis direction vol., V_d *175*veh/h

Opposing direction vol., V_o *128*veh/h

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 20-9 or 20-15)	*1.7*	*1.7*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9 or 20-17)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.812*	*0.812*
Grade adjustment factor [1], f_G (Exhibit 20-7 or 20-13)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV}*f_G)$	*253*	*185*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field measured speed[3], S_{FM}	*mi/h*	Base free-flow speed[3], $BFFS_{FM}$	*50.0 mi/h*
Observed volume[3], V_f	veh/h	Adj. for lane width and shoulder width,[3] f_{LS}(Exh 20-5)	*1.3 mi/h*
Free-flow speed, FFS_d $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points[3], f_A (Exhibit 20-5)	*0.0 mi/h*
Adjustment for no-passing zones, f_{np} (Exhibit 20-19)	*2.0 mi/h*	Free-flow speed, FFS_d $(FSS=BFFS-f_{LS}-f_A)$	*48.7 mi/h*
		Average travel speed, $ATS=FFS-0.00776v_p-f_{np}$	*43.3 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 20-10 or 20-16)	*1.1*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.968*	*0.968*
Grade adjustment factor[1], f_G (Exhibit 20-8 or 20-14)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h)=$V_i/(PHF*f_{HV}*f_G)$	*213*	*156*
Base percent time-spent-following[4], $BPTSF(\%)=100(1-e^{av_d^b})$	*22.7*	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	*48.8*	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$	*50.9*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 or 20-4)	*D*
Volume to capacity ratio, v/c=V_p/ 1,700	*0.15*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)=$0.25L_t(V/PHF)$	*437*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=$V*L_t$	*1488*
Peak 15-min total travel time, TT_{15}(veh-h)=VMT_{15}/ATS	*10.1*

2

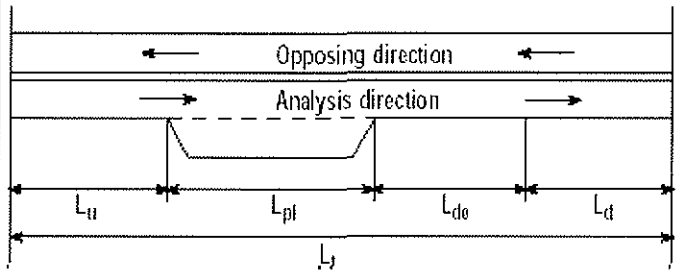
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET WITH PASSING LANE WORKSHEET

General Information		***Site Information***	
Analyst	*Stinger*	Highway of Travel	*SR-20*
Agency or Company	*Fehr & Peers*	From/To	*Upslope / Summit*
Date Performed	*9/12/2007*	Jurisdiction	*Iron County, UT*
Analysis Time Period	*Weekday Average*	Analysis Year	*2020+Trucks*

Project Description: *06-721 Coal Hollow EIS*

Input Data

☐ Class I highway ☑ Class II highway



Show North Arrow

Total length of analysis segment, L_t (*mi*)	*2.3*
Length of two-lane highway upstream of the passing lane, L_u (*mi*)	*0.0*
Length of passing lane including tapers , L_{pl} (*mi*)	*2.2*
Average travel speed, ATS_d (from Directional Two-Lane Highway Segment Worksheet)	*32.0*
Percent time-spent-following, $PTSF_d$ (from Directional Two-Lane Highway Segment Worksheet)	*26.5*
Level of service[1], LOS_d (from Directional Two-Lane Highway Segment Worksheet)	*A*
Average Travel Speed	
Downstream length of two-lane highway within effective length of passing lane for average travel speed, L_{de} (*mi*) (Exhibit 20-23)	*1.70*
Length of two-lane highway downstream of effective length of the passing lane for avg travel speed, L_d (*mi*) $L_d=L_t-(L_u+L_{pl}+L_{de})$	*-1.60*
Adj. factor for the effect of passing lane on average speed, f_{pl} (Exhibit 20-24)	*1.11*
Average travel speed including passing lane[2], $ATS_{pl} = (ATS_d * L_t) / (L_u+L_d+(L_{pl}/f_{pl})+ (2L_{de}/(1+f_{pl}))$)	*35.5*
Percent Time-Spent-Following	
Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, L_{de} (*mi*)(Exhibit 20-23)	*13.00*
Length of two-lane highway downstream of effective length of the passing lane for percent-time-following, L_d (*mi*)=$L_t-(L_u+L_{pl}+L_{de})$	*-12.90*
Adj. factor for the effect of passing lane on percent time-spent-following, f_{pl}(Exhibit 20-24)	*0.58*
Percent time-spent-following including passing lane[3], $PTSF_{pl}$(%) $PTSF_{pl}= PTSF_d[L_u+L_d+f_{pl}L_{pl}+((1+f_{pl})/2)L_{de}]/L_t$	*15.4*

2

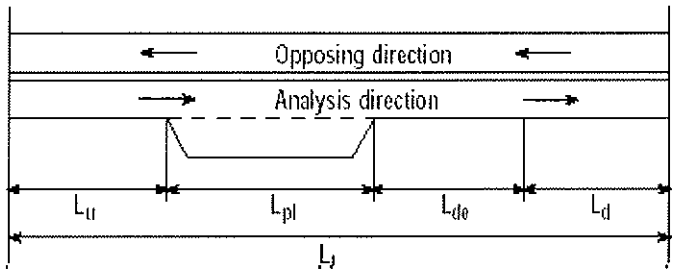
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET WITH PASSING LANE WORKSHEET

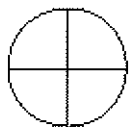
General Information		***Site Information***	
Analyst	*Stinger*	Highway of Travel	*SR-20*
Agency or Company	*Fehr & Peers*	From/To	*Upslope / Summit*
Date Performed	*9/12/2007*	Jurisdiction	*Iron County, UT*
Analysis Time Period	*Weekend*	Analysis Year	*2020+Trucks*

Project Description: *06-721 Coal Hollow EIS*

Input Data

☐ Class I highway ☑ Class II highway





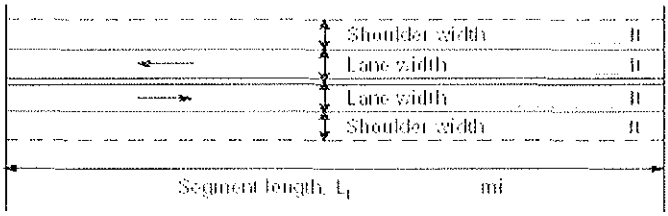
Total length of analysis segment, L_t (*mi*)	*2.3*
Length of two-lane highway upstream of the passing lane, L_u (*mi*)	*0.0*
Length of passing lane including tapers , L_{pl} (*mi*)	*2.0*
Average travel speed, ATS_d (from Directional Two-Lane Highway Segment Worksheet)	*29.1*
Percent time-spent-following, $PTSF_d$ (from Directional Two-Lane Highway Segment Worksheet)	*33.9*
Level of service[1], LOS_d (from Directional Two-Lane Highway Segment Worksheet)	*A*
Average Travel Speed	
Downstream length of two-lane highway within effective length of passing lane for average travel speed, L_{de} (*mi*) (Exhibit 20-23)	*1.70*
Length of two-lane highway downstream of effective length of the passing lane for avg travel speed, L_d (*mi*) $L_d=L_t-(L_u+L_{pl}+L_{de})$	*-1.40*
Adj. factor for the effect of passing lane on average speed, f_{pl} (Exhibit 20-24)	*1.11*
Average travel speed including passing lane[2], $ATS_{pl} = (ATS_d * L_t) / (L_u+L_d+(L_{pl}/f_{pl})+ (2L_{de}/(1+f_{pl}))$)	*32.2*
Percent Time-Spent-Following	
Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, L_{de} (*mi*)(Exhibit 20-23)	*11.36*
Length of two-lane highway downstream of effective length of the passing lane for percent-time-following, L_d (*mi*)$=L_t-(L_u+L_{pl}+L_{de})$	*-11.06*
Adj. factor for the effect of passing lane on percent time-spent-following, f_{pl}(Exhibit 20-24)	*0.58*
Percent time-spent-following including passing lane[3], $PTSF_{pl}$(%) $PTSF_{pl}= PTSF_d[L_u+L_d+f_{pl}L_{pl}+((1+f_{pl})/2)L_{de}]/L_t$	*19.7*

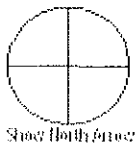
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*Stinger*	Highway / Direction of Travel	*SR-20*
Agency or Company	*Fehr & Peers*	From/To	*Summit / Downslope*
Date Performed	*9/12/2007*	Jurisdiction	*Iron County, UT*
Analysis Time Period	*Weekday Average*	Analysis Year	*2020+Trucks*

Project Description: *06-721 Coal Hollow EIS*

Input Data





Class I highway ■ Class II highway

Terrain ■ Level ■ Rolling

Grade Length *1.30* mi Up/down *7.1*

Peak-hour factor, PHF *0.85*

No-passing zone *100%*

% Trucks and Buses , P_T *33 %*

% Recreational vehicles, P_R *14%*

Access points/ *mi* *1*

Analysis direction vol., V_d *114*veh/h

Opposing direction vol., V_o *128*veh/h

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 20-9 or 20-15)	*12.9*	*12.9*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9 or 20-17)	*1.6*	*1.6*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.200*	*0.200*
Grade adjustment factor [1], f_G (Exhibit 20-7 or 20-13)	*0.91*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV}*f_G)$	*739*	*755*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field measured speed[3], S_{FM}	*mi/h*	Base free-flow speed[3], $BFFS_{FM}$	*60.0 mi/h*
Observed volume[3], V_f	veh/h	Adj. for lane width and shoulder width,[3] f_{LS}(Exh 20-5)	*1.3 mi/h*
Free-flow speed, FFS_d $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points[3], f_A (Exhibit 20-5)	*0.3 mi/h*
Adjustment for no-passing zones, f_{np} (Exhibit 20-19)	*1.5 mi/h*	Free-flow speed, FFS_d $(FSS=BFFS-f_{LS}-f_A)$	*58.5 mi/h*
		Average travel speed, $ATS=FFS-0.00776v_p-f_{np}$	*45.3 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 20-10 or 20-16)	*2.8*	*2.8*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.627*	*0.627*
Grade adjustment factor[1], f_G (Exhibit 20-8 or 20-14)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h)$=V_i/(PHF*f_{HV}*f_G)$	*214*	*240*
Base percent time-spent-following[4], $BPTSF(\%)=100(1-e^{av_d^b})$	*23.9*	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	*55.8*	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$	*50.3*	

Level of Service and Other Performance Measures

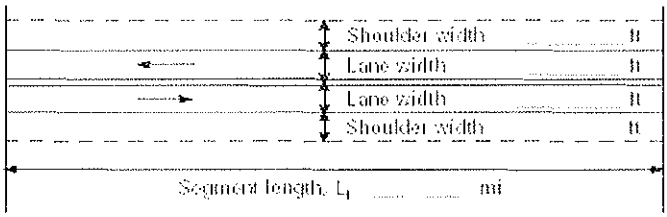
Level of service, LOS (Exhibit 20-3 or 20-4)	*C*
Volume to capacity ratio, $v/c=V_p/1{,}700$	*0.43*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)$=0.25L_t(V/PHF)$	*44*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)$=V*L_t$	*148*
Peak 15-min total travel time, TT_{15}(veh-h)$=VMT_{15}/ATS$	*1.0*

DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*Stinger*	Highway / Direction of Travel	*SR-20*
Agency or Company	*Fehr & Peers*	From/To	*Summit / Downslope*
Date Performed	*9/12/2007*	Jurisdiction	*Iron County, UT*
Analysis Time Period	*Weekend*	Analysis Year	*2020+Trucks*

Project Description: *06-721 Coal Hollow EIS*

Input Data



Analysis direction vol., V_d *175*veh/h

Opposing direction vol., V_o *128*veh/h

■ Class I highway ■ Class II highway

Terrain ■ Level ■ Rolling

Grade Length *1.30* mi Up/down *7.1*

Peak-hour factor, PHF *0.85*

No-passing zone *100%*

% Trucks and Buses , P_T *32 %*

% Recreational vehicles, P_R *14%*

Access points/ *mi* *1*

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 20-9 or 20-15)	*12.9*	*12.9*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9 or 20-17)	*1.6*	*1.6*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.204*	*0.204*
Grade adjustment factor [1], f_G (Exhibit 20-7 or 20-13)	*0.91*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV}*f_G)$	*1107*	*737*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field measured speed[3], S_{FM}	*mi/h*	Base free-flow speed[3], $BFFS_{FM}$	*60.0 mi/h*
Observed volume[3], V_f	veh/h	Adj. for lane width and shoulder width,[3] f_{LS}(Exh 20-5)	*1.3 mi/h*
Free-flow speed, FFS_d $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points[3], f_A (Exhibit 20-5)	*0.3 mi/h*
Adjustment for no-passing zones, f_{np} (Exhibit 20-19)	*1.6 mi/h*	Free-flow speed, FFS_d $(FSS=BFFS-f_{LS}-f_A)$	*58.5 mi/h*
		Average travel speed, $ATS=FFS-0.00776v_p-f_{np}$	*42.6 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 20-10 or 20-16)	*2.8*	*2.8*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.635*	*0.635*
Grade adjustment factor[1], f_G (Exhibit 20-8 or 20-14)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h)=$V_i/(PHF*f_{HV}*f_G)$	*324*	*237*
Base percent time-spent-following[4], $BPTSF(\%)=100(1-e^{av_d^b})$	*33.4*	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	*56.0*	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$	*65.8*	

Level of Service and Other Performance Measures

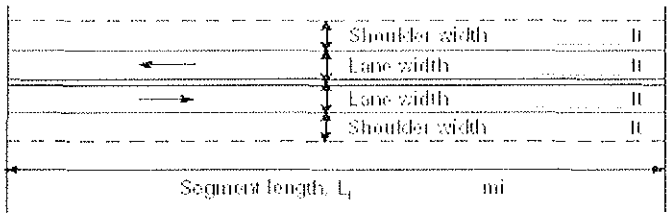
Level of service, LOS (Exhibit 20-3 or 20-4)	*D*
Volume to capacity ratio, $v/c=V_p/1{,}700$	*0.65*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)=$0.25L_t(V/PHF)$	*67*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=$V*L_t$	*227*
Peak 15-min total travel time, TT_{15}(veh-h)=VMT_{15}/ATS	*1.6*

DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*Stinger*	Highway / Direction of Travel	*SR-20*
Agency or Company	*Fehr & Peers*	From/To	*Downslope / I-15*
Date Performed	*7/24/2007*	Jurisdiction	*Iron County, UT*
Analysis Time Period	*Weekday average*	Analysis Year	*2020+Trucks*

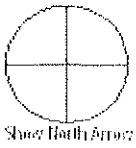
Project Description: *06-721 Coal Hollow EIS*

Input Data



Analysis direction vol., V_d *114* veh/h

Opposing direction vol., V_o *128* veh/h



■ Class I highway ■ Class II highway

Terrain ■ Level ■ Rolling

Grade Length *4.00* mi Up/down *3.4*

Peak-hour factor, PHF *0.85*

No-passing zone *70%*

% Trucks and Buses , P_T *33 %*

% Recreational vehicles, P_R *14%*

Access points/ *mi* *1*

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 20-9 or 20-15)	*9.1*	*9.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9 or 20-17)	*1.5*	*1.5*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.267*	*0.267*
Grade adjustment factor [1], f_G (Exhibit 20-7 or 20-13)	*0.94*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV}*f_G)$	*534*	*564*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field measured speed[3], S_{FM}	*mi/h*	Base free-flow speed[3], $BFFS_{FM}$	*60.0 mi/h*
Observed volume[3], V_f	veh/h	Adj. for lane width and shoulder width,[3] f_{LS}(Exh 20-5)	*1.3 mi/h*
Free-flow speed, FFS_d $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points[3], f_A (Exhibit 20-5)	*0.3 mi/h*
Adjustment for no-passing zones, f_{np} (Exhibit 20-19)	*1.9 mi/h*	Free-flow speed, FFS_d $(FSS=BFFS-f_{LS}-f_A)$	*58.5 mi/h*
		Average travel speed, $ATS=FFS-0.00776v_p-f_{np}$	*48.0 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 20-10 or 20-16)	*1.5*	*1.5*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.858*	*0.858*
Grade adjustment factor[1], f_G (Exhibit 20-8 or 20-14)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h)=$V_i/(PHF*f_{HV}*f_G)$	*156*	*175*
Base percent time-spent-following[4], $BPTSF(\%)=100(1-e^{av_d^b})$	*17.4*	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	*53.4*	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$	*42.5*	

Level of Service and Other Performance Measures

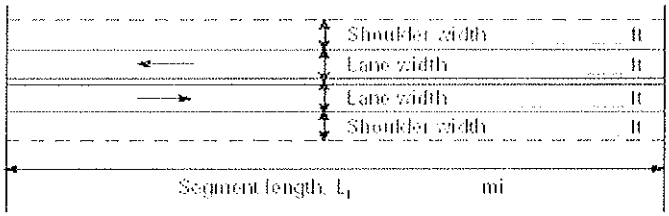
Level of service, LOS (Exhibit 20-3 or 20-4)	*C*
Volume to capacity ratio, $v/c=V_p/1,700$	*0.31*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)=$0.25L_t(V/PHF)$	*262*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=$V*L_t$	*889*
Peak 15-min total travel time, TT_{15}(veh-h)=VMT_{15}/ATS	*5.5*

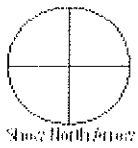
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*Stinger*	Highway / Direction of Travel	*SR-20*
Agency or Company	*Fehr & Peers*	From/To	*Downslope / I-15*
Date Performed	*9/12/2007*	Jurisdiction	*Iron County, UT*
Analysis Time Period	*Weekend*	Analysis Year	*2020+Trucks*

Project Description: *06-721 Coal Hollow EIS*

Input Data





Class I highway ■ Class II highway ■

Terrain ■ Level ■ Rolling

Grade Length *4.00* mi Up/down *3.4*

Peak-hour factor, PHF *0.85*

No-passing zone *70%*

% Trucks and Buses , P_T *32 %*

% Recreational vehicles, P_R *14%*

Access points/ *mi* *1*

Analysis direction vol., V_d *167*veh/h

Opposing direction vol., V_o *128*veh/h

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 20-9 or 20-15)	*9.1*	*9.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9 or 20-17)	*1.5*	*1.5*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.273*	*0.273*
Grade adjustment factor [1], f_G (Exhibit 20-7 or 20-13)	*0.95*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV}*f_G)$	*757*	*551*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field measured speed[3], S_{FM}	*mi/h*	Base free-flow speed[3], $BFFS_{FM}$	*60.0 mi/h*
Observed volume[3], V_f	veh/h	Adj. for lane width and shoulder width,[3] f_{LS}(Exh 20-5)	*1.3 mi/h*
Free-flow speed, FFS_d $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points[3], f_A (Exhibit 20-5)	*0.3 mi/h*
Adjustment for no-passing zones, f_{np} (Exhibit 20-19)	*1.9 mi/h*	Free-flow speed, FFS_d (FSS=BFFS-f_{LS}-f_A)	*58.5 mi/h*
		Average travel speed, ATS=FFS-0.00776v_p-f_{np}	*46.4 mi/h*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 20-10 or 20-16)	*1.5*	*1.5*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10 or 20-16)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.862*	*0.862*
Grade adjustment factor[1], f_G (Exhibit 20-8 or 20-14)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h)=$V_i/(PHF*f_{HV}*f_G)$	*228*	*175*
Base percent time-spent-following[4], $BPTSF(\%)=100(1-e^{av_d^b})$	*24.1*	
Adj. for no-passing zone, f_{np} (Exhibit. 20-20)	*57.5*	
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$	*56.6*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 or 20-4)	*C*
Volume to capacity ratio, v/c=V_p/ 1,700	*0.45*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)=0.25L_t(V/PHF)	*383*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=V*L_t	*1303*
Peak 15-min total travel time, TT_{15}(veh-h)=VMT_{15}/ATS	*8.3*

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*Stinger*	Intersection	*US-89 / SR-12*
Agency/Co.	*Fehr & Peers*	Jurisdiction	*Panguitch, UT*
Date Performed	*9/11/2007*	Analysis Year	*2020+Trucks*
Analysis Time Period	*8:00 - 9:00*		

Project Description *06-721 Coal Hollow EIS*

East/West Street: *SR-12*	North/South Street: *US-89*
Intersection Orientation: *North-South*	Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*48*	*31*	*56*	*41*	
Peak-Hour Factor, PHF	*1.00*	*0.85*	*0.85*	*0.85*	*0.85*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*0*	*56*	*36*	*65*	*48*	*0*
Percent Heavy Vehicles	*0*	--	--	*25*	--	--
Median Type	*Undivided*					
RT Channelized			*1*			*0*
Lanes	*0*	*1*	*1*	*1*	*1*	*0*
Configuration		*T*	*R*	*L*	*T*	
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*48*		*40*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*0.85*	*1.00*	*0.85*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*56*	*0*	*47*
Percent Heavy Vehicles	*0*	*0*	*0*	*21*	*0*	*10*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*1*
Lanes	*0*	*0*	*0*	*1*	*0*	*1*
Configuration				*L*		*R*

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*L*	*L*		*R*			
v (veh/h)		*65*	*56*		*47*			
C (m) (veh/h)		*1414*	*681*		*988*			
v/c		*0.05*	*0.08*		*0.05*			
95% queue length		*0.14*	*0.27*		*0.15*			
Control Delay (s/veh)		*7.7*	*10.8*		*8.8*			
LOS		*A*	*B*		*A*			
Approach Delay (s/veh)	--	--	*9.9*					
Approach LOS	--	--	*A*					

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DELAY 5.2

LOS A

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	Stinger
Agency/Co.	Fehr & Peers
Date Performed	9/11/2007
Analysis Time Period	16:00 - 17:00

Site Information

Intersection	US-89 / SR-12
Jurisdiction	Panguitch, UT
Analysis Year	2020+Trucks

Project Description 06-721 Coal Hollow EIS

East/West Street: SR-12 | North/South Street: US-89

Intersection Orientation: North-South | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		101	82	44	61	
Peak-Hour Factor, PHF	1.00	0.89	0.89	0.89	0.89	1.00
Hourly Flow Rate, HFR (veh/h)	0	113	92	49	68	0
Percent Heavy Vehicles	0	--	--	25	--	--
Median Type	Undivided					
RT Channelized			1			0
Lanes	0	1	1	1	1	0
Configuration		T	R	L	T	
Upstream Signal		0			0	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				78		78
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.89	1.00	0.89
Hourly Flow Rate, HFR (veh/h)	0	0	0	87	0	87
Percent Heavy Vehicles	0	0	0	13	0	4
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			1
Lanes	0	0	0	1	0	1
Configuration				L		R

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		L	L		R			
v (veh/h)		49	87		87			
C (m) (veh/h)		1345	663		934			
v/c		0.04	0.13		0.09			
95% queue length		0.11	0.45		0.31			
Control Delay (s/veh)		7.8	11.2		9.2			
LOS		A	B		A			
Approach Delay (s/veh)	--	--	10.2					
Approach LOS	--	--	B					

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DELAY 4.9
LOS A

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*Stinger*	Intersection	*US-89 / SR-14*
Agency/Co.	*Fehr & Peers*	Jurisdiction	*Panguitch, UT*
Date Performed	*9/11/2007*	Analysis Year	*2020+Trucks*
Analysis Time Period	*8:00 - 9:00*		

Project Description *06-721 Coal Hollow EIS*

East/West Street: *SR-14*	North/South Street: *US-89*
Intersection Orientation: *North-South*	Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*33*	*69*	*1*	*3*	*74*	*17*
Peak-Hour Factor, PHF	*0.85*	*0.85*	*0.85*	*0.85*	*0.85*	*0.85*
Hourly Flow Rate, HFR (veh/h)	*38*	*81*	*1*	*3*	*87*	*19*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*1*	*1*	*0*	*0*	*2*	*0*
Configuration	*L*		*TR*	*LT*		*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*19*	*4*	*20*	*0*	*1*	*4*
Peak-Hour Factor, PHF	*0.85*	*0.85*	*0.85*	*0.85*	*0.85*	*0.85*
Hourly Flow Rate, HFR (veh/h)	*22*	*4*	*23*	*0*	*1*	*4*
Percent Heavy Vehicles	*6*	*0*	*5*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*	*LT*		*LTR*			*LTR*	
v (veh/h)	*38*	*3*		*5*			*49*	
C (m) (veh/h)	*1498*	*1528*		*871*			*768*	
v/c	*0.03*	*0.00*		*0.01*			*0.06*	
95% queue length	*0.08*	*0.01*		*0.02*			*0.20*	
Control Delay (s/veh)	*7.5*	*7.4*		*9.2*			*10.0*	
LOS	*A*	*A*		*A*			*B*	
Approach Delay (s/veh)	--	--	*9.2*			*10.0*		
Approach LOS	--	--	*A*			*B*		

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DELAY 3.4

LOS A

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	Stinger
Agency/Co.	Fehr & Peers
Date Performed	9/11/2007
Analysis Time Period	16:00 - 17:00

Site Information

Intersection	US-89 / SR-14
Jurisdiction	Panguitch, UT
Analysis Year	2020+Trucks

Project Description 06-721 Coal Hollow EIS

East/West Street: SR-14 | North/South Street: US-89

Intersection Orientation: North-South | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	33	161	0	5	112	26
Peak-Hour Factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91
Hourly Flow Rate, HFR (veh/h)	36	176	0	5	123	28
Percent Heavy Vehicles	3	--	--	50	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	1	1	0	0	2	0
Configuration	L		TR	LT		TR
Upstream Signal		0			0	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	25	1	29	0	0	0
Peak-Hour Factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91
Hourly Flow Rate, HFR (veh/h)	27	1	31	0	0	0
Percent Heavy Vehicles	9	0	7	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration		LTR			LTR	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L	LT		LTR			LTR	
v (veh/h)	36	5		0			59	
C (m) (veh/h)	1420	1109					675	
v/c	0.03	0.00					0.09	
95% queue length	0.08	0.01					0.29	
Control Delay (s/veh)	7.6	8.3					10.8	
LOS	A	A					B	
Approach Delay (s/veh)	--	--				10.8		
Approach LOS	--	--				B		

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DELAY 2.4
LOS A

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Stinger*
Agency/Co.	*Fehr & Peers*
Date Performed	*9/11/2007*
Analysis Time Period	*8:00 - 9:00*

Site Information

Intersection	*US-89 / SR-20*
Jurisdiction	*Panguitch, UT*
Analysis Year	*2020+Trucks*

Project Description *06-721 Coal Hollow EIS*

East/West Street: *SR-20* North/South Street: *US-89*

Intersection Orientation: *East-West* Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*11*		*49*			
Peak-Hour Factor, PHF	*0.84*	*1.00*	*0.84*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*13*	*0*	*58*	*0*	*0*	*0*
Percent Heavy Vehicles	*18*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*1*	*0*	*1*	*0*	*0*	*0*
Configuration	*L*		*R*			
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*54*	*35*			*19*	*9*
Peak-Hour Factor, PHF	*0.84*	*0.84*	*1.00*	*1.00*	*0.84*	*0.84*
Hourly Flow Rate, HFR (veh/h)	*64*	*41*	*0*	*0*	*22*	*10*
Percent Heavy Vehicles	*32*	*23*	*0*	*0*	*24*	*50*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*1*	*1*	*0*	*0*	*1*	*1*
Configuration	*L*	*T*			*T*	*R*

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*		*L*	*T*			*T*	*R*
v (veh/h)	*13*		*64*	*41*			*22*	*10*
C (m) (veh/h)	*1524*		*857*	*821*			*759*	*960*
v/c	*0.01*		*0.07*	*0.05*			*0.03*	*0.01*
95% queue length	*0.03*		*0.24*	*0.16*			*0.09*	*0.03*
Control Delay (s/veh)	*7.4*		*9.5*	*9.6*			*9.9*	*8.8*
LOS	*A*		*A*	*A*			*A*	*A*
Approach Delay (s/veh)	--	--	*9.6*			*9.5*		
Approach LOS	--	--	*A*			*A*		

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DELAY 7.9

LOS A

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Stinger*
Agency/Co.	*Fehr & Peers*
Date Performed	*9/11/2007*
Analysis Time Period	*16:00 - 17:00*

Site Information

Intersection	*US-89 / SR-20*
Jurisdiction	*Panguitch, UT*
Analysis Year	*2020+Trucks*

Project Description *06-721 Coal Hollow EIS*

East/West Street: *SR-20* North/South Street: *US-89*

Intersection Orientation: *East-West* Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*32*		*79*			
Peak-Hour Factor, PHF	*0.95*	*1.00*	*0.95*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*33*	*0*	*83*	*0*	*0*	*0*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*1*	*0*	*1*	*0*	*0*	*0*
Configuration	*L*		*R*			
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*104*	*44*			*45*	*13*
Peak-Hour Factor, PHF	*0.95*	*0.95*	*1.00*	*1.00*	*0.95*	*0.95*
Hourly Flow Rate, HFR (veh/h)	*109*	*46*	*0*	*0*	*47*	*13*
Percent Heavy Vehicles	*20*	*13*	*0*	*0*	*16*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*1*	*1*	*0*	*0*	*1*	*1*
Configuration	*L*	*T*			*T*	*R*

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*		*L*	*T*			*T*	*R*
v (veh/h)	*33*		*109*	*46*			*47*	*13*
C (m) (veh/h)	*1636*		*780*	*788*			*704*	*1091*
v/c	*0.02*		*0.14*	*0.06*			*0.07*	*0.01*
95% queue length	*0.06*		*0.48*	*0.19*			*0.21*	*0.04*
Control Delay (s/veh)	*7.2*		*10.4*	*9.9*			*10.5*	*8.3*
LOS	*A*		*B*	*A*			*B*	*A*
Approach Delay (s/veh)	--	--	*10.2*			*10.0*		
Approach LOS	--	--	*B*			*B*		

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DELAY 7.7

LOS A

ALL-WAY STOP CONTROL ANALYSIS

General Information

Analyst	*Stinger*
Agency/Co.	*Fehr & Peers*
Date Performed	*9/11/2007*
Analysis Time Period	*8:00 - 9:00*

Site Information

Intersection	*US-89 / Main Street*
Jurisdiction	*Panguitch, UT*
Analysis Year	*2020+Trucks*

Project ID *06-721 Coal Hollow EIS*

East/West Street: *US-89 / Center Street* North/South Street: *SR-143 / US-89*

Volume Adjustments and Site Characteristics

Approach	Eastbound			Westbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	7	26	4	23	16	90
%Thrus Left Lane						

Approach	Northbound			Southbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	5	42	48	91	26	11
%Thrus Left Lane						

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Configuration	*LT*	*R*	*LT*	*R*	*LT*	*R*	*L*	*TR*
PHF	0.88	0.88	0.88	1.00	0.88	0.88	0.88	0.88
Flow Rate (veh/h)	36	4	44	90	52	54	103	41
% Heavy Vehicles	0	0	6	22	5	0	26	0
No. Lanes	2		2		2		2	
Geometry Group	5		5		5		5	
Duration, T	0.25							

Saturation Headway Adjustment Worksheet

Prop. Left-Turns	0.2	0.0	0.6	0.0	0.1	0.0	1.0	0.0
Prop. Right-Turns	0.0	1.0	0.0	1.0	0.0	1.0	0.0	0.3
Prop. Heavy Vehicle	0.0	0.0	0.1	0.2	0.0	0.0	0.3	0.0
hLT-adj	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
hRT-adj	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7
hHV-adj	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
hadj, computed	0.1	-0.7	0.4	-0.3	0.1	-0.7	0.9	-0.2

Departure Headway and Service Time

hd, initial value (s)	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20
x, initial	0.03	0.00	0.04	0.08	0.05	0.05	0.09	0.04
hd, final value (s)	5.37	4.57	5.58	4.85	5.22	4.39	5.97	4.83
x, final value	0.05	0.01	0.07	0.12	0.08	0.07	0.17	0.05
Move-up time, m (s)	2.3		2.3		2.3		2.3	
Service Time, t_s (s)	3.1	2.3	3.3	2.6	2.9	2.1	3.7	2.5

Capacity and Level of Service

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Capacity (veh/h)	286	254	294	340	302	304	353	291
Delay (s/veh)	8.37	7.30	8.68	8.22	8.34	7.40	9.90	7.81
LOS	A	A	A	A	A	A	A	A
Approach: Delay (s/veh)	8.27		8.37		7.86		9.30	
LOS	A		A		A		A	
Intersection Delay (s/veh)	8.55							
Intersection LOS	A							

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ALL-WAY STOP CONTROL ANALYSIS

General Information

Analyst	Stinger
Agency/Co.	Fehr & Peers
Date Performed	9/11/2007
Analysis Time Period	16:15 - 17:15

Site Information

Intersection	US-89 / Main Street
Jurisdiction	Panguitch, UT
Analysis Year	2020+Trucks

Project ID 06-721 Coal Hollow EIS

East/West Street: US-89 / Center Street | North/South Street: SR-143 / US-89

Volume Adjustments and Site Characteristics

Approach	Eastbound			Westbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	20	44	11	52	46	178
%Thrus Left Lane						

Approach	Northbound			Southbound		
Movement	L	T	R	L	T	R
Volume (veh/h)	9	59	25	140	45	32
%Thrus Left Lane						

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Configuration	LT	R	LT	R	LT	R	L	TR
PHF	0.85	0.85	0.85	1.00	0.85	0.85	0.85	0.85
Flow Rate (veh/h)	74	12	115	178	79	29	164	89
% Heavy Vehicles	4	7	6	18	5	6	18	4
No. Lanes	2		2		2		2	
Geometry Group	5		5		5		5	
Duration, T	0.25							

Saturation Headway Adjustment Worksheet

Prop. Left-Turns	0.3	0.0	0.5	0.0	0.1	0.0	1.0	0.0
Prop. Right-Turns	0.0	1.0	0.0	1.0	0.0	1.0	0.0	0.4
Prop. Heavy Vehicle	0.0	0.1	0.1	0.2	0.0	0.1	0.2	0.0
hLT-adj	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
hRT-adj	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7
hHV-adj	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
hadj, computed	0.2	-0.6	0.4	-0.4	0.1	-0.6	0.8	-0.2

Departure Headway and Service Time

hd, initial value (s)	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20
x, initial	0.07	0.01	0.10	0.16	0.07	0.03	0.15	0.08
hd, final value (s)	6.09	5.29	5.99	5.23	5.98	5.23	6.44	5.41
x, final value	0.13	0.02	0.19	0.26	0.13	0.04	0.29	0.13
Move-up time, m (s)	2.3		2.3		2.3		2.3	
Service Time, t_s (s)	3.8	3.0	3.7	2.9	3.7	2.9	4.1	3.1

Capacity and Level of Service

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Capacity (veh/h)	324	262	365	428	329	279	414	339
Delay (s/veh)	9.66	8.08	10.10	9.74	9.58	8.16	11.78	8.94
LOS	A	A	B	A	A	A	B	A
Approach: Delay (s/veh)	9.44		9.88		9.20		10.78	
LOS	A		A		A		B	
Intersection Delay (s/veh)	10.04							
Intersection LOS	B							

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99		1.00	0.99	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85		1.00	0.89	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1805	3406	1442	1787	3471	1615	1516	1567		1800	1678	
Flt Permitted	0.46	1.00	1.00	0.34	1.00	1.00	0.75	1.00		0.65	1.00	
Satd. Flow (perm)	868	3406	1442	639	3471	1615	1202	1567		1235	1678	
Volume (vph)	3	423	124	89	319	5	81	2	141	12	2	4
Peak-hour factor, PHF	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Adj. Flow (vph)	3	492	144	103	371	6	94	2	164	14	2	5
RTOR Reduction (vph)	0	0	108	0	0	5	0	59	0	0	2	0
Lane Group Flow (vph)	3	492	36	103	371	1	94	107	0	14	5	0
Confl. Peds. (#/hr)							1		1	5		5
Heavy Vehicles (%)	0%	6%	12%	1%	4%	0%	19%	0%	2%	0%	0%	0%
Turn Type	Perm		Perm	Perm		Perm	Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8		8	2			6		
Actuated Green, G (s)	15.3	15.3	15.3	15.3	15.3	15.3	42.7	42.7		42.7	42.7	
Effective Green, g (s)	17.3	17.3	17.3	17.3	17.3	17.3	44.7	44.7		44.7	44.7	
Actuated g/C Ratio	0.25	0.25	0.25	0.25	0.25	0.25	0.64	0.64		0.64	0.64	
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	215	842	356	158	858	399	768	1001		789	1072	
v/s Ratio Prot		0.14			0.11			c0.11			0.00	
v/s Ratio Perm	0.00		0.10	c0.16		0.00	0.08			0.01		
v/c Ratio	0.01	0.58	0.10	0.65	0.43	0.00	0.12	0.11		0.02	0.00	
Uniform Delay, d1	19.9	23.2	20.3	23.6	22.2	19.9	5.0	4.9		4.6	4.6	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.0	1.0	0.1	9.3	0.4	0.0	0.3	0.2		0.0	0.0	
Delay (s)	19.9	24.2	20.5	32.9	22.6	19.9	5.3	5.1		4.7	4.6	
Level of Service	B	C	C	C	C	B	A	A		A	A	
Approach Delay (s)		23.4			24.7			5.2			4.6	
Approach LOS		C			C			A			A	

Intersection Summary			
HCM Average Control Delay	20.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.30		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	51.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor		0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes		1.00	1.00	1.00	1.00	1.00	1.00	0.99		1.00	1.00	
Flpb, ped/bikes		1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt		1.00	0.85	1.00	1.00	0.85	1.00	0.85		1.00	0.97	
Flt Protected		1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		3505	1538	1770	3539	1615	1566	1584		1805	1843	
Flt Permitted		1.00	1.00	0.37	1.00	1.00	0.75	1.00		0.65	1.00	
Satd. Flow (perm)		3505	1538	682	3539	1615	1244	1584		1233	1843	
Volume (vph)	0	483	183	154	587	15	104	4	157	9	4	1
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	0	514	195	164	624	16	111	4	167	10	4	1
RTOR Reduction (vph)	0	0	134	0	0	11	0	71	0	0	0	0
Lane Group Flow (vph)	0	514	61	164	624	5	111	100	0	10	5	0
Confl. Peds. (#/hr)							3		3			
Heavy Vehicles (%)	0%	3%	5%	2%	2%	0%	15%	0%	1%	0%	0%	0%
Turn Type	Perm		Perm	Perm		Perm	Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8		8	2			6		
Actuated Green, G (s)		19.8	19.8	19.8	19.8	19.8	38.2	38.2		38.2	38.2	
Effective Green, g (s)		21.8	21.8	21.8	21.8	21.8	40.2	40.2		40.2	40.2	
Actuated g/C Ratio		0.31	0.31	0.31	0.31	0.31	0.57	0.57		0.57	0.57	
Clearance Time (s)		6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	
Vehicle Extension (s)		3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		1092	479	212	1102	503	714	910		708	1058	
v/s Ratio Prot		0.15			0.18			c0.11			0.00	
v/s Ratio Perm			0.13	c0.24		0.01	0.09			0.01		
v/c Ratio		0.47	0.13	0.77	0.57	0.01	0.16	0.11		0.01	0.00	
Uniform Delay, d1		19.4	17.3	21.9	20.1	16.6	7.0	6.8		6.4	6.4	
Progression Factor		1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2		0.3	0.1	16.0	0.7	0.0	0.5	0.2		0.0	0.0	
Delay (s)		19.8	17.4	37.9	20.8	16.7	7.4	7.0		6.4	6.4	
Level of Service		B	B	D	C	B	A	A		A	A	
Approach Delay (s)		19.1			24.2			7.2			6.4	
Approach LOS		B			C			A			A	

Intersection Summary			
HCM Average Control Delay	19.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.39		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	56.9%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

APPENDIX C
Crash Data

State of Utah

JON M. HUNTSMAN, JR.
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GARY R. HERBERT
Lieutenant Governor

DEPARTMENT OF TRANSPORTATION

JOHN R. NJORD, P.E.
Executive Director

CARLOS M. BRACERAS, P.E.
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August 15, 2007

Preston Stinger
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Fehr & Peers
2180 South 1300 East, Suite 220
Salt Lake City, UT 84106

Re: Operational Safety Report #07-037; US-89, MP 90.04 to MP 156.36 (Glendale to Jct. SR-20). Safety Evaluation.

Dear Mr. Stinger:

We have evaluated the crash history for the subject section of US-89 for the three-year period of 2003 through 2005, with the following results:

RURAL OTHER PRINCIPAL ARTERIAL		ACTUAL				EXPECTED
		2003	2004	2005	TOTAL/AVG	
Number of Crashes		82	104	101	287/95.67	
Crash Rate		2.25	2.85	2.68	2.59	1.46
Severity		1.61	1.46	1.52	1.59	1.70
Single Vehicle Crashes	81.2%				233	

Crash data indicates that the crash rate of this section is higher than the expected and the severity is lower than the expected. The predominant crash type was the single vehicle, accounting for 81.2% or 233 of the total number of crashes. The breakdown of these crashes by type, number, and percent is as follows:

CRASH TYPE	**No.**	**% OF SINGLE VEH. CRASHES**
1. Wildlife Related	126	54.1
2. Ran Off Road Right	63	27.0
3. Ran Off Road Left	24	10.3
4. Fixed Object	10	4.3

CRASH TYPE	No.	% OF SINGLE VEH. CRASHES
5. Domestic Animal Related	5	2.1
6. Other Object	4	1.7
7. Overturned in Roadway	1	0.5
	233	100.0%

We recommend that the following items be considered during design of the project to reduce the number/severity of/or the potential for crashes:

1. Several sections of guardrail though this segment of US-89 need to be upgraded with regards to height, hardware, and the removal of Texas Turndown sections, replacing them with adequate end treatments.
2. Replace all concrete barrier using wire rope loop for the barrier pin connections
3. Various CMP culverts are inside the clear zone and need to be extended.
4. Dilapidated or defaced signs need to be upgraded to current MUTCD standards.
5. We recommend installing bicycle safe drainage grates through the towns of Glendale and Panguitch.
6. It is also recommended to eliminate unused or unnecessary driveway cuts through the two towns mentioned above.
7. Upgrade disabled pedestrian ramps to current ADA standards, meeting also UDOT Standard Drawing GW-5.
8. Various locations with steep slopes might have guardrail warranted.
9. Several concrete box culverts within this segment of US-89 lie inside the clear zone at distances ranging from 4 feet to 12 feet, thus needing to be extended.
10. Stop sign at Alton Road needs to be moved ahead closer to US-89. Currently, in its present location, it sits too far back from the main highway at approximately 70 feet $\pm$.
11. Construct both a right turn and an acceleration lane NB at the intersection with Alton Road.
12. Construct an exclusive right turn lane EB at the intersection with SR-14.
13. Extend the climbing lane NB along US-89 to just past the crest of the vertical curve at the intersection with SR-14.
14. Ideally, it would be advisable to relocate the intersection of US-89 and SR-14 to the top of the crest of the vertical curve for better sight distance to the north. In its current location, this intersection provides excellent sight distance to the south only.

Source documents are available at the Division of Traffic and Safety for additional analysis. If questions arise, please call me at 801-965-4045.

Sincerely,

John L. Leonard, P.E.
Traffic and Safety Operations Engineer

cc: Robert Hull, John Leonard, Zeke Gonzalez
Roland Stanger, FHWA, Troy Torgerson, R-4, Mike Miles, R-4

State of Utah

JON M. HUNTSMAN, JR.
Governor

GARY R. HERBERT
Lieutenant Governor

DEPARTMENT OF TRANSPORTATION

JOHN R. NJORD, P.E.
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CARLOS M. BRACERAS, P.E.
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August 15, 2007

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Fehr & Peers
2180 South 1300 East, Suite 220
Salt Lake City, Utah 84106

Re: Operational Safety Report #07-038; SR-20, MP 0.00 to MP 20.61. (I-15 to Jct. US-89). Safety Evaluation.

Dear Mr. Stinger:

We have evaluated the crash history for the subject section of SR-20 for the three-year period of 2003 through 2005, with the following results:

RURAL MINOR ARTERIAL		ACTUAL				EXPECTED
		2003	2004	2004	TOTAL/AVG	
Number of Crashes		26	28	25	79/26.33	
Crash Rate		2.56	2.76	2.46	2.59	1.96
Severity		1.35	1.39	1.76	1.50	1.72
Single Vehicle Crashes	86.1%				68	

Crash data indicates that the crash rate of this section is higher than the expected and the severity is lower than the expected. The predominant crash type was the single vehicle, accounting for 86.1% or 68 of the total number of crashes. The distribution of these crashes by type, number, and percent of single vehicle crashes is as follows:

CRASH TYPE	No.	% OF SINGLE VEH. CRASHES
1. Ran Off Road Right	31	45.5
2. Ran Off Road Left	12	17.7
3. Wildlife Related	12	17.7
4. Fixed Object	10	14.7
5. Other Non-Collision	3	4.4
	TOTAL = 68	100.0%

There were no clusters of crashes at any location. Approximately 70% of these crashes occurred under snowy/icy conditions. With regards to all types of crashes, 53% occurred in dry weather conditions and 60% during daytime hours. The main contributing factor for crashes where vehicles ran off the road was excessive speed; the objects most commonly struck were a dirt embankment, followed by guardrail.

This state road was widened and improved within the last 3 to 4 years, and many, if not all of its features were upgraded, such as flattening of side slopes, guardrail, end treatments, drainage, signing, shoulders, etc. Therefore, based on our crash analysis, in its current geometric condition, and after our field review, we feel that this facility does not present safety deficiencies that need to be corrected.

Source documents are available at the Division of Traffic and Safety for additional analysis. If questions arise, please call me at 801-965-4045.

Sincerely,

John L. Leonard, P.E.
Traffic and Safety Operations Engineer

cc: Robert Hull, John Leonard, Zeke Gonzalez
Roland Stanger, FHWA, Troy Torgerson, R-4, Mike Miles, R-4

State of Utah

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August 15, 2007

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Salt Lake City, Utah 84106

Re: Operational Safety Report #07-039; I-15 from MP 59.05 to MP 100.02 (Cedar City to SR-20). Safety Evaluation.

Dear Mr. Stinger:

We have evaluated the crash history for the subject section of I-15 for the three-year period of 2003 through 2005, with the following results:

RURAL INTERSTATE		ACTUAL				EXPECTED
		2003	2004	2005	TOTAL/AVG	
Number of Crashes		140	146	155	441/147.00	
Crash Rate		0.71	0.74	0.79	0.75	0.87
Severity		2.11	1.96	1.95	2.01	1.83
Single Vehicle Crashes	77.6%				342	
Rear End Crashes	11.1%				49	
Same Dir. Side Swipe	9.8%				43	

Crash data indicates that the crash rate of this section is lower than the expected and the severity is higher than the expected. The predominant crash types are listed on the table above.

Single vehicle crashes were distributed by type, number, and percent as follows:

CRASH TYPE	No.	% OF SINGLE VEH. CRASHES
1. Ran Off Road Right	108	31.6
2. Ran Off Road Left	68	19.9
3. Ran Off Road Through Median	44	12.9
4. Wildlife Related	39	11.4
5. Other Object	25	7.3
6. Fixed Object	23	6.7
7. Other Non-Collision	22	6.4
8. Overturned in Roadway	10	2.9
9. Pedestrian Related	1	0.3
10. Bicycle Related	1	0.3
11. Domestic Animal Related	1	0.3
	TOTAL = 342	100.0%

There where no significant clusters of crashes at any location. The first primary factor to crashes where vehicles ran off the road was “excessive speed”, followed by “falling asleep at the wheel”, and “other improper driver behavior”. Rear end crashes occurred mostly as some drivers were following other drivers too closely and sideswipe crashes were caused primarily by drivers attempting an unsafe passing maneuver.

There were a total of 12 fatal crashes that occurred within this segment of interstate and these crashes resulted in 14 fatalities. These fatal crashes were associated with vehicles running off the road (11); one was the result of a rear end collision, one was pedestrian related, and the last one resulted out of a sideswipe crash. Six of the fatal run off the road crashes were caused by drivers falling asleep at the wheel.

We recommend that the following items be considered during design of the project to reduce the number/severity of/or the potential for crashes:

1. Ensure that continuous shoulder rumble strips are in place.
2. Upgrade guardrail to height standards and replace Texas Turndown sections with adequate end treatments.
3. Along with number 2 above, install guardrail transition elements.
4. Replace all concrete barrier using wire rope loop for the barrier pin connections.
5. Upgrade signing as needed to meet the most current edition of the MUTCD.
6. Ensure that all breakaway installations are placed at the required height from the ground level to ensure proper operation.
7. Ensure that wood signposts requiring drilling for breakaway operations are drilled appropriately.
8. Correct localized areas of shoulder edge rut.

9. Side slopes appear to be adequate.
10. Verify that roadside delineators are placed at the correct spacing and that those that are missing or damaged are replaced accordingly.
11. Extend CMP and concrete box culverts that lie inside the clear zone.

Source documents are available at the Division of Traffic and Safety for additional analysis. If questions arise, please call me at 801-965-4045.

Sincerely,

John L. Leonard, P.E.
Traffic and Safety Operations Engineer

cc: Robert Hull, John Leonard, Zeke Gonzalez
Roland Stanger, FHWA, Troy Torgerson, R-4, Mike Miles, R-4

State of Utah

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August 15, 2007

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Salt Lake City, UT 84106

RE: Operational Safety Report # 07-040; SR-56 from MP 9.80 to MP 61.39. Safety Evaluation

Dear Mr. Stinger:

We have evaluated the crash history for the subject section of SR-56 for the three-year period of 2003 through 2005, with the following results:

MAJOR COLLECTOR/MINOR ARTERIAL		ACTUAL				EXPECTED
		2003	2004	2005	TOTAL/AVG	
Number of Crashes		58	49	67	174/58.00	
Crash Rate		2.04	1.73	2.32	2.03	2.14
Severity		1.83	1.49	1.75	1.69	1.77
Single Vehicle Crashes	48.3%				84	
Rear End Crashes	19.0%				33	
Right Angle Crashes	16.1%				28	
Left Turn Crashes	6.90%				12	

Crash data indicates that both the crash rate and severity of this section are lower than the expected. The predominant crash types are listed on the table above.

Single vehicle crashes were distributed by type, number, and percentage as follows:

CRASH TYPE	No.	% OF SINGLE VEH. CRASHES
1. Wildlife Related	34	40.5
2. Ran Off Road Left	16	19.0
3. Ran Off Road Right	16	19.0
4. Domestic Animal Related	6	7.1
5. Fixed Object	4	4.8
6. Other Non-Collision	3	3.6
7. Other Object	2	2.4
8. Bicycle Related	2	2.4
9. Pedestrian Related	1	1.2
	TOTAL = 84	100.0%

There were no significant clusters of crashes at any location. Primary contributing factors to crashes where vehicles left the roadway included: “Excessive speed”; “Falling asleep at the wheel”, and a few “DUI’s”. Rear end, left turn, and right angle crashes were mainly concentrated at intersections along the western boundaries of the city. With regards to all types of crashes, approximately 80% occurred in dry weather conditions and 70% occurred in the daytime.

There were two fatal crashes within this segment of SR-56. A distracted EB driver who crossed the centerline and impacted a WB vehicle head on caused one of these crashes. The second one was the result of a single vehicle that left the roadway.

We recommend that the following items be considered during design of the project to reduce the number/severity of/or the potential for crashes:

1. Upgrade signing to current MUTCD standards.
2. Replace all concrete barrier using wire rope loop for the barrier pin connections
3. Various drainage issues, such as bicycle safe drainage grates, extension of CPMs, and concrete box culverts.
4. Upgrade disabled pedestrian ramps to current ADA standards meeting also UDOT Standard Drawing GW-5.
5. Various highway signs near the intersection with Lund Highway appear to create too much clutter, as they are too close to each other, specifically obscuring the RR X-ing sign.
6. Ensure that wood signposts are properly drilled.
7. Install T-intersection signing at Iron Springs Road for SB traffic.
8. No shoulders past Iron Springs Road continuing west.
9. Rock outcrop is too close (2’) to the travel lane in the WB direction of travel at MP 48.9±.

10. Concrete box culvert headwall at MP 47.2 is at 2’ from the travel lane; needs to be extended.
11. Create WB right turn lane and an EB left turn lane into the housing community directly across the UDOT shed.
12. Paint stop bars at all stop controlled intersections.
13. Install turning lanes into the post office in the town of Beryl.
14. Improve attenuation application at the structure at MP 32 just east of the town of New Castle.

Source documents are available at the Division of Traffic and Safety for additional analysis. If questions arise, please call me at 801-965-4045.

Sincerely,

John L. Leonard, P.E.
Traffic and Safety Operations Engineer

cc: Robert Hull, John Leonard, Zeke González
Roland Stanger, FHWA, Troy Torgerson, R-4, Mike Miles, R-4

APPENDIX I.
ALTON COAL TRACT LBA EIS BIOLOGICAL AND WETLAND FIELD INVESTIGATIONS

APPENDIX I CONTENTS

I.1. Alton Coal Tract LBA EIS Report of Reconnaissance Surveys: Vegetation And Special Status Species, Wildlife And Special Status Species, Sandloving Penstemon, Wet Meadows

I.2. Preliminary Jurisdictional Determination for the Alton Coal Tract

I.3. Wetland and Stream Delineation Technical Report - Alton Coal Tract Lease by Application Project

I.4. Alton Coal Tract Special Status Plant Species Clearance Survey Report

I.1. Alton Coal Tract LBA EIS Report of Reconnaissance Surveys: Vegetation And Special Status Species, Wildlife And Special Status Species, Sandloving Penstemon, Wet Meadows

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ATTACHMENTS

Attachment 1: Relevé Plot Data

Attachment 2: Vegetation Associations and Species List

PRELIMINARY THREATENED AND ENDANGERED AND SENSITIVE SPECIES ANALYSIS

On June 7, 2007, personnel from the Bureau of Land Management (BLM) Kanab Field Office met with personnel from SWCA Environmental Consultants (SWCA's) Salt Lake City office about the Alton Coal Tract LBA EIS. At this meeting, the BLM requested that SWCA compile a list of threatened and endangered and sensitive (TES) plant and animal species that may be subject to impacts associated with the potential development of the Alton Coal Tract.

SWCA conducted a three-step process to determine which species may be impacted:

Step 1. Development of a comprehensive species list, including all potentially present species in the affected counties. SWCA personnel compiled a comprehensive list of all potentially impacted TES plant and animal species from the sources listed below. For plants, the comprehensive list was limited to Kane County because ground-disturbing activities would be limited to this county and impacts would be expected to be limited to this area. Impacts to plants would not occur along the proposed transportation corridor. For animals, the comprehensive list comprised Kane, Garfield, and Iron counties. Though new ground disturbance would not be expected in Garfield and Iron counties, the comprehensive list pulls from these counties because impacts may occur from truck collisions with animals.

- **TES Plant Species**
  - Utah Department of Natural Resources, Conservation Data Center (CDC)
  - Inventory of Sensitive Species and Ecosystems in Utah, Endemic and Rare Plants of Utah: An Overview of Their Distribution and Status
  - Kanab Field Office RMP/EIS Final Analysis of the Management Situation (12/2005)
  - Utah Rare Plant Guide (http://www.utahrareplants.org/rpg_species.html; accessed 6/20/2007)
- **TES Animal Species**
  - Utah Department of Natural Resources, CDC
  - Utah State Listed Species by County (compiled using known species occurrences and species observations from the Utah Natural Heritage Program's Biodiversity Tracking and Conservation System [BIOTICS])
  - County Lists of Utah's Federally Listed Threatened (T), Endangered (E), and Candidate (C) Species
  - Kanab Field Office RMP/EIS Final Analysis of the Management Situation (12/2005)

Step 2. Reduction of the comprehensive species list based on the probability of occurrence as determined through the analysis of SWReGAP data, elevation within the potentially affected area, and known distribution according to the CDC database.

- **TES Plant Species**

  SWCA researched each species on the comprehensive list to determine the probability of occurrence in the Alton Coal Tract LBA. Key factors in determining probability of occurrence were vegetation type (SWReGAP), elevation, and known distribution according to the CDC database. Species were sorted into three groups:

  1. Known distribution shown on CDC or SWReGAP; recommend survey/further investigation
  2. Known distribution provided by CDC did not overlap with the tract, but habitat type may occur in the tract; recommend survey/further investigation
  3. Not likely to occur; do not recommend survey

Additional information on each plant's bloom period (where readily available) was also obtained to provide detail relevant to surveying.

- **TES Animal Species**

  SWCA researched each species on the comprehensive list to determine the probability of occurrence in the Alton Coal Tract LBA and along the reasonably foreseeable transportation route and one alternate transportation route. Key factors in determining probability of occurrence were vegetation type (SWReGAP) and known distribution according to the CDC database. Species were sorted into three groups:

  1. Habitat shown on CDC; recommend survey/further investigation
  2. Not shown on CDC but habitat may occur; recommend survey/further investigation
  3. Not likely to occur, do not recommend survey

  Additional information on the survey period for each animal was also obtained.

Step 3. Further reduction of the comprehensive species list based on spatial analysis (GIS) modeling coupled with SWReGAP and CDC analyses.

- **TES Plant Species**

  SWCA used a GIS model to determine specific locations of potential occurrences of TES plant species in the Alton Coal Tract LBA. The GIS model included elevation, vegetation type, and species listed in groups 1 and 2 from Step 2.

- **TES Animal Species**

  SWCA used a GIS model to determine specific locations of potential occurrences of TES animal species in the Alton Coal Tract LBA. The GIS model included habitat type and the listed species in groups 1 and 2 from Step 2.

  SWCA used the same model to determine specific locations of potential occurrences of TES animal species along the reasonably foreseeable transportation route and one alternate route. The GIS model included habitat type and the listed species in groups 1, 2, and 3 from Step 2. The model was limited to a 200-foot buffer zone on either side of the roads making up the reasonably foreseeable transportation route and alternate route. Potential occurrences of TES animals for each transportation segment were provided in a memorandum to the BLM.

At the conclusion of the three-step analysis process, SWCA presented to BLM a list of species for which surveys were recommended, which BLM further refined based on personnel knowledge of the resources in the tract. The final list of recommendations was as follows:

Plants

- Paria breadroot
- Sandloving penstemon
- Ruth's sphaeromeria
- Charleston Mountain violet
- Slender (meager) camissonia
- Jones Cycladenia

Animals

- Bald Eagle
- Yellow-Billed Cuckoo
- Mexican Spotted Owl
- Southwestern Willow Flycatcher
- Three-Toed Woodpecker
- Townsend's Big-Eared Bat
- Western Toad
- Black Swift
- Kit Fox

- Utah Prairie Dog
- Allen's Big-Eared Bat
- Arizona Toad
- Big Free-Tailed Bat
- Burrowing Owl
- Ferruginous Hawk
- Fringed Myotis
- Greater Sage-Grouse
- Lewis's Woodpecker
- Long-Billed Curlew
- Northern Goshawk
- Spotted Bat
- Pygmy Rabbit
- Short-Eared Owl
- **Surveys recommended for proposed and alternate transportation routes:**
  - Pygmy Rabbit
  - Utah Prairie Dog
  - Kit Fox
  - Greater Sage Grouse

This list was then further refined through the reconnaissance surveys discussed below.

RECONNAISSANCE SURVEYS AND POTENTIAL SPECIES OCCURRENCE DETERMINATIONS

During fall 2007 and spring 2008, three reconnaissance-level surveys were conducted on the Alton Coal Tract. These surveys were conducted to

- characterize vegetation communities on the tract,
- determine presence/absence of certain wildlife and plant species on the tract, and
- make a preliminary determination of the presence of wet meadow wetlands on the tract.

Surveys were conducted November 16–18, 2007; May 27–30, 2008; and July 2, 2008. The methods, results, and conclusions of these field inventories are reported below by survey date in ascending chronological order.

RECONNAISSANCE SURVEY NOVEMBER 16–18, 2007

From November 16 to 18, 2007, three personnel from SWCA's Salt Lake City Office and one personnel from Mt. Nebo Consulting (surveyors listed in Attachment 1) conducted a reconnaissance-level survey of lands within the Alton Coal Tract LBA. The purpose of the survey was to 1) provide data for use in alternatives development for the Alton Coal Tact LBA EIS; 2) provide data for Chapters 3 and 4 of the Alton Coal Tract LBA EIS; and 3) narrow the list of species for which species-specific surveys may need to be completed in support of the Alton Coal Tract LBA EIS and provide documentation of this and target areas for species specific surveys during the appropriate survey period.

WILDLIFE SURVEY NOVEMBER 16–18, 2007

METHODS

Mexican Spotted Owl (MSO)

Using the 1997 and 2000 MSO habitat models (Spotskey and Willey 1997, 2000) two areas near the tract were identified as potentially suitable nesting habitat (Figure 1). These areas were assessed by recording the presence-absence of the five primary constituent elements (PCEs) identified in the MSO Recovery Plan (USFWS 1995) and other parameters on a standardized field form, to verify their suitability as MSO nesting habitat.

Southwestern Willow Flycatcher and Western Yellow-billed Cuckoo

Three riparian areas were identified through SWReGAP as potentially suitable habitat for southwestern willow flycatchers (SWFL) and yellow-billed cuckoos (YBCU). These riparian areas were labeled as Riparian A, Riparian B, and Riparian C (see Figure 1). These three stretches were walked and assessed to vserify their suitability as potential stopover and nesting habitat.

The surveyors focused on finding areas containing tamarisk and other species such as Fremont cottonwood *(Populus fremontii)* and black willow *(Salix gooddingii)*, which have the proper structure to be potentially suitable for use by nesting willow flycatchers. For the purposes of the study, potentially suitable habitat was defined as dense, woody, riparian vegetation greater than 3.0 m (9.8 feet) in height with greater than 75% canopy cover.

Pygmy Rabbit

Pygmy rabbits were listed as a potentially occurring species within the tract. Potentially suitable habitat was assessed during other wildlife and general vegetation surveys. According to *Surveying for Pygmy Rabbits* (Ulmschneider et al. 2004):

> The site characteristics of areas inhabited by pygmy rabbits in Utah vary considerably. Burrow habitat in southern, low elevation sites is often limited to the bottom of gentle drainages supporting Wyoming sagebrush amid a black sage, shadscale, and gray molly community of minimal height (28 cm). Understory condition is variable: many sites have grasses and forbs in excellent condition, but some of the most numerous pygmy rabbit populations discovered are in chronically grazed areas (sheep and cattle) being targeted for rehabilitation.

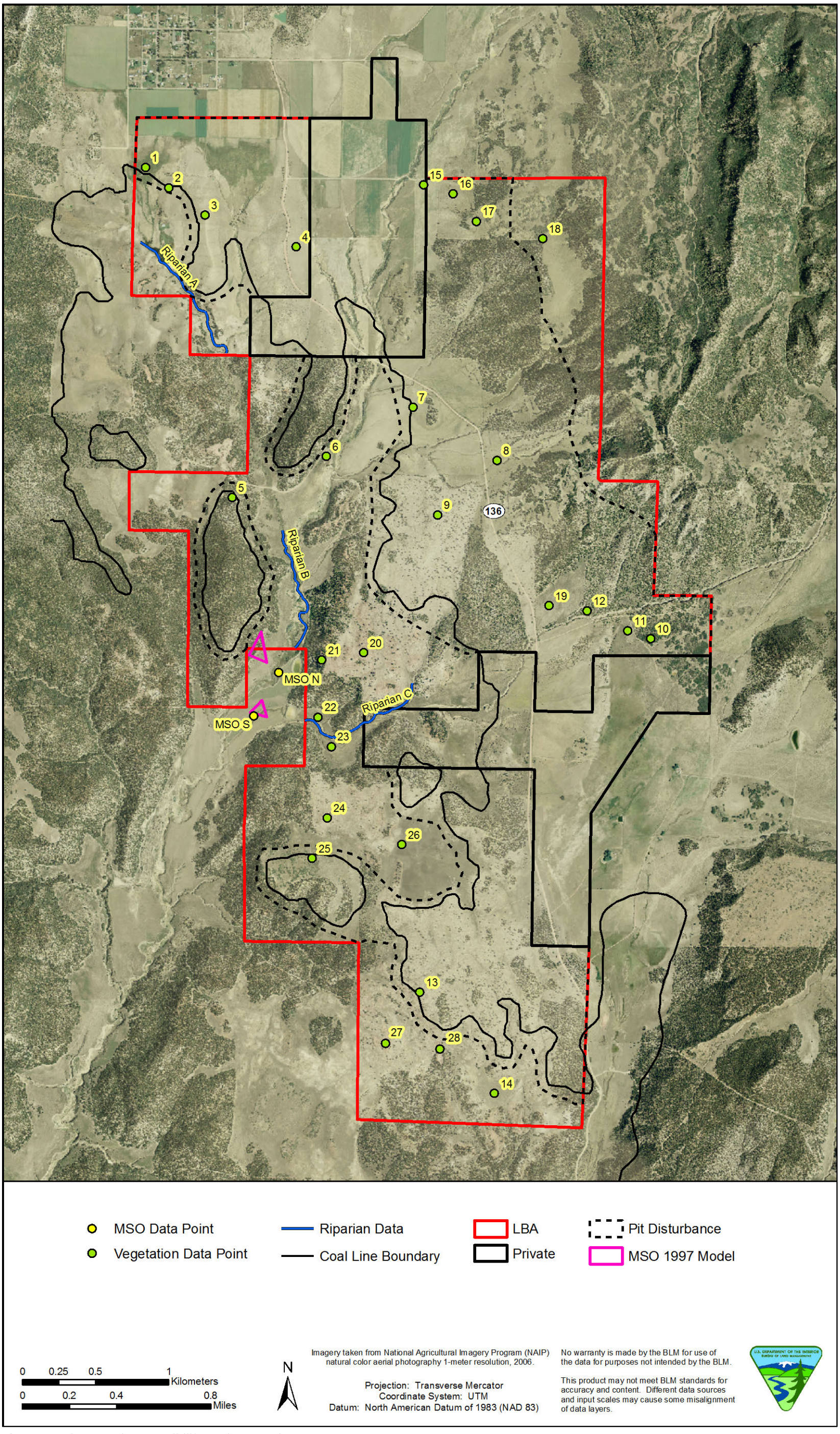

Figure 1. Alton Coal Tract wildlife and vegetation survey map.

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Therefore, areas of large dense sagebrush were of particular concern, and the fact that certain areas are grazed did not affect how the area was assessed as to the possibility of the presence of pygmy rabbits.

RESULTS AND DISCUSSION

Mexican Spotted Owl (MSO)

The two potentially suitable MSO habitat units, A-North and A-South (see Figure 1), were evaluated by recording and ranking the presence-absence of the five PCEs identified in the MSO Recovery Plan (USFWS 2004). Both A-North and A-South received poor ratings and therefore are no longer considered potentially suitable habitat for MSO. It is therefore very unlikely that any MSO occur anywhere near the tract.

Southwestern Willow Flycatcher (SWFL) and Western Yellow-billed Cuckoo (YBCU)

The three riparian areas were walked and evaluated (see Figure 1). Riparian Area A did not contain any tamarisk, willow, or cottonwood trees. Riparian Area B had only sparse cottonwood trees along with relatively common Russian olive trees. Riparian Area C had only one cottonwood tree along the entire stretch. Therefore, all three areas Riparian A, B, and C were found to be of no nesting or stopover value to SWFL or YBCU.

Pygmy Rabbit

During the vegetation surveys two different areas were found to be potentially suitable pygmy rabbit habitat (see Figure 1). These areas had relatively large patches of large sagebrush. Potential pygmy rabbit pellets were found and collected. It is possible that these pellets are young or small cottontails.

Table 1. Summary of SWFL, YBCU and MSO Potential to Occur in the LBA

Common Name (*Scientific Name*)	Status	Habitat Type	Potential On Tract	Field Surveys Recommended? EIS Analysis?
Mexican Spotted Owl (*Strix occidentalis lucida*)	T	This species uses cliff, canyon, riparian, conifer forest, and mixed forest habitats.	No Potential Habitat. Based on fall habitat surveys.	No Field Surveys. No EIS Analysis.
Southwestern Willow Flycatcher (*Empidonax traillii extimus*)	E	This species uses riparian, forested wetland, shrubland, and mixed woodland habitats.	No Potential Habitat. Based on fall habitat surveys.	No additional Field Surveys. No EIS Analysis.
Western Yellow-billed Cuckoo (*Coccyzus americanus occidentalis*)	C	This species uses riparian, forested wetland, scrub-shrub wetland, shrubland, and mixed woodland habitats.	No Potential Habitat. Based on fall habitat surveys.	No additional Field Surveys. No EIS Analysis.
Pygmy Rabbit (*Brachylagus idahoensis*)	SPC	This species uses big sagebrush and shrubland habitats.	Two Potential habitat areas	Additional Field Surveys Recommended. EIS Analysis: Yes.

Other Species

Other special status wildlife species with potential to occur in the tract are listed in Table 2.

Table 2. Other Special Status Wildlife Species with Potential to Occur in the LBA

Common Name (*Scientific Name*)	**Status**	**Habitat Type**	**Potential On Tract**	**Field Surveys Recommended?** **EIS Analysis?**
Bald Eagle (*Haliaeetus leucocephalus*)	Delisted 2008	This species uses riparian, riverine, forested wetland, coniferous forest, mixed forest, and woodland habitats.	Potential wintering habitat is present but no known nests	Raptor surveys completed in 2007 and again before project implementation. EIS Analysis: Yes
Allen's Big-eared Bat (*Idionycteris Phyllotis*)	SPC	This species uses cliff, canyon, and riparian habitats.	Potential habitat surrounding the tract but not within it.	No Field Surveys. EIS Analysis of Indirect Effects.
Arizona Toad (*Bufo microscaphus*)	SPC	This species uses open water, riparian, shrubland, desert, and woodland habitats.	Potential Habitat is present	No Field Surveys. EIS Analysis: Yes
Big Free-tailed Bat (*Nyctinomops macrotis*)	SPC	This species uses cliff, canyon, and riparian habitats.	Potential habitat surrounding the tract but not within it.	No Field Surveys. EIS Analysis of Indirect Effects.
Burrowing Owl (*Athene cunicularia*)	SPC	This species uses grassland, shrubland, and desert habitats.	Likely to occur on the tract	Field surveys should occur where the ground will be disturbed. EIS Analysis: Yes
Ferruginous Hawk (*Buteo regalis*)	SPC	This species uses riparian, cliff, desert, grassland, sagebrush, and shrubland habitats.	Likely to occur on or near the tract. Raptor nest surveys are needed	Raptor surveys completed in 2007 and again before project implementation. EIS Analysis: Yes
Fringed Myotis (*Myotis thysanodes*)	SPC	This species uses cliff, canyon, and riparian habitats.	Potential habitat surrounding the Tract but not within it.	No Field Surveys. EIS Analysis of Indirect Effects.
Greater Sage-grouse (*Centrocercus urophasianus*)	SPC	This species uses grassland, sagebrush, shrubland, and riparian habitats.	Individuals and a lek present on the Tract.	Field Surveys: Yes EIS Analysis: Yes
Lewis's Woodpecker (*Melanerpes lewis*)	SPC	This species uses coniferous forest, woodland, and shrubland habitats.	The CDC shows primary breeding habitat in and adjacent to the tract.	No Field Surveys. EIS Analysis: Yes
Long-billed Curlew (*Numenius americanus*)	SPC	This species uses grassland, wetland, riparian, and shrubland habitats.	Potential habitat	No Field Surveys. EIS Analysis: Yes
Northern Goshawk (*Accipiter gentilis*)	CS	This species uses coniferous forest, mixed forest, woodland, and riparian habitats.	Potential habitat surrounding the Tract but not within it.	No Field Surveys. EIS Analysis: Yes
Spotted Bat (*Euderma maculatum*)	SPC	This species uses cliff, canyon, and riparian habitats.	Potential habitat surrounding the Tract but not within it.	No Field Surveys. EIS Analysis of Indirect Effects.

Table 2. Other Special Status Wildlife Species with Potential to Occur in the LBA

Common Name (*Scientific Name*)	Status	Habitat Type	Potential On Tract	Field Surveys Recommended? EIS Analysis?
Three-toed Woodpecker (*Picoides tridactylus*)	SPC	This species uses coniferous forest, mixed forest, woodland, shrubland, and riparian habitats.	Potential habitat surrounding the Tract but not within it.	No Field Surveys. EIS Analysis of Indirect Effects.
Townsend's Big-eared Bat (*Corynorhinus townsendii*)	SPC	This species uses cliff, canyon, forested, woodland, and riparian habitats.	Potential habitat surrounding the Tract but not within it.	No Field Surveys. EIS Analysis of Indirect Effects.
Western Toad (*Bufo boreas*)	SPC	This species uses open water, springs, wet meadows, riparian, coniferous forest, and woodland habitats.	Potential habitat	No Field Surveys. EIS Analysis of Indirect Effects.
Black Swift (*Cypseloides niger*)	SPC	This species uses waterfall, cliff, riparian, coniferous forest, mixed forest, and woodland habitats.	No Potential Habitat. Based on fall habitat surveys.	No Field Surveys. No EIS Analysis.
Kit Fox (*Vulpes macrotis)*	SPC	This species uses grassland, desert, shrubland, and savanna habitats.	Potential habitat, but not shown on CDC distribution map	No Field Surveys. EIS Analysis: Yes
Short-eared Owl (*Asio flammeus*)	SPC	This species uses sagebrush, grassland, shrubland, and savanna habitat.	Potential habitat, but not shown on CDC distribution map	No Field Surveys. EIS Analysis: Yes
Utah Prairie Dog (*Cynomys parvidens)*	Fed-T	This species inhabits open, grassy habitats and swales within sagebrush communities (Crocker-Bedford and Spillett 1981). It requires well-drained, deep soils suitable for burrowing, and moist herbage, particularly during drought.	Potential habitat not present on the tract. Populations known to occur along the coal haul transportation route adjacent to SR-20 and have high potential to occur along the coal haul transportation route adjacent to Highways 56 and 89.	Field Surveys: Yes EIS Analysis: Yes

SUMMARY OF WILDLIFE SPECIES ELIMINATED FROM DETAILED ANALYSIS

Based on the data gathered by the original preliminary analysis and supplemented by the results of the reconnaissance surveys, the following wildlife and special status species were eliminated from detailed analysis:

Table 3. Wildlife and Special Status Animal Species Eliminated from Detailed Analysis

Common Name (*Scientific Name*)	Status	Reason Eliminated
Bonytail (*Gila elegans*)	Fed-E	No potential habitat in tract or coal haul transportation route
Bonneville Cutthroat trout *(Oncorhynchus clarkia Utah)*	CS	No potential habitat in tract or coal haul transportation route

Table 3. Wildlife and Special Status Animal Species Eliminated from Detailed Analysis

Common Name (*Scientific Name*)	Status	Reason Eliminated
Colorado pikeminnow (*Ptychocheilus lucius*)	Fed-E	No potential habitat in tract or coal haul transportation route
Desert Sucker *(Catostomus clarkia)*	SPC	No potential habitat in tract or coal haul transportation route
Humpback chub (*Gila cypha*)	Fed-E	No potential habitat in tract or coal haul transportation route
Razorback sucker (*Xyrauchen texanus*)	Fed-E	No potential habitat in tract or coal haul transportation route
Southwestern willow flycatcher (*Empidonax traillii extimus*)	Fed-E	Not likely to occur in tract or coal haul transportation route
Kanab ambersnail (*Oxyloma kanabense*)	Fed-E	Not likely to occur in tract or coal haul transportation route
Leatherside Chub *(Gila copei)*	SPC	No potential habitat in tract or coal haul transportation route
Mexican spotted owl (*Strix occidentalis*)	Fed-T	Not likely to occur in tract or coal haul transportation route
California Condor (*Gymnogyps californianus*)	Fed-Experimental	Not likely to occur in tract or coal haul transportation route
Coral pink sand dunes tiger beetle (*Cicindela limbata albissima*)	Fed-C	Not likely to occur in tract or coal haul transportation route
Western yellow-billed cuckoo (*Coccyzus americanus occidentalis*)	Fed-C	No potential habitat in tract or coal haul transportation route
Desert bighorn sheep (*Ovis canadensis nelsoni*)	UDWR	Not likely to occur in tract or coal haul transportation route
Dark kangaroo mouse (*Microdipodops megacephalus*)	SPC	Not likely to occur in tract or coal haul transportation route
American white pelican (*Pelecanus erythrorhynchos*)	SPC	No potential habitat in tract or coal haul transportation route
Common chuckwalla (*Sauromalus ater*)	SPC	Not likely to occur in tract or coal haul transportation route
Utah physa (*Physella utahensis*)	SPC	Not likely to occur in tract or coal haul transportation route
Virgin Spinedace *(Lepidomeda mollispinis)*	CS	No potential habitat in tract or coal haul transportation route

VEGETATION COMMUNITIES/HABITAT CLASSIFICATION SURVEY NOVEMBER 16–18, 2007

The tract was surveyed over a three-day period (November 16–18, 2007), with the main areas of focus being those planned for known surface-disturbing activities.

METHODS

SWCA and Mt. Nebo Scientific ecologists surveyed and collected data on dominant species cover in the various vegetation communities within the tract (see Attachment 1, Relevé Plot Data). Vegetation community classification surveys were conducted by recording plant species present and their general percentage cover within an approximate 10 meter radius of the data point. Data points were recorded in areas that typified the overall vegetation community (Figure 2).

The percentage cover for each species was classified as rare (< 5% cover), few (5%–25% cover), moderate (26%–50% cover), or common (> 50% cover). As many data collection points as possible were established in each area of the tract to increase the reliability (for characterization of the affected environment and the analysis of impacts and for photo interpretation) of the data collected. Twenty-six vegetation data points were surveyed during fall 2007 field reconnaissance (see Attachment 1, Relevé Plot Data). Vegetation communities were ground-truthed and delineated on the aerial photograph while recording the data points with a handheld GPS unit as well as driving and walking through the tract.

The information collected was used to delineate the various vegetation communities within the tract. Vegetation data points were plotted on an aerial photo of the area and used to interpret patterns of vegetation cover, which were outlined and digitized onto a map using GIS. The results of the vegetation community delineation are shown in Figure 2.

For consistency, vegetation communities as identified by Mt. Nebo Scientific for other areas in the vicinity of the tract were used with minor modifications. These are sagebrush/grassland, meadows, perennial/annual grasses, pinyon-juniper/sagebrush, mountain brush, rabbitbrush, pinyon-juniper/mountain brush, and pinyon-juniper woodland (see Attachment 2, Vegetation Associations and Species List).

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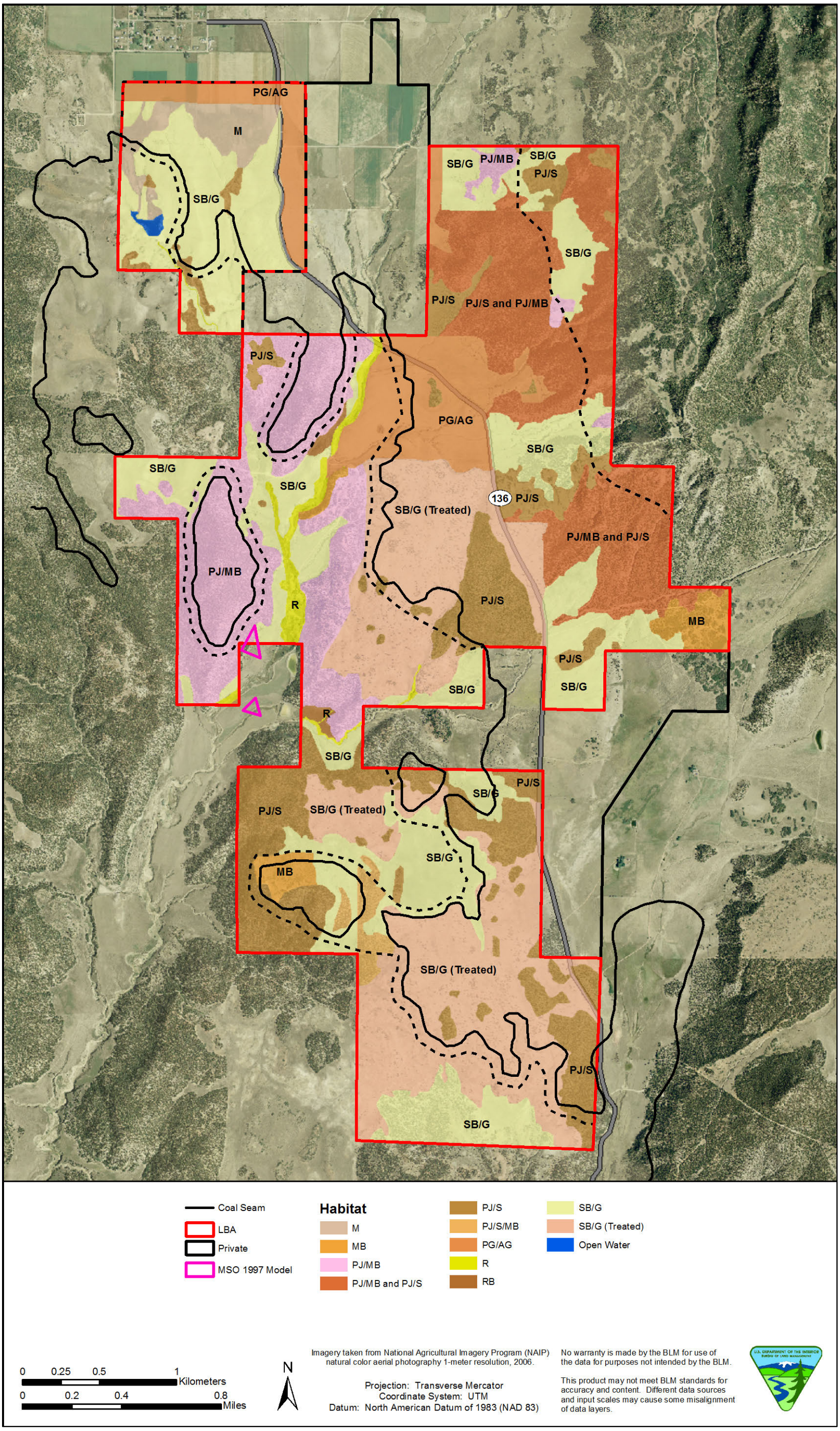

Figure 2. Alton Coal Tract vegetation (habitat) community map.

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RESULTS

Reconnaissance survey data coupled with aerial photo interpretation showed approximately 1,440 acres of pinyon-juniper habitat (including pinyon-juniper/sage and pinyon-juniper/mountain brush vegetation types), 275 acres of perennial/annual grasses, 10 acres of rabbitbrush habitat, 915 acres of sagebrush/grassland habitat, 755 acres of sagebrush/grassland (treated) habitat, 65 acres of meadow habitat, and 60 acres of mountain brush habitat. See Figure 2 for vegetation community delineation results. Table 4 lists the acreages of each of these habitats within the tract.

Table 4. Vegetation Communities and Approximate Acreages with the Alton Coal Tract

	Pinyon-juniper*	Sagebrush/ grassland	Sagebrush/ Grassland (Treated)**	Perennial/ Annual Grasses	Meadow	Mountain Brush	Rabbit-brush
Acres	1,440	915	755	275	65	60	10
% of Total (3,581)	40	25.5	21	7.6	1.8	1.7	0.3

* Pinyon-juniper habitat classification includes pinyon-juniper/sagebrush and pinyon-juniper/mountain brush vegetation communities.

** Sagebrush/Grassland (treated) habitat classification includes areas if sagebrush and grassland vegetation communities where pinyon and juniper trees have been cut or chained and the body of the tree chipped.

SPECIAL STATUS PLANT SPECIES POTENTIAL OCCURRENCE DETERMINATION

Potential for special status plant species identified during the preliminary threatened and endangered and sensitive species analysis was determined using the vegetation communities as delineated during the fall 2007 field reconnaissance visit. Using the known habitat preferences of these species, SWCA was able to determine areas of possible occurrence for these species within the tract.

Based on the *County Lists of Utah's Threatened, Endangered, and Candidate Species* (UDWR 2007), sensitive species lists as published in the BLM Kanab Field Office Draft Resource Management Plan (BLM 2007), the *Utah Rare Plant Guide* (UNPS 2007), and GIS analysis using SWReGAP vegetation data and elevation, the following special status or rare plant species may occur in the Alton Coal Tract LBA: Paria breadroot (*Pediomelum pariense*), sandloving penstemon (*Penstemon ammophilus*), Ruth's sphaeromeria (*Sphaeromeria ruthiae*), Charleston Mountain violet (*Viola charlestonensis*), slender camissonia (*Camissonia exilis*), and Jones cycladenia (*Cycladenia humilis* var. *jonesii*). The habitat requirements for each of these species are outlined in Table 5 (UNPS 2007).

Table 5. Habitat Requirements of Certain Special Status or Rare Vegetation Species With Possible Occurrence in the LBA

Species	Elevation Range	Flowering Season	Vegetation Associations	Soils and Geology Associations	Status	Additional surveys recommended?
Paria breadroot (*Pediomelum pariense*)	5,600 to 8,000 feet	June through July	Ponderosa pine and pinyon-juniper	Calcareous or sandy soils on Wasatch limestone	Utah Rare Plant (UNPS 2007)	No
Sandloving penstemon (*Penstemon ammophilus*)	5,900 to 7,200 feet	Late May through June	Ponderosa pine or mixed shrub communities	Blow sand derived from Navajo sandstone	BLM Sensitive Species	Yes
Ruth's sphaeromeria (*Sphaeromeria ruthiae*)	4,400 to 6,600 feet	September	Ponderosa pine, Douglas fir, oak, mountain mahogany, bigtooth maple, box elder, and sandstone crevice communities	Navajo and Kayenta sandstone, on cliffs and boulders	Utah Rare Plant (UNPS 2007)	No
Charleston Mountain violet (*Viola charlestonensis*)	6,500 to 9,500 feet	May through June	Ponderosa pine communities, limestone hills, slopes, and dry washes	Claron and Carmel Limestone	Utah Rare Plant (UNPS 2007)	No
Slender camissonia (*Camissonia exilis*)	5,000 to 6,900 feet	Late April to May	Sagebrush, galleta, and pinyon-juniper communities	Gypsiferous strata of Moenkopi, Entrada, Carmel, and other fine-textured substrates (Welsh et al. 2003)	BLM Sensitive Species	No

Table 5. Habitat Requirements of Certain Special Status or Rare Vegetation Species With Possible Occurrence in the LBA

Species	Elevation Range	Flowering Season	Vegetation Associations	Soils and Geology Associations	Status	Additional surveys recommended?
Jones cycladenia (*Cycladenia humilis* var. *jonesii*)	4,400 to 6,000 feet	Mid-May to June	Eriogonum-Ephedra cool desert shrub and juniper communities	Gypsiferous saline soils on Chinle, Cutler, and Summerville formations	Federally listed as threatened	No

To precisely determine areas of suitable habitat for these species within the Alton Coal Tract, data on surface geology (UGS 1999) and elevation were used in combination with vegetation community data as delineated through survey work. The main types of surface geology in the area are Tropic Shale (Kt) and Dakota formation (Kd), both of which are a mix of shale and sandstone. Other types of surface geology in the tract are Alluvium (Qa) and Mass Movement Deposits (Qms). Alluvium areas are mostly sand and other loose materials deposited in stream beds and washes, and Mass Movement Deposits include rock fall, talus, and colluvium (UGS 1999). Since there are no areas of limestone in the tract, Charleston Mountain violet and Paria breadroot are not likely to occur in the tract. There are also no Chinle, Cutler, or Summerville formations, which excludes Jones' Cycladenia. Finally, the lack of Navajo and Kayenta sandstone, and Moenkopi, Entrada, and Carmel formations excludes Ruth's sphaeromeria and slender camissonia from occurring in the tract. No surveys are recommended for these five species in the 2008 field season.

Possible areas of occurrence for the remaining species, sandloving penstemon, are shown in Figure 3. These potential habitat areas were identified by referencing surface geology information (UGS 1999) and vegetation covers as delineated using data acquired during the fall 2007 field surveys. Based on habitat requirements listed by the Utah Rare Plant Guide (UNPS 2007), sandloving penstemon has a relatively high likelihood of occurrence in Qa surface geology coupled with mountain brush, sagebrush/grass, or rabbitbrush ecology. Sandloving penstemon may also occur, although with lower likelihood, in Qa or Qms surface geology coupled with sagebrush/grassland (treated) or pinyon-juniper/mountain brush communities. Estimated areas of potential habitat for this species are shown in Table 6 and Figure 3.

Table 6. Acres of Potential Occurrence of Special Status or Rare Plant Species in the LBA (see also Figure 3)

	Acres of Higher Likelihood Potential Occurrence	Acres of Lower Likelihood Potential Occurrence
Sandloving penstemon	625.09	443.26

Surveys for sandloving penstemon are recommended in identified potential habitat during their flowering period (May and June) in the 2008 field season. Recommended areas of focus include locations where potential habitats overlap with proposed impact areas, although surrounding areas may also be surveyed as necessary.

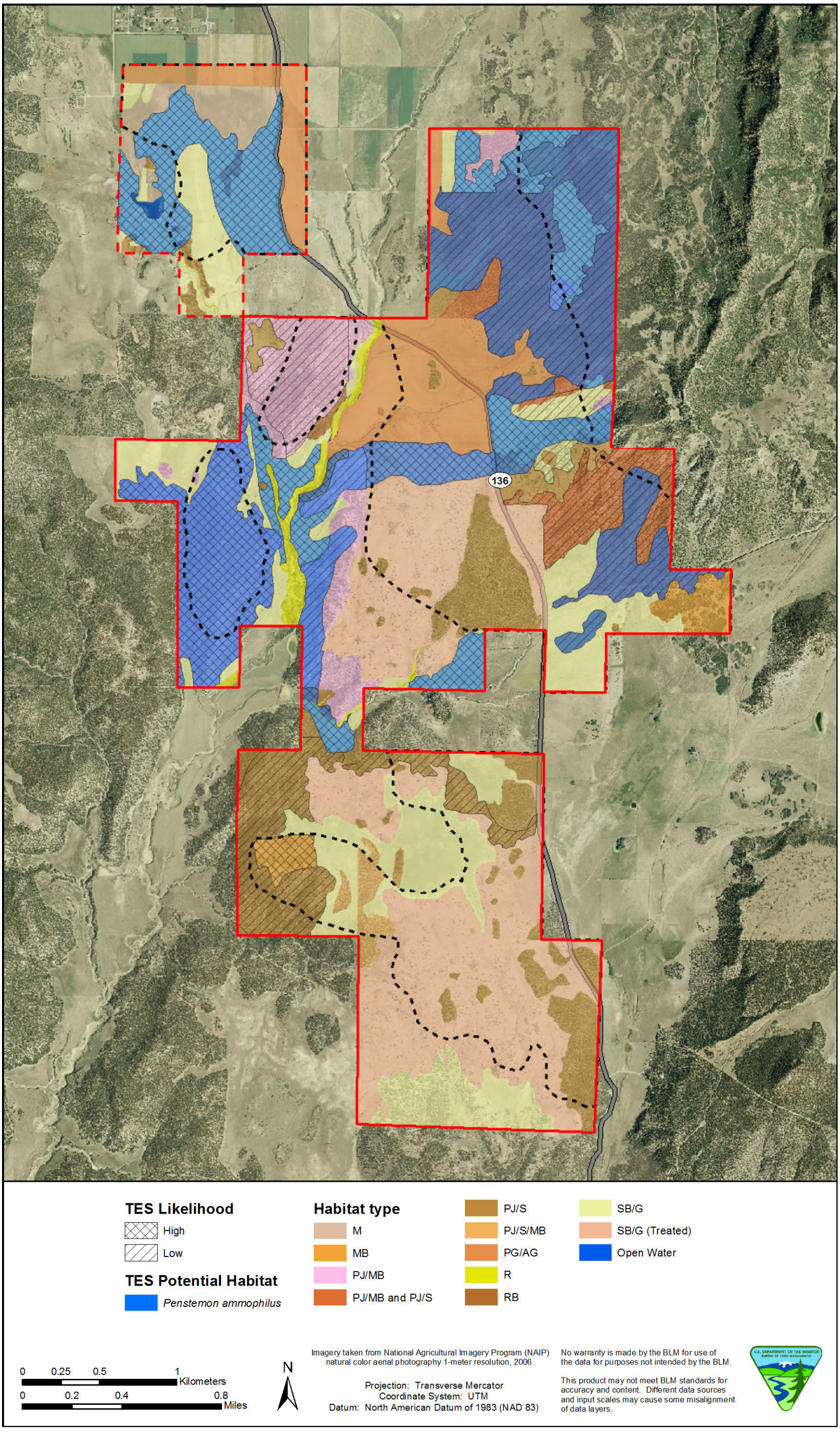

Figure 3. Alton Coal Tract threatened, endangered, and sensitive plant species habitat.

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RARE PLANT SPECIES SURVEY: *PENSTEMON AMMOPHILUS* MAY 27–30, 2008

Based on the recommendation from the habitat classification surveys and special status plant species potential occurrence determinations, a field survey was conducted to further assess the potential for sandloving penstemon to be present in the Alton Coal Tract.

METHODS

Prior to the field survey, known locations of sandloving penstemon were reviewed at the herbarium at Brigham Young University, Provo, Utah. All specimen locations were plotted on a field map. Notes about habitats, associated plant communities, elevation, phenology, geology, soil types, and other applicable information were written in a field notebook. Based on the voucher specimens for this plant species, the most appropriate days believed to successfully locate sandloving penstemon in a field survey were chosen for the survey period.

Prior to surveying the Alton Coal Tract, several known locations of the plant were visited to review the specific habitats, identify the current phenology of the species and also to re-create a visual or "target" image for the surveyor. Once these locations, habitats, and live plants were visited, the survey then focused on the areas within the Alton Coal Tract.

The field survey for sandloving penstemon was conducted from May 27 to May 30, 2008 by Mt. Nebo Scientific, Inc. Figure 4 identifies the survey area for the sandloving penstemon. These areas were accessed using a 4WD vehicle and an ATV on the roads and trails, then by walking the areas not accessible by the vehicles. Binoculars and spotting scopes were also used to assist in the search for suitable habitat for the plants.

RESULTS AND DISCUSSION

Although relatively close in proximity to known populations of the sandloving penstemon, this plant species was not found in the tract shown in Figure 4, nor was the precise habitat of which this plant is currently thought to be limited to, found in the tract. Based on the research and subsequent field survey for the sandloving penstemon, it is believed that there is a very low probability that the species occurs in the tract.

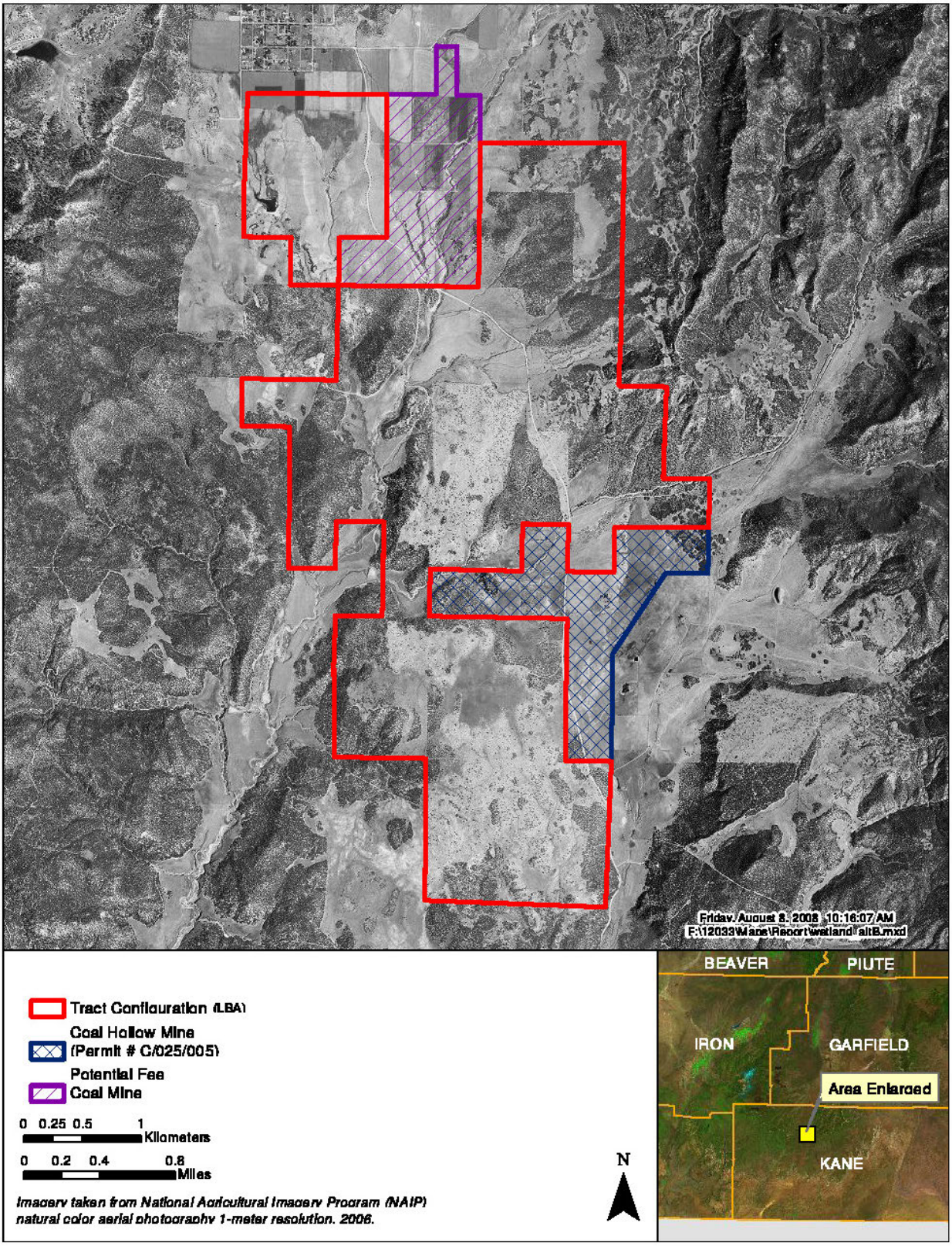

Figure 4. Survey area for sandloving penstemon.

WET MEADOWS OF THE ALTON COAL TRACT: A PRELIMINARY ASSESSMENT JULY 2, 2008

The scope of this study was to provide a preliminary assessment of some specific wet meadows currently used as pasture lands near the northern most boundary of the tract. The scope of the study was to provide a preliminary description of the pastures/meadows from a vegetation aspect with implications regarding their potential for being considered for future wetland studies. Soils and hydrology, two additional components required for wetland determinations, are only cursorily addressed in this study.

The study area was visited in November 2007, June 2008, and July 2008. On July 2, 2008, quantitative and qualitative data were recorded in the wet meadows near the northern boundary of the tract, just south of the Town of Alton, Utah (Figure 5).

METHODS

SAMPLING DESIGN AND TRANSECT/QUADRAT PLACEMENT

Transect lines for vegetation sampling were placed randomly within the boundaries of the meadow areas (see Figure 5). The transect placement technique was employed with the goal to adequately sample the meadows with a representative number of samples for each area. Once transects were established, quadrat locations for sampling were chosen using random numbers from the transect lines with the objective to record data without preconceived bias.

COVER, FREQUENCY AND COMPOSITION

Cover estimates were made using ocular methods with meter square quadrats. Species composition, cover by species, and relative frequencies were also assessed from the quadrats. Additional information was recorded on the raw data sheets notes such as: slope, exposure, grazing use, disturbance and/or other appropriate notes. Plant nomenclature follows Welsh et al. (2003).

RESULTS AND DISCUSSION

The sample areas were comprised of two wet meadows. They were sampled and have been reported separately and were called the “East Pasture" and "West Pasture" (see Figure 5).

WET MEADOWS: EAST PASTURE

The dominant plant species present in the sample quadrats in the East Pasture were wiregrass (*Juncus arcticus*), small-wing sedge (*Carex microptera*), and Missouri iris (*Iris missouriensis*). All species present in the sample quadrats along with their cover and frequency values are shown in Table 7. The total living cover for the East Pasture was estimated at 80.75% (Table 8). The living understory cover composition was comprised of 85.48% grasses (or grass-like species) and 14.52% forbs (see Table 8). No woody species were present in the sample quadrats.

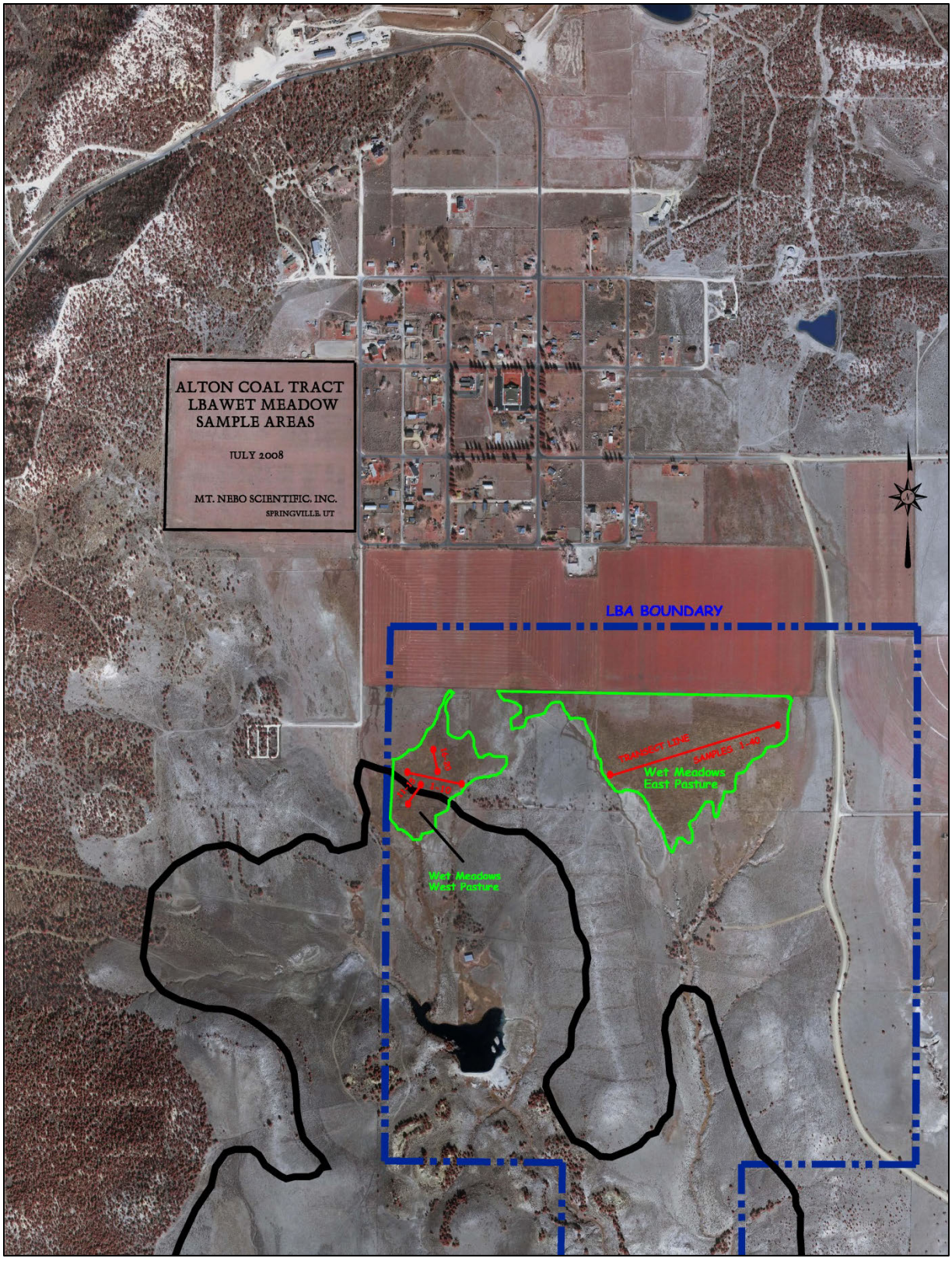

Figure 5. Wetland meadow sample areas.

Table 7. East Pasture Wet Meadow at the Alton Coal Tract. Total Cover, Standard Deviation and Frequency by Species (2008)

	Mean Percentage	Standard Deviation	Percentage Frequency
Trees and Shrubs			
Forbs			
Chenopodium sp.	0.13	0.78	2.50
Erigeron sp.	3.38	8.47	20.00
Iris missouriensis	7.13	11.88	32.50
Melilotus officinalis	0.25	1.56	2.50
Plantago major	0.25	1.09	5.00
Grasses			
Bromus inermis	3.13	6.39	22.50
Carex microptera	18.50	19.50	60.00
Juncus arcticus	47.50	26.76	90.00

Table 8. East Pasture Wet Meadow at the Alton Coal Tract. Total Cover, Standard Deviation and Sample Size (2008)

	Mean Percentage	Standard Deviation	Percentage Frequency
A. Total Cover			
Total Living Cover	80.75	10.34	40
Litter	16.20	9.33	40
Bareground	2.03	2.40	40
Rock	1.03	0.16	40
B. % Composition			
Shrubs	0.00	0.00	40
Forbs	14.52	18.08	40
Grasses	85.48	18.08	40

WET MEADOWS: WEST PASTURE

The dominant plant species for the West Pasture was primarily wiregrass (Table 9). Total living cover in this meadow was 78.00% (Table 10). The living cover was comprised almost exclusively of grass or grass-like species, which made up nearly 97% of the living cover by composition (see Table 10). Like the East Pasture, no woody species were present in the sample quadrats.

Table 9. West Pasture Wet Meadow at the Alton Coal Tract LBA. Total Cover, Standard Deviation and Frequency by Species (2008)

	Mean Percentage	Standard Deviation	Percentage Frequency
Trees and Shrubs			
Forbs			
Cirsium sp.	0.75	1.79	15.00
Erigeron sp.	0.85	1.80	20.00

Table 9. West Pasture Wet Meadow at the Alton Coal Tract LBA. Total Cover, Standard Deviation and Frequency by Species (2008)

	Mean Percentage	Standard Deviation	Percentage Frequency
Melilotus officinalis	0.75	2.38	10.00
Grasses			
Bromus inermis	6.40	9.53	50.00
Elymus elymoides	0.25	1.09	5.00
Juncus arcticus	67.50	14.45	100.00
Poa pratensis	1.50	4.77	10.00

Table 10. West Pasture Wet Meadow at the Alton Coal Tract. Total Cover, Standard Deviation and Sample Size (2008)

	Mean Percentage	Standard Deviation	Percentage Frequency
A. Total Cover			
Total Living Cover	78.00	7.65	20
Litter	15.85	9.60	20
Bareground	5.10	6.63	20
Rock	1.05	0.22	20
B. % Composition			
Shrubs	0.00	0.00	20
Forbs	3.01	4.83	20
Grasses	96.99	4.83	20

DISCUSSION

HYDROPHYTIC VEGETATION

As mentioned, the scope of this report was to provide vegetation information regarding the wet meadows near the northern boundary of the Alton Coal Tract. Quantitative data from sampling the plant communities of the wet meadows can provide insight as to whether these areas may have the potential to be delineated as jurisdictional wetlands and if additional studies should be conducted in the future to make this determination. The U.S. Army Corps of Engineers (COE), the regulatory agency responsible for jurisdiction of wetlands under Section 404 of the Clean Water Act (33 USC 1344), has recently provided a manual that provides technical guidance and procedures for identifying and delineating wetlands in the arid west region, of which the Alton Coal Tract is part (COE 2006).

The COE manual mentioned above has a section regarding hydrophytic vegetation indicators for wetland delineations. This section describes two procedures that may be used to indicate the presence of hydrophytic vegetation, which is one step in determining if a given area would be considered wetland or jurisdictional wetland by definition. Both hydrophytic vegetation indicator procedures use quantitative data for their determinations. The first test is called the Dominance Test.

The Dominance Test is the basic hydrophytic vegetation indicator and “should be applied in every wetland determination in the arid west”. This test is described by suggesting that the vegetation in a given

community is "hydrophytic" if more that 50% of the dominant plant species across all strata are rated as follows:

1. OBL [Obligate Wetland: occurs almost always (estimated probability 99%) under natural condition in wetlands]
2. FACW [Facultative Wetland: usually occurs in wetlands (estimated probability 67%– 99%), but occasionally found in non-wetlands]
3. FAC [Facultative Wetland: Equally likely to occur in wetland or non-wetland (estimated probability 34%–66%)]

When the data from the East Pasture and West Pasture wet meadows were put through the Dominance Test, **both pastures would be considered to support hydrophytic vegetation** by the COE methods.

The second COE hydrophytic vegetation indicator procedure is called the Prevalence Test. This test can be employed on the vegetation in a community if it fails the Dominance Test described above, but meets those requirements for hydric soils and wetland hydrology in the wetland delineation process. The Prevalence Test considers all species in a plant community; however, the indicator categories assigned to the species (OBL, FACW, FAC, etc.) places a "weighted" value on them by using cover values of individual species. In other words, if a given plant species has more cover and is assigned OBL, FACW or FAC it is more likely that the community will be determined to be hydrophytic.

When the quantitative data of the East Pasture and West Pasture wet meadows are computed through the Prevalence Test, **both pastures would be considered as supporting hydrophytic vegetation**.

HYDRIC SOILS

As mentioned previously, the focus of this study was to be on vegetation analyses and *not* on soils or hydrology, two other important aspects for studies when delineating wetlands using COE protocols. Nonetheless, a few holes were dug in the pastures and the soils were examined for redox characteristics. These soil characteristics were present in the limited amount of sample holes observed. These holes were dug at random locations, but the sample number was not enough to be considered an adequate number of samples to determine if the meadows were dominated by hydric soils to be determined as jurisdictional by the COE.

WETLAND HYDROLOGY

This discipline is another crucial consideration necessary for wetland determinations and has not been studied in enough detail to make the determination in the scope of this report. However, when aerial photographs were examined (i.e., Figure 5) and when field observations were considered, it appears that the water supporting wet meadows in the East Pasture and West Pasture is a result of runoff irrigation from the fields directly north and adjacent to the pastures—not the result of water being supplied by natural means such as springs or seeps in the immediate area.

CONCLUSIONS

The quantitative data and the test procedures that determine the presence of hydrophytic vegetation suggests that the wet meadows of the East Pasture and West Pasture are that of wetlands—whether or not they are jurisdictional through the COE has not yet been determined. Cursory thoughts about soils and hydrology also suggest these areas could be considered wetlands. However, because the hydrologic regime may be artificially induced by present and historical irrigation practices, more study is probably warranted if a determination is to be made if the areas would be considered jurisdictional through the COE.

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Attachment 1: Relevé Plot Data

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Relevé Plot Data Date	Relevé ID	Plant Community	Surveyors	General Notes
11/17/2007	Veg 1	Wiregrass	PDC and AAM	Pasture, grazed, irrigation runoff area
11/17/2007	Veg 2	Black sagebrush/ grass	PDC and AAM	Could have been seeded because lots of AGCR, may not be as "natural" as other ARNO communities. Small scattered JUOS.
11/17/2007	Veg 3	Black sagebrush/ grass	PDC and AAM	Close to native condition as compared to veg 2.
11/17/2007	Veg 4	Pastureland	PDC and AAM	Previously was a sagebrush/grass community. Presently pasture, unirrigated and fenced.
11/17/2007	Veg 5	Pinyon/ juniper	PDC, AAM, BG, and TS	
11/17/2007	Veg 6	Rabbitbrush	PDC and AAM	Heavily grazed, previously s/g community
11/17/2007	Veg 7	Dry pastureland	PDC and AAM	Converted from s/g, scattered PJ, very heavily grazed. Fairly recently worked by tractor.
11/17/2007	Veg 8	Sagebrush/ grass	PDC and AAM	PJ cleared but not ARNO. Other side of road was cleared of ARNO.
11/17/2007	Veg 9	S/G, scattered PJ	PDC and AAM	Chipped PJ. To ehn.(?) sage grouse habitat.
11/17/2007	Veg 10	Oakbrush	PDC and AAM	Area adjacent to PJ removed with track hoe and grapple claw to increase sage grouse habitat. Piles of PJ.
11/17/2007	Ref 11	S/G sagebrush	PDC and AAM	
11/18/2007	Veg 12	PJ	PDC and AAM	Lots of bare ground
11/18/2007	Veg 13	Sagebrush/ grass	PDC and AAM	Lots of bare ground covered with chipped PJ, weeds, and a fair amount oak, used to be mostly PJ with sage but much of the PJ has been cleared.
11/17/2007	Veg A (15)	Pastureland	TS and BTG	Grazed grasses also part of cover. Grazed.
11/17/2007	Veg B (16)	Sagebrush/ grass	TS and BTG	Grazed grasses have moderate cover.
11/17/2007	Veg C (17)	Sage/ Gambel Oak/ Grass	TS and BTG	Grazed grasses have abundant cover. PJ near edge of plot.
11/17/2007	Veg D (18)	Black sagebrush/ grass	TS and BTG	Grasses have abundant cover. Less grazed than A, B, C.
11/17/2007	Veg E (19)	Black sagebrush/ grass	TS and BTG	PJ in surrounding area.
11/18/2007	Veg F (20)	S/G chipped	PDC and BTG	Previously this area was mostly PJ. Currently it is progressing toward a S/G community. Chipped to increase sage grouse habitat.
11/18/2007	Veg G (21)	P-J	PDC and BTG	Some soil pavement present (0.5"). Sparse understory. No forbs or grasses noted here.
11/18/2007	Veg H (22)	Rabbitbrush	PDC and BTG	
11/18/2007	Veg I (23)	ARNO / CHNA	PDC and BTG	ARNO and CHNA areas interspersed. Few forb species.
11/18/2007	Veg J (24)	S/G chipped	PDC and BTG	
11/18/2007	Veg K (25)	Gambel oak	PDC and BTG	Relatively small area with lots of ARNO.
11/18/2007	Veg L (26)	S/G (ARNO)	PDC and BTG	Very homogenous.

Relevé Plot Data	**Relevé ID**	**Plant Community**	**Surveyors**	***Achillea millefolium***	***Agropyrum cristatum***	***Artemisia nova***	***Artemisia tridentata***
Date				**ACMI**	**AGCR**	**ARNO**	**ARTR**
11/17/2007	Veg 1	Wiregrass	PDC and AAM				
11/17/2007	Veg 2	Black sagebrush/ grass	PDC and AAM			common	
11/17/2007	Veg 3	Black sagebrush/ grass	PDC and AAM			common	
11/17/2007	Veg 4	Pastureland	PDC and AAM		common	few	
11/17/2007	Veg 5	Pinyon/ juniper	PDC, AAM, BG, and TS			moderate	
11/17/2007	Veg 6	Rabbitbrush	PDC and AAM			rare	few
11/17/2007	Veg 7	Dry pastureland	PDC and AAM		moderate	few	
11/17/2007	Veg 8	Sagebrush/ grass	PDC and AAM		moderate	common	moderate
11/17/2007	Veg 9	S/G, scattered PJ	PDC and AAM		moderate	common	
11/17/2007	Veg 10	Oakbrush	PDC and AAM				moderate
11/17/2007	Ref 11	S/G sagebrush	PDC and AAM				
11/18/2007	Veg 12	PJ	PDC and AAM			moderate	
11/18/2007	Veg 13	Sagebrush/ grass	PDC and AAM			moderate	
11/17/2007	Veg A (15)	Pastureland	TS and BTG			few	
11/17/2007	Veg B (16)	Sagebrush/ grass	TS and BTG			few	
11/17/2007	Veg C (17)	Sage/ Gambel Oak/ Grass	TS and BTG			moderate	
11/17/2007	Veg D (18)	Black sagebrush/ grass	TS and BTG			common	
11/17/2007	Veg E (19)	Black sagebrush/ grass	TS and BTG			common	
11/18/2007	Veg F (20)	S/G chipped	PDC and BTG		few	moderate	moderate
11/18/2007	Veg G (21)	P-J	PDC and BTG			moderate	few
11/18/2007	Veg H (22)	Rabbitbrush	PDC and BTG				moderate
11/18/2007	Veg I (23)	ARNO / CHNA	PDC and BTG			common	
11/18/2007	Veg J (24)	S/G chipped	PDC and BTG	moderate		few	few
11/18/2007	Veg K (25)	Gambel oak	PDC and BTG		common	common	
11/18/2007	Veg L (26)	S/G (ARNO)	PDC and BTG			common	few

Relevé Plot Data	**Relevé ID**	**Plant Community**	**Surveyors**	***Artemisia tridentata* var. *vaseyana***	**Aster or composite sp.**	***Astragalus* sp.**	***Atriplex canescens***
Date				**ATRVA**	**ASTER**	**ASTRAGALUS**	**ATCA**
11/17/2007	Veg 1	Wiregrass	PDC and AAM				
11/17/2007	Veg 2	Black sagebrush/ grass	PDC and AAM				
11/17/2007	Veg 3	Black sagebrush/ grass	PDC and AAM				
11/17/2007	Veg 4	Pastureland	PDC and AAM				
11/17/2007	Veg 5	Pinyon/ juniper	PDC, AAM, BG, and TS				
11/17/2007	Veg 6	Rabbitbrush	PDC and AAM				rare
11/17/2007	Veg 7	Dry pastureland	PDC and AAM				
11/17/2007	Veg 8	Sagebrush/ grass	PDC and AAM				
11/17/2007	Veg 9	S/G, scattered PJ	PDC and AAM				
11/17/2007	Veg 10	Oakbrush	PDC and AAM				
11/17/2007	Ref 11	S/G sagebrush	PDC and AAM				
11/18/2007	Veg 12	PJ	PDC and AAM				
11/18/2007	Veg 13	Sagebrush/ grass	PDC and AAM		few	few	
11/17/2007	Veg A (15)	Pastureland	TS and BTG				
11/17/2007	Veg B (16)	Sagebrush/ grass	TS and BTG				
11/17/2007	Veg C (17)	Sage/ Gambel Oak/ Grass	TS and BTG				
11/17/2007	Veg D (18)	Black sagebrush/ grass	TS and BTG				
11/17/2007	Veg E (19)	Black sagebrush/ grass	TS and BTG				
11/18/2007	Veg F (20)	S/G chipped	PDC and BTG				
11/18/2007	Veg G (21)	P-J	PDC and BTG				
11/18/2007	Veg H (22)	Rabbitbrush	PDC and BTG				
11/18/2007	Veg I (23)	ARNO / CHNA	PDC and BTG				
11/18/2007	Veg J (24)	S/G chipped	PDC and BTG				
11/18/2007	Veg K (25)	Gambel oak	PDC and BTG	moderate			
11/18/2007	Veg L (26)	S/G (ARNO)	PDC and BTG				

Relevé Plot Data	**Relevé ID**	**Plant Community**	**Surveyors**	***Bromus carinatus***	***Bromus inermis***	***Bromus tectorum***	***Carex* sp.**	***Cercocarpus montanus***
Date				**BRCA**	**BRIN**	**BRTE**	**CAREX**	**CEMO**
11/17/2007	Veg 1	Wiregrass	PDC and AAM					
11/17/2007	Veg 2	Black sagebrush/ grass	PDC and AAM					
11/17/2007	Veg 3	Black sagebrush/ grass	PDC and AAM	common				
11/17/2007	Veg 4	Pastureland	PDC and AAM		few			
11/17/2007	Veg 5	Pinyon/ juniper	PDC, AAM, BG, and TS					common
11/17/2007	Veg 6	Rabbitbrush	PDC and AAM				few	
11/17/2007	Veg 7	Dry pastureland	PDC and AAM	few				
11/17/2007	Veg 8	Sagebrush/ grass	PDC and AAM	moderate				few
11/17/2007	Veg 9	S/G, scattered PJ	PDC and AAM					
11/17/2007	Veg 10	Oakbrush	PDC and AAM					
11/17/2007	Ref 11	S/G sagebrush	PDC and AAM			common		
11/18/2007	Veg 12	PJ	PDC and AAM					
11/18/2007	Veg 13	Sagebrush/ grass	PDC and AAM			few		
11/17/2007	Veg A (15)	Pastureland	TS and BTG					
11/17/2007	Veg B (16)	Sagebrush/ grass	TS and BTG					
11/17/2007	Veg C (17)	Sage/ Gambel Oak/ Grass	TS and BTG					
11/17/2007	Veg D (18)	Black sagebrush/ grass	TS and BTG					
11/17/2007	Veg E (19)	Black sagebrush/ grass	TS and BTG					
11/18/2007	Veg F (20)	S/G chipped	PDC and BTG	few		few		
11/18/2007	Veg G (21)	P-J	PDC and BTG					
11/18/2007	Veg H (22)	Rabbitbrush	PDC and BTG					
11/18/2007	Veg I (23)	ARNO / CHNA	PDC and BTG					
11/18/2007	Veg J (24)	S/G chipped	PDC and BTG					
11/18/2007	Veg K (25)	Gambel oak	PDC and BTG		moderate			few
11/18/2007	Veg L (26)	S/G (ARNO)	PDC and BTG			few		

Relevé Plot Data	**Relevé ID**	**Plant Community**	**Surveyors**	***Cirsium* sp.**	***Cirsium arvense***	***Chrysothamnus nauseosus***	***Dactylis glomerata***	***Echinocereus* sp.**
Date				**CIRSIUM**	**CIAR**	**CHNA**	**DAGL**	**ECHINOCACTUS**
11/17/2007	Veg 1	Wiregrass	PDC and AAM		rare			
11/17/2007	Veg 2	Black sagebrush/ grass	PDC and AAM					
11/17/2007	Veg 3	Black sagebrush/ grass	PDC and AAM			few		
11/17/2007	Veg 4	Pastureland	PDC and AAM	few			few	
11/17/2007	Veg 5	Pinyon/ juniper	PDC, AAM, BG, and TS					rare
11/17/2007	Veg 6	Rabbitbrush	PDC and AAM			common		
11/17/2007	Veg 7	Dry pastureland	PDC and AAM	few		few		
11/17/2007	Veg 8	Sagebrush/ grass	PDC and AAM					
11/17/2007	Veg 9	S/G, scattered PJ	PDC and AAM					
11/17/2007	Veg 10	Oakbrush	PDC and AAM					
11/17/2007	Ref 11	S/G sagebrush	PDC and AAM	rare		few		
11/18/2007	Veg 12	PJ	PDC and AAM					
11/18/2007	Veg 13	Sagebrush/ grass	PDC and AAM	moderate				
11/17/2007	Veg A (15)	Pastureland	TS and BTG			moderate		
11/17/2007	Veg B (16)	Sagebrush/ grass	TS and BTG			few		
11/17/2007	Veg C (17)	Sage/ Gambel Oak/ Grass	TS and BTG			few		
11/17/2007	Veg D (18)	Black sagebrush/ grass	TS and BTG					
11/17/2007	Veg E (19)	Black sagebrush/ grass	TS and BTG					
11/18/2007	Veg F (20)	S/G chipped	PDC and BTG	few		few		
11/18/2007	Veg G (21)	P-J	PDC and BTG					
11/18/2007	Veg H (22)	Rabbitbrush	PDC and BTG			common		
11/18/2007	Veg I (23)	ARNO / CHNA	PDC and BTG			common		
11/18/2007	Veg J (24)	S/G chipped	PDC and BTG	moderate				
11/18/2007	Veg K (25)	Gambel oak	PDC and BTG			moderate		
11/18/2007	Veg L (26)	S/G (ARNO)	PDC and BTG					

Relevé Plot Data	**Relevé ID**	**Plant Community**	**Surveyors**	***Elymus hispidus***	***Elymus smithii***	***Elymus trachycaulus***	***Elytrigia juncea***	**?**
Date				**ELHI**	**ELSM**	**ELTR**	**ELJU**	**ERCO**
11/17/2007	Veg 1	Wiregrass	PDC and AAM					
11/17/2007	Veg 2	Black sagebrush/ grass	PDC and AAM					
11/17/2007	Veg 3	Black sagebrush/ grass	PDC and AAM					
11/17/2007	Veg 4	Pastureland	PDC and AAM	moderate			moderate	
11/17/2007	Veg 5	Pinyon/ juniper	PDC, AAM, BG, and TS					
11/17/2007	Veg 6	Rabbitbrush	PDC and AAM			common		
11/17/2007	Veg 7	Dry pastureland	PDC and AAM			moderate	few	
11/17/2007	Veg 8	Sagebrush/ grass	PDC and AAM		moderate			
11/17/2007	Veg 9	S/G, scattered PJ	PDC and AAM			few	moderate	few
11/17/2007	Veg 10	Oakbrush	PDC and AAM					
11/17/2007	Ref 11	S/G sagebrush	PDC and AAM			common		
11/18/2007	Veg 12	PJ	PDC and AAM			few		
11/18/2007	Veg 13	Sagebrush/ grass	PDC and AAM					
11/17/2007	Veg A (15)	Pastureland	TS and BTG					
11/17/2007	Veg B (16)	Sagebrush/ grass	TS and BTG					
11/17/2007	Veg C (17)	Sage/ Gambel Oak/ Grass	TS and BTG					
11/17/2007	Veg D (18)	Black sagebrush/ grass	TS and BTG					
11/17/2007	Veg E (19)	Black sagebrush/ grass	TS and BTG					
11/18/2007	Veg F (20)	S/G chipped	PDC and BTG			few		
11/18/2007	Veg G (21)	P-J	PDC and BTG					
11/18/2007	Veg H (22)	Rabbitbrush	PDC and BTG					
11/18/2007	Veg I (23)	ARNO / CHNA	PDC and BTG			few		
11/18/2007	Veg J (24)	S/G chipped	PDC and BTG			few		
11/18/2007	Veg K (25)	Gambel oak	PDC and BTG					
11/18/2007	Veg L (26)	S/G (ARNO)	PDC and BTG					

Relevé Plot Data	**Relevé ID**	**Plant Community**	**Surveyors**	***Erigeron* sp.**	***Eriogonum* sp.**	***Festuca* sp.**	***Grindelia squarrosa***	***Gutierrezia sarothrae***
Date				**ERIGERON**	**ERIOGONUM**	**FESTUCA**	**GRSQ**	**GUSA**
11/17/2007	Veg 1	Wiregrass	PDC and AAM					
11/17/2007	Veg 2	Black sagebrush/ grass	PDC and AAM					few
11/17/2007	Veg 3	Black sagebrush/ grass	PDC and AAM					few
11/17/2007	Veg 4	Pastureland	PDC and AAM					rare
11/17/2007	Veg 5	Pinyon/ juniper	PDC, AAM, BG, and TS	few	rare	few		
11/17/2007	Veg 6	Rabbitbrush	PDC and AAM					
11/17/2007	Veg 7	Dry pastureland	PDC and AAM				rare	few
11/17/2007	Veg 8	Sagebrush/ grass	PDC and AAM					
11/17/2007	Veg 9	S/G, scattered PJ	PDC and AAM					few
11/17/2007	Veg 10	Oakbrush	PDC and AAM					
11/17/2007	Ref 11	S/G sagebrush	PDC and AAM					few
11/18/2007	Veg 12	PJ	PDC and AAM					few
11/18/2007	Veg 13	Sagebrush/ grass	PDC and AAM					
11/17/2007	Veg A (15)	Pastureland	TS and BTG					
11/17/2007	Veg B (16)	Sagebrush/ grass	TS and BTG					
11/17/2007	Veg C (17)	Sage/ Gambel Oak/ Grass	TS and BTG					
11/17/2007	Veg D (18)	Black sagebrush/ grass	TS and BTG					
11/17/2007	Veg E (19)	Black sagebrush/ grass	TS and BTG					
11/18/2007	Veg F (20)	S/G chipped	PDC and BTG					
11/18/2007	Veg G (21)	P-J	PDC and BTG					
11/18/2007	Veg H (22)	Rabbitbrush	PDC and BTG					
11/18/2007	Veg I (23)	ARNO / CHNA	PDC and BTG	few				
11/18/2007	Veg J (24)	S/G chipped	PDC and BTG					
11/18/2007	Veg K (25)	Gambel oak	PDC and BTG					
11/18/2007	Veg L (26)	S/G (ARNO)	PDC and BTG					

Relevé Plot Data	**Relevé ID**	**Plant Community**	**Surveyors**	***Hordeum jubatum***	***Juncus arcticus***	***Juniperus osteosperma***	***Juniperus scopulorum***
Date				**HOJU**	**JUAR**	**JUOS**	**JUSC**
11/17/2007	Veg 1	Wiregrass	PDC and AAM	moderate	common		
11/17/2007	Veg 2	Black sagebrush/ grass	PDC and AAM			few	
11/17/2007	Veg 3	Black sagebrush/ grass	PDC and AAM			few	
11/17/2007	Veg 4	Pastureland	PDC and AAM			rare	
11/17/2007	Veg 5	Pinyon/ juniper	PDC, AAM, BG, and TS			common	
11/17/2007	Veg 6	Rabbitbrush	PDC and AAM		moderate	few	
11/17/2007	Veg 7	Dry pastureland	PDC and AAM				
11/17/2007	Veg 8	Sagebrush/ grass	PDC and AAM			few	
11/17/2007	Veg 9	S/G, scattered PJ	PDC and AAM			few	
11/17/2007	Veg 10	Oakbrush	PDC and AAM			few	moderate
11/17/2007	Ref 11	S/G sagebrush	PDC and AAM		moderate		
11/18/2007	Veg 12	PJ	PDC and AAM			common	rare
11/18/2007	Veg 13	Sagebrush/ grass	PDC and AAM	few		few	
11/17/2007	Veg A (15)	Pastureland	TS and BTG				
11/17/2007	Veg B (16)	Sagebrush/ grass	TS and BTG				
11/17/2007	Veg C (17)	Sage/ Gambel Oak/ Grass	TS and BTG				
11/17/2007	Veg D (18)	Black sagebrush/ grass	TS and BTG			few	
11/17/2007	Veg E (19)	Black sagebrush/ grass	TS and BTG			few	
11/18/2007	Veg F (20)	S/G chipped	PDC and BTG			few	
11/18/2007	Veg G (21)	P-J	PDC and BTG			common	
11/18/2007	Veg H (22)	Rabbitbrush	PDC and BTG				
11/18/2007	Veg I (23)	ARNO / CHNA	PDC and BTG				
11/18/2007	Veg J (24)	S/G chipped	PDC and BTG			few	
11/18/2007	Veg K (25)	Gambel oak	PDC and BTG			few	
11/18/2007	Veg L (26)	S/G (ARNO)	PDC and BTG	few			

Relevé Plot Data	**Relevé ID**	**Plant Community**	**Surveyors**	***Mustard* sp.**	***Opuntia* sp.**	***Penstemon palmeri***	***Peraphyllum ramosissimum***
Date				**MUSTARD**	**OPUNTIA**	**PEPA**	**PERA**
11/17/2007	Veg 1	Wiregrass	PDC and AAM				
11/17/2007	Veg 2	Black sagebrush/ grass	PDC and AAM				
11/17/2007	Veg 3	Black sagebrush/ grass	PDC and AAM				
11/17/2007	Veg 4	Pastureland	PDC and AAM				
11/17/2007	Veg 5	Pinyon/ juniper	PDC, AAM, BG, and TS		moderate		rare
11/17/2007	Veg 6	Rabbitbrush	PDC and AAM			rare	
11/17/2007	Veg 7	Dry pastureland	PDC and AAM				
11/17/2007	Veg 8	Sagebrush/ grass	PDC and AAM				
11/17/2007	Veg 9	S/G, scattered PJ	PDC and AAM				
11/17/2007	Veg 10	Oakbrush	PDC and AAM				
11/17/2007	Ref 11	S/G sagebrush	PDC and AAM				
11/18/2007	Veg 12	PJ	PDC and AAM	rare	rare		rare
11/18/2007	Veg 13	Sagebrush/ grass	PDC and AAM			few	
11/17/2007	Veg A (15)	Pastureland	TS and BTG				
11/17/2007	Veg B (16)	Sagebrush/ grass	TS and BTG				
11/17/2007	Veg C (17)	Sage/ Gambel Oak/ Grass	TS and BTG				
11/17/2007	Veg D (18)	Black sagebrush/ grass	TS and BTG				
11/17/2007	Veg E (19)	Black sagebrush/ grass	TS and BTG				
11/18/2007	Veg F (20)	S/G chipped	PDC and BTG				
11/18/2007	Veg G (21)	P-J	PDC and BTG				
11/18/2007	Veg H (22)	Rabbitbrush	PDC and BTG				
11/18/2007	Veg I (23)	ARNO / CHNA	PDC and BTG				
11/18/2007	Veg J (24)	S/G chipped	PDC and BTG				
11/18/2007	Veg K (25)	Gambel oak	PDC and BTG		few		
11/18/2007	Veg L (26)	S/G (ARNO)	PDC and BTG				

Relevé Plot Data	**Relevé ID**	**Plant Community**	**Surveyors**	***Sanguisorba minor***	***Sissymbrium* sp.**	***Sissymbrium altissimum***	***Stipa hymenoides***
Date				**SAMI**	**SISSYMBRIUM**	**SIAL**	**STHY**
11/17/2007	Veg 1	Wiregrass	PDC and AAM				
11/17/2007	Veg 2	Black sagebrush/ grass	PDC and AAM				
11/17/2007	Veg 3	Black sagebrush/ grass	PDC and AAM				
11/17/2007	Veg 4	Pastureland	PDC and AAM				few
11/17/2007	Veg 5	Pinyon/ juniper	PDC, AAM, BG, and TS				
11/17/2007	Veg 6	Rabbitbrush	PDC and AAM				
11/17/2007	Veg 7	Dry pastureland	PDC and AAM				
11/17/2007	Veg 8	Sagebrush/ grass	PDC and AAM				
11/17/2007	Veg 9	S/G, scattered PJ	PDC and AAM				
11/17/2007	Veg 10	Oakbrush	PDC and AAM				
11/17/2007	Ref 11	S/G sagebrush	PDC and AAM				
11/18/2007	Veg 12	PJ	PDC and AAM				
11/18/2007	Veg 13	Sagebrush/ grass	PDC and AAM		moderate		
11/17/2007	Veg A (15)	Pastureland	TS and BTG				
11/17/2007	Veg B (16)	Sagebrush/ grass	TS and BTG				
11/17/2007	Veg C (17)	Sage/ Gambel Oak/ Grass	TS and BTG				
11/17/2007	Veg D (18)	Black sagebrush/ grass	TS and BTG				
11/17/2007	Veg E (19)	Black sagebrush/ grass	TS and BTG				
11/18/2007	Veg F (20)	S/G chipped	PDC and BTG			few	
11/18/2007	Veg G (21)	P-J	PDC and BTG				
11/18/2007	Veg H (22)	Rabbitbrush	PDC and BTG				
11/18/2007	Veg I (23)	ARNO / CHNA	PDC and BTG				
11/18/2007	Veg J (24)	S/G chipped	PDC and BTG	few			
11/18/2007	Veg K (25)	Gambel oak	PDC and BTG				
11/18/2007	Veg L (26)	S/G (ARNO)	PDC and BTG				

Relevé Plot Data	**Relevé ID**	**Plant Community**	**Surveyors**	***Symphorocarpus oreophilus***	***Trifolium* sp.**	***Triglochin maritima***	***Verbascum thapsis***	***Yucca* sp.**
Date				**SYOR**	**TRIFOLIUM**	**TRMA**	**VETH**	**YUCCA**
11/17/2007	Veg 1	Wiregrass	PDC and AAM			few		
11/17/2007	Veg 2	Black sagebrush/ grass	PDC and AAM					
11/17/2007	Veg 3	Black sagebrush/ grass	PDC and AAM					
11/17/2007	Veg 4	Pastureland	PDC and AAM					
11/17/2007	Veg 5	Pinyon/ juniper	PDC, AAM, BG, and TS	few				rare
11/17/2007	Veg 6	Rabbitbrush	PDC and AAM					
11/17/2007	Veg 7	Dry pastureland	PDC and AAM		rare			
11/17/2007	Veg 8	Sagebrush/ grass	PDC and AAM					
11/17/2007	Veg 9	S/G, scattered PJ	PDC and AAM					
11/17/2007	Veg 10	Oakbrush	PDC and AAM	moderate				
11/17/2007	Ref 11	S/G sagebrush	PDC and AAM					
11/18/2007	Veg 12	PJ	PDC and AAM	few				
11/18/2007	Veg 13	Sagebrush/ grass	PDC and AAM					
11/17/2007	Veg A (15)	Pastureland	TS and BTG					
11/17/2007	Veg B (16)	Sagebrush/ grass	TS and BTG					
11/17/2007	Veg C (17)	Sage/ Gambel Oak/ Grass	TS and BTG					
11/17/2007	Veg D (18)	Black sagebrush/ grass	TS and BTG					
11/17/2007	Veg E (19)	Black sagebrush/ grass	TS and BTG					
11/18/2007	Veg F (20)	S/G chipped	PDC and BTG					
11/18/2007	Veg G (21)	P-J	PDC and BTG					
11/18/2007	Veg H (22)	Rabbitbrush	PDC and BTG					
11/18/2007	Veg I (23)	ARNO / CHNA	PDC and BTG					
11/18/2007	Veg J (24)	S/G chipped	PDC and BTG				rare	
11/18/2007	Veg K (25)	Gambel oak	PDC and BTG	few				
11/18/2007	Veg L (26)	S/G (ARNO)	PDC and BTG					

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Attachment 2. Vegetation Associations and Species List

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VEGETATION SURVEY PROTOCOLS FOR ALTON COAL TRACT LBA

Habitat schemes as set by Mt. Nebo Scientific 2007

Sagebrush/Grass
Artemisia tridentata var. *tridentata*- big sagebrush
Artemisia nova- Black sagebrush
Koeleria micrantha- Junegrass
Poa secunda- Sandberg's bluegrass
Chrysothamnus depressus- longflower rabbitbrush
Gutierrezia sarothrae- Broom snakeweed
Eriogonum racemosum- redroot buckwheat
Gillia agreggata
Linum perenne- Flax
Bouteloua gracilis- Sideoats grama
Bromus tectorum- Cheatgrass
Elymus smithii- Western wheatgrass
Elymus trachycaulus- Slender wheatgrass
Hordeum jubatum- Foxtail barley
Poa pratensis- Kentucky bluegrass
Stipa hymenoides- Indian ricegrass

Meadows (Wet and dry)
Carex sp.-Sedges
Juncus arcticus- wiregrass
Gutierrezia sarothrae- Broom snakeweed
Achillea millefolium- yarrow
Aster ascendens- Pacific aster
Artemisia nova- Black sagebrush
Eriogonum racemosum- redroot buckwheat
Linum lewisii- Flax
Potentilla anserina
Bouteloua gracilis- Sideoats grama
Elymus elymoides- Squirreltail
Elymus smithii- Western wheatgrass
Hordeum jubatum- Foxtail barley
Koeleria micrantha- Junegrass
Muhlenbergia asperifolia- Scratchgrass
Poa pratensis- Kentucky bluegrass

Perennial/Annual Grasses
No quantitative vegetation surveys

Pinyon-Juniper/Sagebrush
Artemisia nova- Black sagebrush
Juniperus osteosperma- Utah juniper
Artemisia tridentata var. *tridentata*- big sagebrush
Phlox austromontana- Desert phlox
Pinus edulis- Pinyon pine
Amelanchier utahensis- Utah serviceberry
Gutierrezia sarothrae- Broom snakeweed

Mountain Brush
Quercus gambelii- Gambel oak
Cercocarpus montanus- Alderleaf mountain mahogany
Peraphyllum ramosissimum- Squaw-apple
Amelanchier utahensis- Utah serviceberry
Elymus smithii- Western wheatgrass
Symphorocarpus oreophilus- snowberry
Agropyron cristatum- Crested wheatgrass

Pinyon-Juniper/Mountain Brush ***Transition between pinyon-juniper and mountain brush***
Quercus gambelii- Gambel oak
Juniperus osteosperma- Utah juniper
Amelanchier utahensis- Utah serviceberry
Pinus edulis- Pinyon pine

Pinyon-Juniper Woodland
Juniperus osteosperma- Utah juniper
Pinus edulis- Pinyon pine
Phlox austromontana- Desert phlox

I.2. Preliminary Jurisdictional Determination for the Alton Coal Tract

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO CA 95814-2922

REPLY TO
ATTENTION OF

October 29, 2012

Regulatory Division SPK-2011-01248

Mr. Keith Rigtrup
Bureau of Land Management, Kanab Field Office
319 North 100 East
Kanab, Utah 84741

Dear Mr. Rigtrup:

We are responding to your consultants September 14, 2012 request for a preliminary jurisdictional determination (JD), in accordance with our Regulatory Guidance Letter (RGL) 08-02, for the Alton Coal Tract EIS site. The approximately 3500-acre site is located on or near Kanab Creek, Section 14, Township 39 S, Range 6 W, Salt Lake Meridian, Latitude 37.40757°, Longitude -112.46555°, Alton, Kane County, Utah.

Based on available information, **we concur with the amount and location of wetlands and/or other water bodies on the site as depicted on the enclosed Figures 1 and 2 from Long Resource Consultants, Inc. and Mt. Nebo Scientific, Inc; and Figures 3, 4A-4D prepared by Frontier Corporation (Enclosure 1)**. The approximately 69.07 acres of wetlands and 72,528 linear feet of other water bodies present within the survey area are potential waters of the United States regulated under Section 404 of the Clean Water Act.

A copy of our RGL 08-02 Preliminary Jurisdictional Determination Form (Enclosure 2) for this site is enclosed. Please sign and return a copy of the completed form to this office. Once we receive a copy of the form with your signature we can accept and process a Pre-Construction Notification or permit application for your proposed project.

You should not start any work in potentially jurisdictional waters of the United States unless you have Department of the Army permit authorization for the activity. You may request an approved JD for this site at any time prior to starting work within waters. In certain circumstances, as described in RGL 08-02, an approved JD may later be necessary.

You should provide a copy of this letter and notice to all other affected parties, including any individual who has an identifiable and substantial legal interest in the property.

This preliminary determination has been conducted to identify the potential limits of wetlands and other water bodies which may be subject to Corps of Engineers' jurisdiction for the particular site identified in this request. A Notification of Appeal Process and Request for Appeal form is enclosed to notify you of your options with this determination (Enclosure 3).

This determination may not be valid for the wetland conservation provisions of the Food Security Act of 1985. If you or your tenant are U.S. Department of Agriculture (USDA) program participants, or anticipate participation in USDA programs, you should request a certified wetland determination from the local office of the Natural Resources Conservation Service, prior to starting work.

We appreciate your feedback. At your earliest convenience, please tell us how we are doing by completing the customer survey on our website under *Customer Service Survey*.

Please refer to identification number SPK-2011-01248 in any correspondence concerning this project. If you have any questions, please contact me at 196 E Tabernacle St, Suite 30, St. George, UT 84770-3474, email *patricia.l.mcqueary@usace.army.mil*, or telephone 435-986-1961. For more information regarding our program, please visit our website at *www.spk.usace.army.mil/Missions/Regulatory.aspx*.

Sincerely,

Patricia L. McQueary
Senior Project Manager, St. George Office
Utah-Nevada Regulatory Branch

Enclosures
Enclosure 1: Figures of the Project Area
Enclosure 1: Preliminary JD Form for signature
Enclosure 3: Appeal Form

Copy Furnished without enclosures
Mr. Robert E. Long, Long Resource Consultants, Inc., 1960 West Deep Creek Road, Morgan, Utah 84050
Mr. Patrick D. Collins, Mt. Nebo Scientific, Inc., 330 East 400 South, Suite 6, P.O. Box 337, Springville, Utah 84663
Mr. Larry Johnson, Alton Coal Development, LLC, 463 North 100 West, Suite 1, Cedar City, Utah 84720
Mr. Dennis Wenger, Frontier Corporation, 221 North Gateway Drive, Suite B, Providence, Utah 84332
Mr. Benjamin Gaddis, SWCA, 257 East 200 South, Suite 200, Salt Lake City, Utah 84111

PRELIMINARY JURISDICTIONAL DETERMINATION FORM
Sacramento District

This preliminary JD finds that there *"may be"* waters of the United States on the subject project site, and identifies all aquatic features on the site that could be affected by the proposed activity, based on the following information:

Regulatory Branch: **Nevada-Utah** File/ORM #: **SPK-2011-01248** PJD Date: **October 29, 2012**

State: **UT** City/County: **Alton, Kane County**
Nearest Waterbody:

Location (Lat/Long): **37.4075°, -112.4655°**

Size of Review Area: **~3500** acres

Name/Address Of Property Owner/Potential Applicant
Keith Rigtrup
Bureau of Land Management, Kanab Field Office
319 North 100 East
Kanab, Utah 84741

Identify (Estimate) Amount of Waters in the Review Area
Non-Wetland Waters:
linear feet **72528** ft wide acre(s)
Stream Flow: **Mixed**

Wetlands: **69.07** acre(s) Cowardin Class: **N/A**

Name of any Water Bodies on the site identified as Section 10 Waters: Tidal: Non-Tidal:

☒ Office (Desk) Determination
☒ Field Determination:
Date(s) of Site Visit(s): **June 19, July 25, August 30, 2012**

SUPPORTING DATA: Data reviewed for preliminary JD (check all that apply – checked items should be included in case file and, where checked and requested, appropriately reference sources below)

☒ Maps, plans, plots or plat submitted by or on behalf of the applicant/consultant:
☒ Data sheets prepared/submitted by or on behalf of the applicant/consultant.
☐ Data sheets prepared by the Corps.
☐ Corps navigable waters' study.
☐ U.S. Geological Survey Hydrologic Atlas:
  ☐ USGS NHD data.
  ☐ USGS HUC maps.
☒ U.S. Geological Survey map(s). Cite scale & quad name: **1:24K; UT-BALD KNOLL**
☐ USDA Natural Resources Conservation Service Soil Survey.
☐ National wetlands inventory map(s).
☐ State/Local wetland inventory map(s).
☐ FEMA/FIRM maps.
☐ 100-year Floodplain Elevation (if known):
☒ Photographs: ☒ Aerial ☒ Other
☒ Previous determination(s). File no. and date of response letter: **SPK-2011-00216, June 30, 2011; SPK-2009-01008, September 27, 2010**
☐ Other information (please specify):

IMPORTANT NOTE: The information recorded on this form has not necessarily been verified by the Corps and should not be relied upon for later jurisdictional determinations.

Patricia L McQueen 10/29/2012

Signature and Date of Regulatory Project Manager (REQUIRED)

Signature and Date of Person Requesting Preliminary JD (REQUIRED, unless obtaining the signature is impracticable)

EXPLANATION OF PRELIMINARY AND APPROVED JURISDICTIONAL DETERMINATIONS:

1. The Corps of Engineers believes that there may be jurisdictional waters of the United States on the subject site, and the permit applicant or other affected party who requested this preliminary JD is hereby advised of his or her option to request and obtain an approved jurisdictional determination (JD) for that site. Nevertheless, the permit applicant or other person who requested this preliminary JD has declined to exercise the option to obtain an approved JD in this instance and at this time.

2. In any circumstance where a permit applicant obtains an individual permit, or a Nationwide General Permit (NWP) or other general permit verification requiring "preconstruction notification" (PCN), or requests verification for a non-reporting NWP or other general permit, and the permit applicant has not requested an approved JD for the activity, the permit applicant is hereby made aware of the following: (1) the permit applicant has elected to seek a permit authorization based on a preliminary JD, which does not make an official determination of jurisdictional waters; (2) that the applicant has the option to request an approved JD before accepting the terms and conditions of the permit authorization, and that basing a permit authorization on an approved JD could possibly result in less compensatory mitigation being required or different special conditions; (3) that the applicant has the right to request an individual permit rather than accepting the terms and conditions of the NWP or other general permit authorization; (4) that the applicant can accept a permit authorization and thereby agree to comply with all the terms and conditions of that permit, including whatever mitigation requirements the Corps has determined to be necessary; (5) that undertaking any activity in reliance upon the subject permit authorization without requesting an approved JD constitutes the applicant's acceptance of the use of the preliminary JD, but that either form of JD will be processed as soon as is practicable; (6) accepting a permit authorization (e.g., signing a proffered individual permit) or undertaking any activity in reliance on any form of Corps permit authorization based on a preliminary JD constitutes agreement that all wetlands and other water bodies on the site affected in any way by that activity are jurisdictional waters of the United States, and precludes any challenge to such jurisdiction in any administrative or judicial compliance or enforcement action, or in any administrative appeal or in any Federal court; and (7) whether the applicant elects to use either an approved JD or a preliminary JD, that JD will be processed as soon as is practicable. Further, an approved JD, a proffered individual permit (and all terms and conditions contained therein), or individual permit denial can be administratively appealed pursuant to 33 C.F.R. Part 331, and that in any administrative appeal, jurisdictional issues can be raised (see 33 C.F.R. 331.5(a)(2)). If, during that administrative appeal, it becomes necessary to make an official determination whether CWA jurisdiction exists over a site, or to provide an official delineation of jurisdictional waters on the site, the Corps will provide an approved JD to accomplish that result, as soon as is practicable.

NOTIFICATION OF ADMINISTRATIVE APPEAL OPTIONS AND PROCESS AND REQUEST FOR APPEAL

Applicant: Keith Rigtrup Bureau of Land Management, Kanab Field Office 319 North 100 East Kanab, Utah 84741	File No.: SPK-2011-01248	Date: October 29, 2012

Attached is:		See Section below
	INITIAL PROFFERED PERMIT (Standard Permit or Letter of permission)	A
	PROFFERED PERMIT (Standard Permit or Letter of permission)	B
	PERMIT DENIAL	C
	APPROVED JURISDICTIONAL DETERMINATION	D
X	PRELIMINARY JURISDICTIONAL DETERMINATION	E

SECTION I - The following identifies your rights and options regarding an administrative appeal of the above decision. Additional information may be found at *http://www.usace.army.mil/cecw/pages/reg_materials.aspx* or Corps regulations at 33 CFR Part 331.

A: INITIAL PROFFERED PERMIT: You may accept or object to the permit.

- ACCEPT: If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.
- OBJECT: If you object to the permit (Standard or LOP) because of certain terms and conditions therein, you may request that the permit be modified accordingly. You must complete Section II of this form and return the form to the district engineer. Your objections must be received by the district engineer within 60 days of the date of this notice, or you will forfeit your right to appeal the permit in the future. Upon receipt of your letter, the district engineer will evaluate your objections and may: (a) modify the permit to address all of your concerns, (b) modify the permit to address some of your objections, or (c) not modify the permit having determined that the permit should be issued as previously written. After evaluating your objections, the district engineer will send you a proffered permit for your reconsideration, as indicated in Section B below.

B: PROFFERED PERMIT: You may accept or appeal the permit

- ACCEPT: If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.
- APPEAL: If you choose to decline the proffered permit (Standard or LOP) because of certain terms and conditions therein, you may appeal the declined permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer (address on reverse). This form must be received by the division engineer within 60 days of the date of this notice.

C: PERMIT DENIAL: You may appeal the denial of a permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer (address on reverse). This form must be received by the division engineer within 60 days of the date of this notice.

D: APPROVED JURISDICTIONAL DETERMINATION: You may accept or appeal the approved JD or provide new information.

- ACCEPT: You do not need to notify the Corps to accept an approved JD. Failure to notify the Corps within 60 days of the date of this notice, means that you accept the approved JD in its entirety, and waive all rights to appeal the approved JD.
- APPEAL: If you disagree with the approved JD, you may appeal the approved JD under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer (address on reverse). This form must be received by the division engineer within 60 days of the date of this notice.

E: PRELIMINARY JURISDICTIONAL DETERMINATION: You do not need to respond to the Corps regarding the preliminary JD. The Preliminary JD is not appealable. If you wish, you may request an approved JD (which may be appealed), by contacting the Corps district for further instruction. Also you may provide new information for further consideration by the Corps to reevaluate the JD.

SECTION II - REQUEST FOR APPEAL or OBJECTIONS TO AN INITIAL PROFFERED PERMIT

REASONS FOR APPEAL OR OBJECTIONS: (Describe your reasons for appealing the decision or your objections to an initial proffered permit in clear concise statements. You may attach additional information to this form to clarify where your reasons or objections are addressed in the administrative record.)

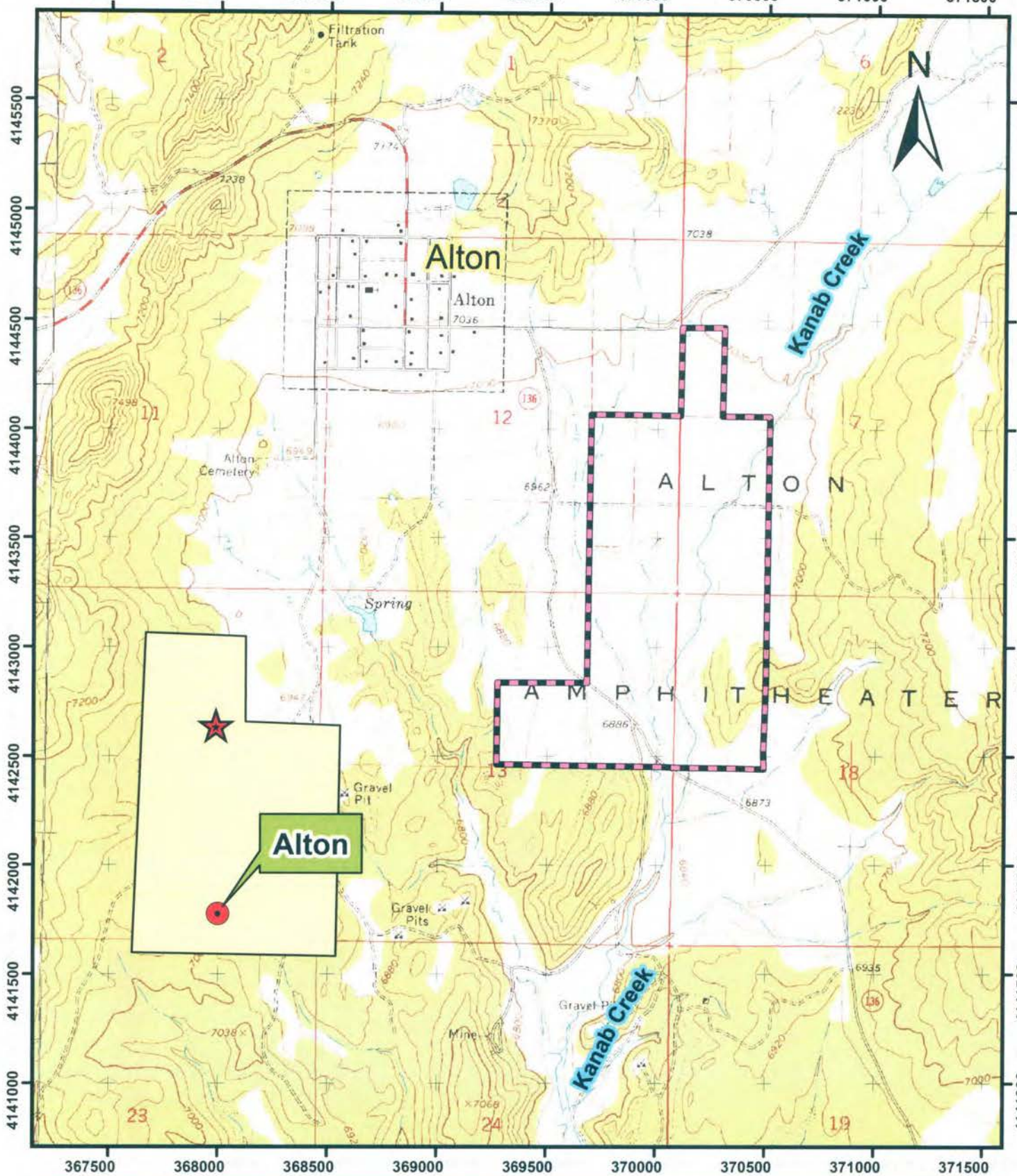
ADDITIONAL INFORMATION: The appeal is limited to a review of the administrative record, the Corps memorandum for the record of the appeal conference or meeting, and any supplemental information that the review officer has determined is needed to clarify the administrative record. Neither the appellant nor the Corps may add new information or analyses to the record. However, you may provide additional information to clarify the location of information that is already in the administrative record.

POINT OF CONTACT FOR QUESTIONS OR INFORMATION:

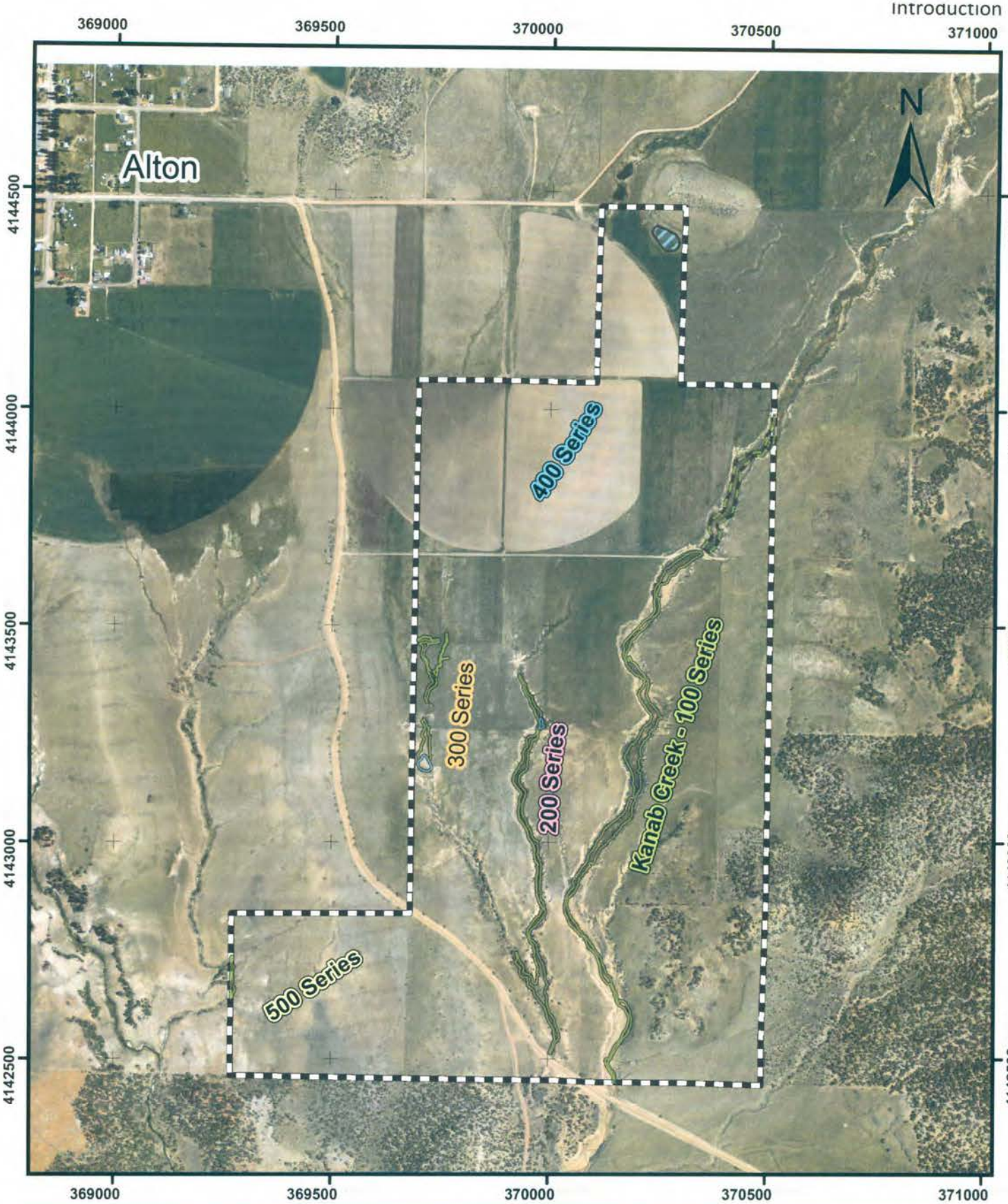
If you have questions regarding this decision and/or the appeal process you may contact: Karen Clementsen Project Manager, St. George Office Utah-Nevada Regulatory Branch U.S. Army Corps of Engineers 196 E Tabernacle St, Suite 30, St. George, UT 84770-3474 Phone: 435-986-1961, FAX 916-557-6877 Email: Karen.L.Clementsen@usace.army.mil (Use this address for submittals to the **district** engineer)	If you only have questions regarding the appeal process you may also contact: Thomas J. Cavanaugh Administrative Appeal Review Officer U.S. Army Corps of Engineers South Pacific Division, CESPD-PDO 1455 Market Street, 2052B San Francisco, California 94103-1399 Phone: 415-503-6574, FAX 415-503-6646) Email: Thomas.J.Cavanaugh@usace.army.mil (Use this address for submittals to the **division** engineer)

RIGHT OF ENTRY: Your signature below grants the right of entry to Corps of Engineers personnel, and any government consultants, to conduct investigations of the project site during the course of the appeal process. You will be provided a 15 day notice of any site investigation, and will have the opportunity to participate in all site investigations.

_____ Signature of appellant or agent.	Date:	Telephone number:



Wetland Survey of Alton Coal - Private Lease Area	Fig 1. Study Area Location Map
By: Long Resource Consultants, Inc. Morgan, Utah Mt. Nebo Scientific, Inc. Springville, Utah	General Location of Wetland Study Area southeast of Alton, Utah.
	Coordinate System: UTM, NAD 1983, Zone 12 North
	Alton, Utah USGS 7.5' Topographic Map — 1 inch = 2,000 feet
	August 11, 2012 — 0 500 1,000 2,000 3,000 4,000 Feet



Wetland Survey of Alton Coal - Private Lease Area	Figure 2. Stream Channels
By: Long Resource Consultants, Inc. Morgan, Utah Mt. Nebo Scientific, Inc. Springville, Utah	Note: Stream channel numbering system used for data points. Coordinate System: UTM, NAD 1983, Zone 12 North NAIP 2011 Aerial Photography — 1 inch = 1,000 feet August 11, 2012 — 0 255 510 1,020 1,530 2,040 Feet

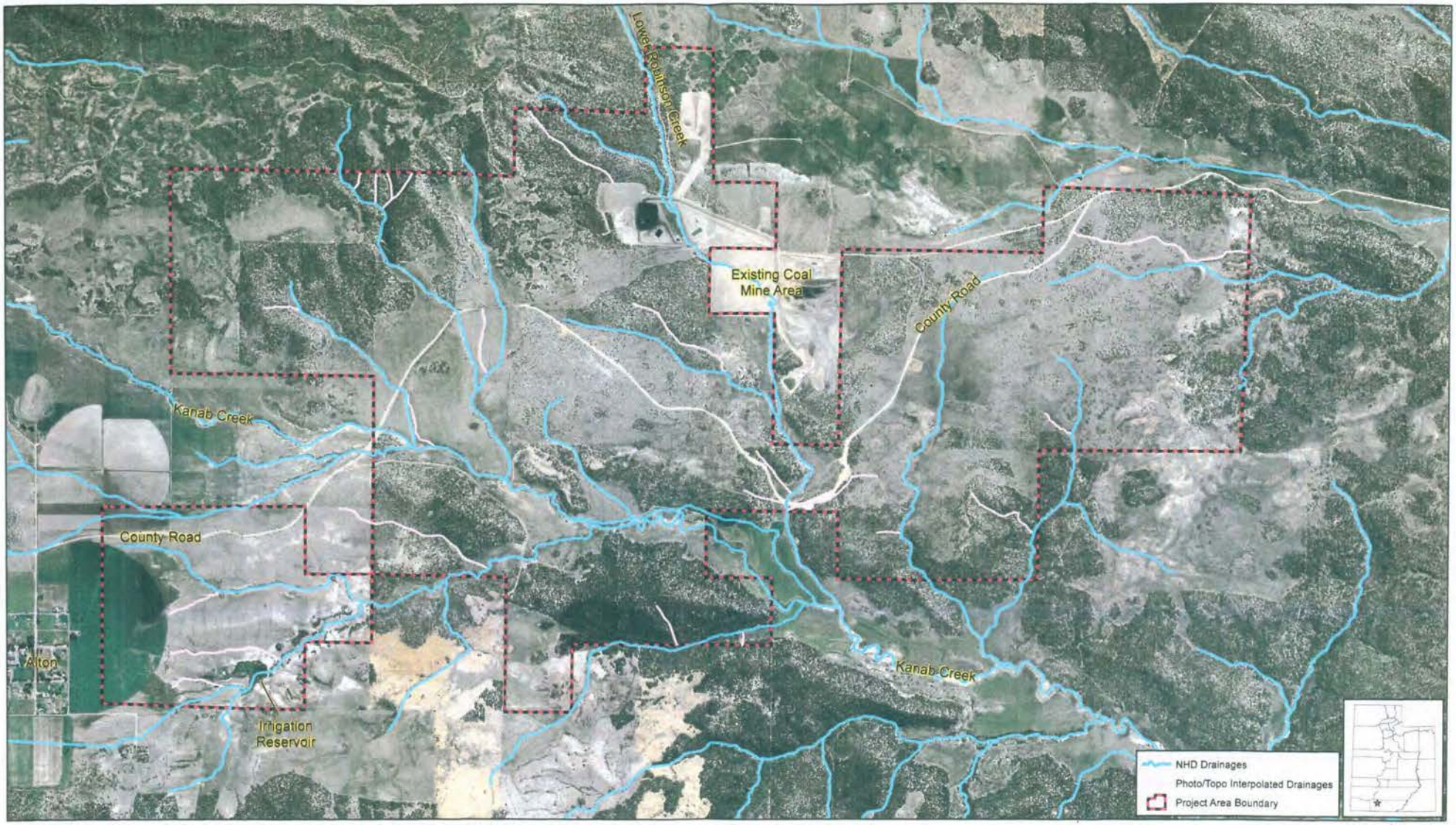


Figure 3. Drainages Investigated for Stream Channels with an Ordinary High Water Mark (OHWM).

Basemap color imagery from 2011 National Agricultural Imagery Program, 1-meter resolution.

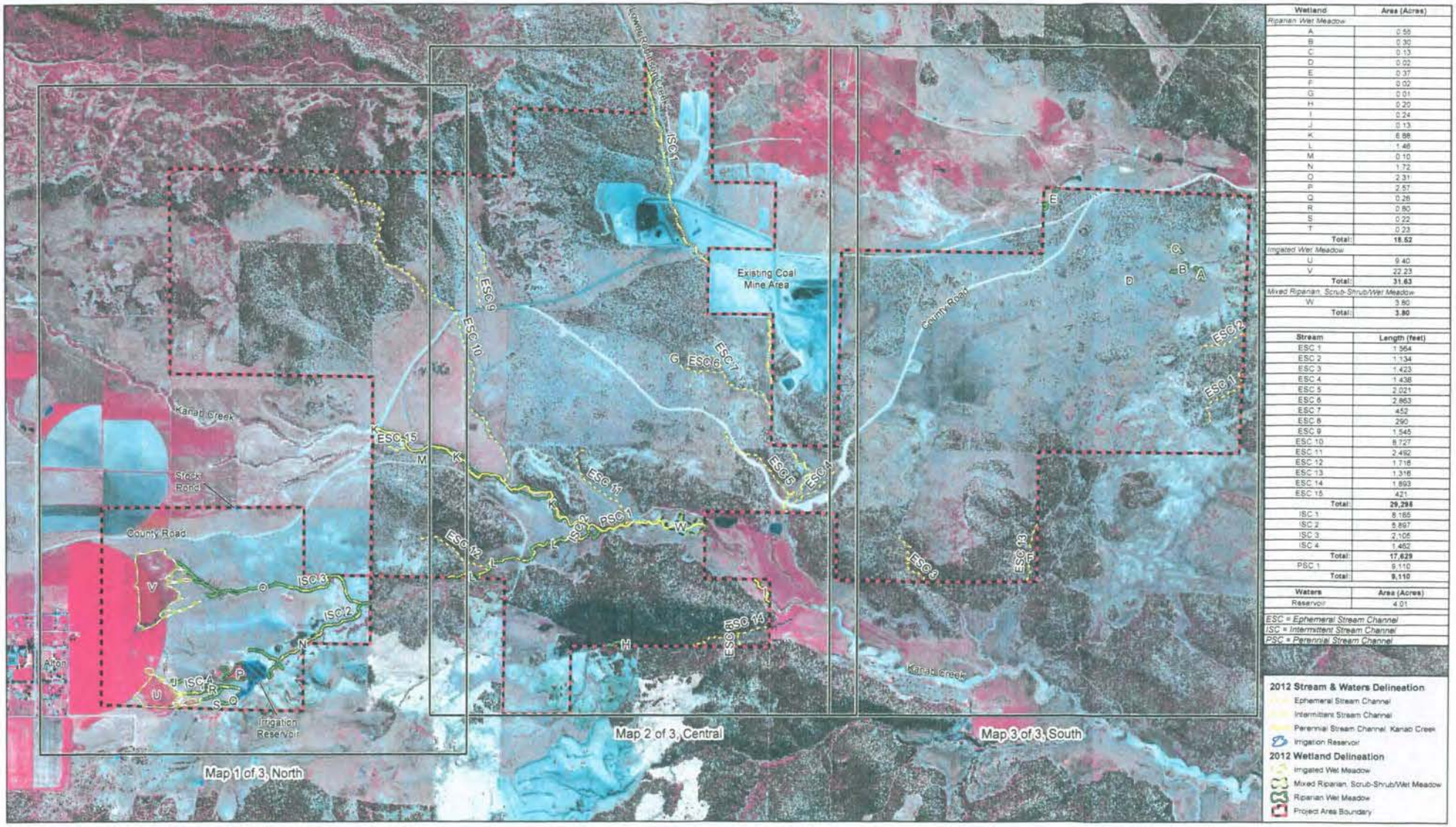
Map Date: July 23, 2012
Image Date: June 22, 2011

N

1 inch = 1,800 feet

0 1,000 2,000 4,000 Feet

FRONTIER CORPORATION USA
Environmental Consultants
221 N. GATEWAY DRIVE, SUITE B
PROVIDENCE, UT 84332
PHONE (435) 753-9502



Wetland	Area (Acres)
Riparian Wet Meadow	
A	0.55
B	0.30
C	0.13
D	0.02
E	0.37
F	0.02
G	0.01
H	0.20
I	0.24
J	0.13
K	6.88
L	1.46
M	0.10
N	1.72
O	2.31
P	2.57
Q	0.26
R	0.80
S	0.22
T	0.23
Total:	**18.52**
Irrigated Wet Meadow	
U	9.40
V	22.23
Total:	**31.63**
Mixed Riparian, Scrub-Shrub/Wet Meadow	
W	3.80
Total:	**3.80**

Stream	Length (feet)
ESC 1	1,564
ESC 2	1,134
ESC 3	1,423
ESC 4	1,438
ESC 5	2,021
ESC 6	2,863
ESC 7	452
ESC 8	290
ESC 9	1,545
ESC 10	8,727
ESC 11	2,492
ESC 12	1,716
ESC 13	1,316
ESC 14	1,893
ESC 15	421
Total:	**29,298**
ISC 1	8,165
ISC 2	5,897
ISC 3	2,105
ISC 4	1,462
Total:	**17,629**
PSC 1	9,110
Total:	**9,110**

Waters	Area (Acres)
Reservoir	4.01

ESC = Ephemeral Stream Channel
ISC = Intermittent Stream Channel
PSC = Perennial Stream Channel

Figure 4A. Wetland and Stream Channel Delineation, Index Map.

Map Date: September 12, 2012
Image Date: June 22, 2011

1 inch = 1,800 feet
0 1,000 2,000 4,000 Feet

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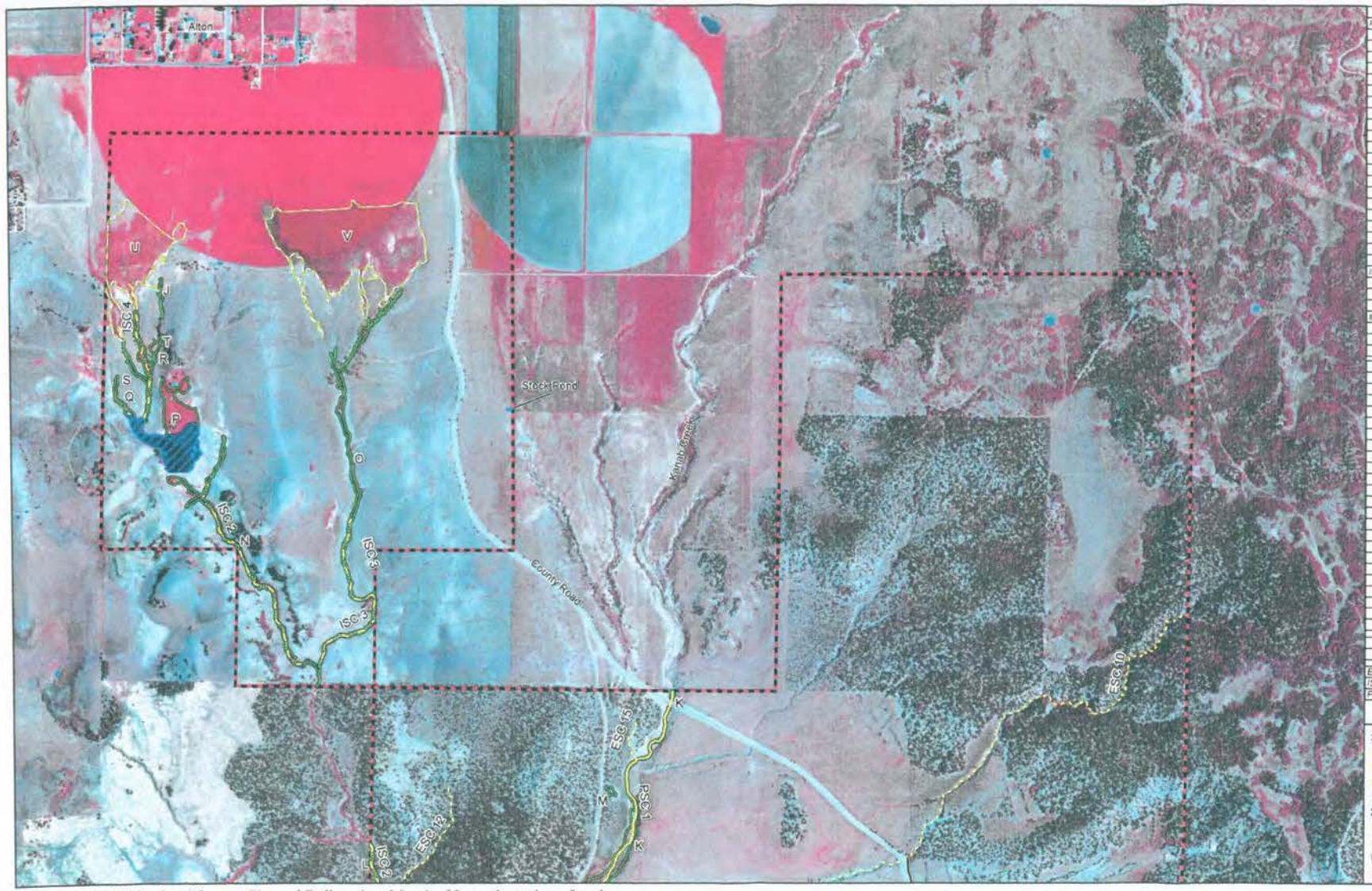
PHONE (435) 753-9502

Basemap color infrared imagery from 2011 National Agricultural Imagery Program, 1-meter resolution.



Wetland	Area (Acres)
Riparian Wet Meadow	
A	0.55
B	0.30
C	0.13
D	0.02
E	0.37
F	0.02
G	0.01
H	0.20
I	0.24
J	0.13
K	6.88
L	1.46
M	0.10
N	1.72
O	2.31
P	2.57
Q	0.26
R	0.80
S	0.22
T	0.23
Total:	**18.52**
Irrigated Wet Meadow	
U	9.40
V	22.23
Total:	**31.63**
Mixed Riparian, Scrub-Shrub/Wet Meadow	
W	3.80
Total:	**3.80**

Stream	Length (feet)
ESC 1	1,564
ESC 2	1,134
ESC 3	1,423
ESC 4	1,438
ESC 5	2,021
ESC 6	2,863
ESC 7	462
ESC 8	290
ESC 9	1,545
ESC 10	8,727
ESC 11	2,482
ESC 12	1,716
ESC 13	1,316
ESC 14	1,893
ESC 15	421
Total:	**29,295**
ISC 1	8,165
ISC 2	5,897
ISC 3	2,105
ISC 4	1,462
Total:	**17,629**
PSC 1	9,110
Total:	**9,110**

Waters	Area (Acres)
Reservoir	4.01

ESC = Ephemeral Stream Channel
ISC = Intermittent Stream Channel
PSC = Perennial Stream Channel

2012 Stream & Waters Delineation
- Ephemeral Stream Channel
- Intermittent Stream Channel
- Perennial Stream Channel, Kanab Creek
- Irrigation Reservoir

2012 Wetland Delineation
- Irrigated Wet Meadow
- Mixed Riparian, Scrub-Shrub/Wet Meadow
- Riparian Wet Meadow
- Project Area Boundary

Figure 4B. Wetland and Stream Channel Delineation, Map 1 of 3, north portion of project area.

Basemap color infrared imagery from 2011 National Agricultural Imagery Program, 1-meter resolution.

Map Date: September 12, 2012
Image Date: June 22, 2011

N

1 inch = 950 feet

0 500 1,000 2,000 Feet

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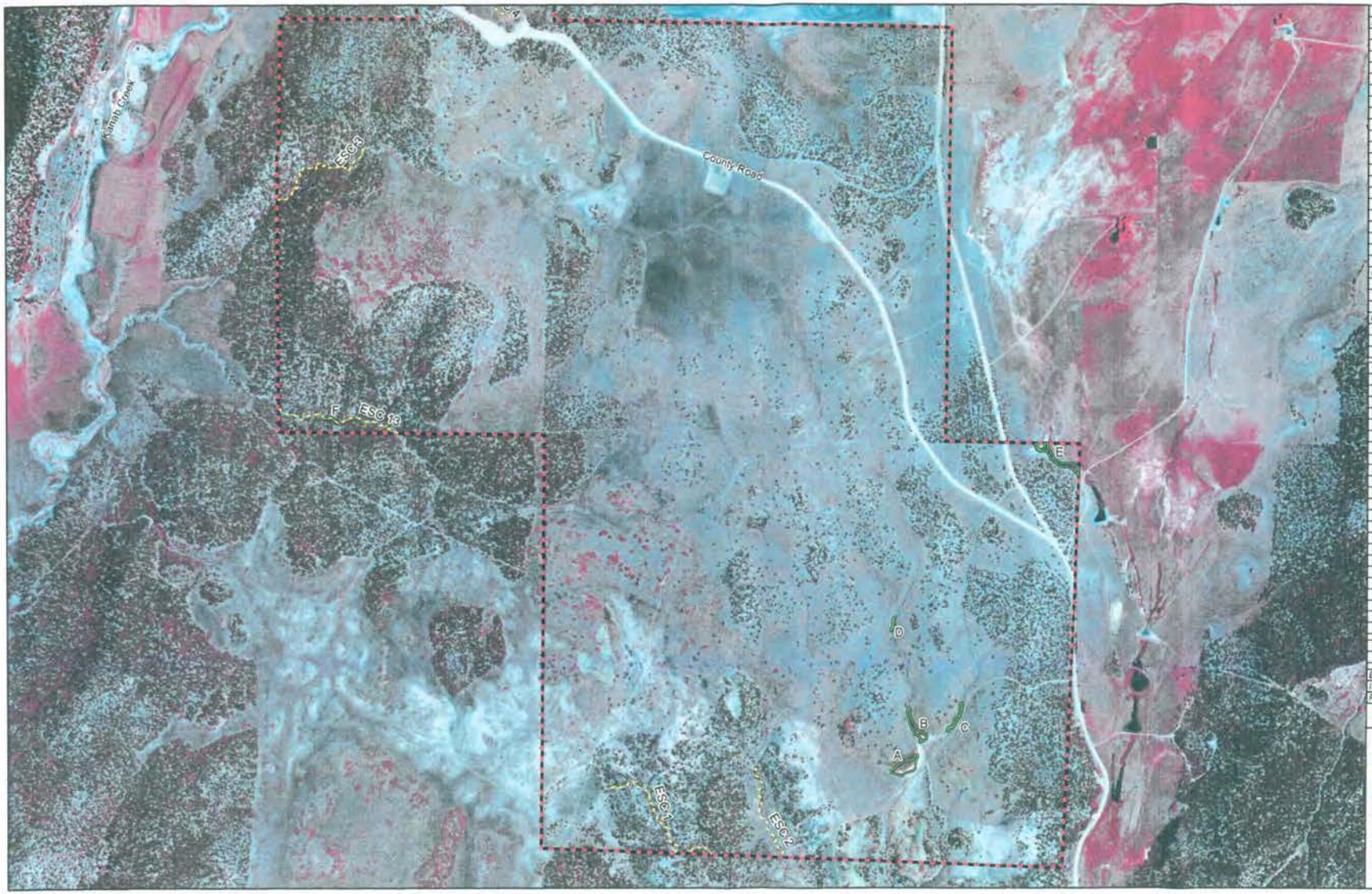

Wetland	Area (Acres)
Riparian Wet Meadow	
A	0.56
B	0.30
C	0.13
D	0.02
E	0.37
F	0.02
G	0.01
H	0.20
I	0.24
J	0.13
K	6.88
L	1.46
M	0.10
N	1.72
O	2.31
P	2.57
Q	0.26
R	0.80
S	0.22
T	0.23
Total:	**18.52**
Irrigated Wet Meadow	
U	9.40
V	22.23
Total:	**31.63**
Mixed Riparian, Scrub-Shrub/Wet Meadow	
W	3.80
Total:	**3.80**

Stream	Length (feet)
ESC 1	1,564
ESC 2	1,134
ESC 3	1,423
ESC 4	1,438
ESC 5	2,021
ESC 6	2,863
ESC 7	452
ESC 8	290
ESC 9	1,545
ESC 10	8,727
ESC 11	2,492
ESC 12	1,716
ESC 13	1,316
ESC 14	1,893
ESC 15	421
Total:	**29,295**
ISC 1	8,185
ISC 2	5,897
ISC 3	2,105
ISC 4	1,452
Total:	**17,639**
PSC 1	9,110
Total:	**9,110**

Waters	Area (Acres)
Reservoir	4.01

ESC = Ephemeral Stream Channel
ISC = Intermittent Stream Channel
PSC = Perennial Stream Channel

2012 Stream & Waters Delineation
- Ephemeral Stream Channel
- Intermittent Stream Channel
- Perennial Stream Channel, Kanab Creek
- Irrigation Reservoir

2012 Wetland Delineation
- Irrigated Wet Meadow
- Mixed Riparian, Scrub-Shrub/Wet Meadow
- Riparian Wet Meadow
- Project Area Boundary

Figure 4D. Wetland and Stream Channel Delineation, Map 3 of 3, south portion of project area.

Basemap color infrared imagery from 2011 National Agricultural Imagery Program, 1-meter resolution.

Map Date: September 12, 2012
Image Date: June 22, 2011

N

1 inch = 950 feet

0 500 1,000 2,000 Feet

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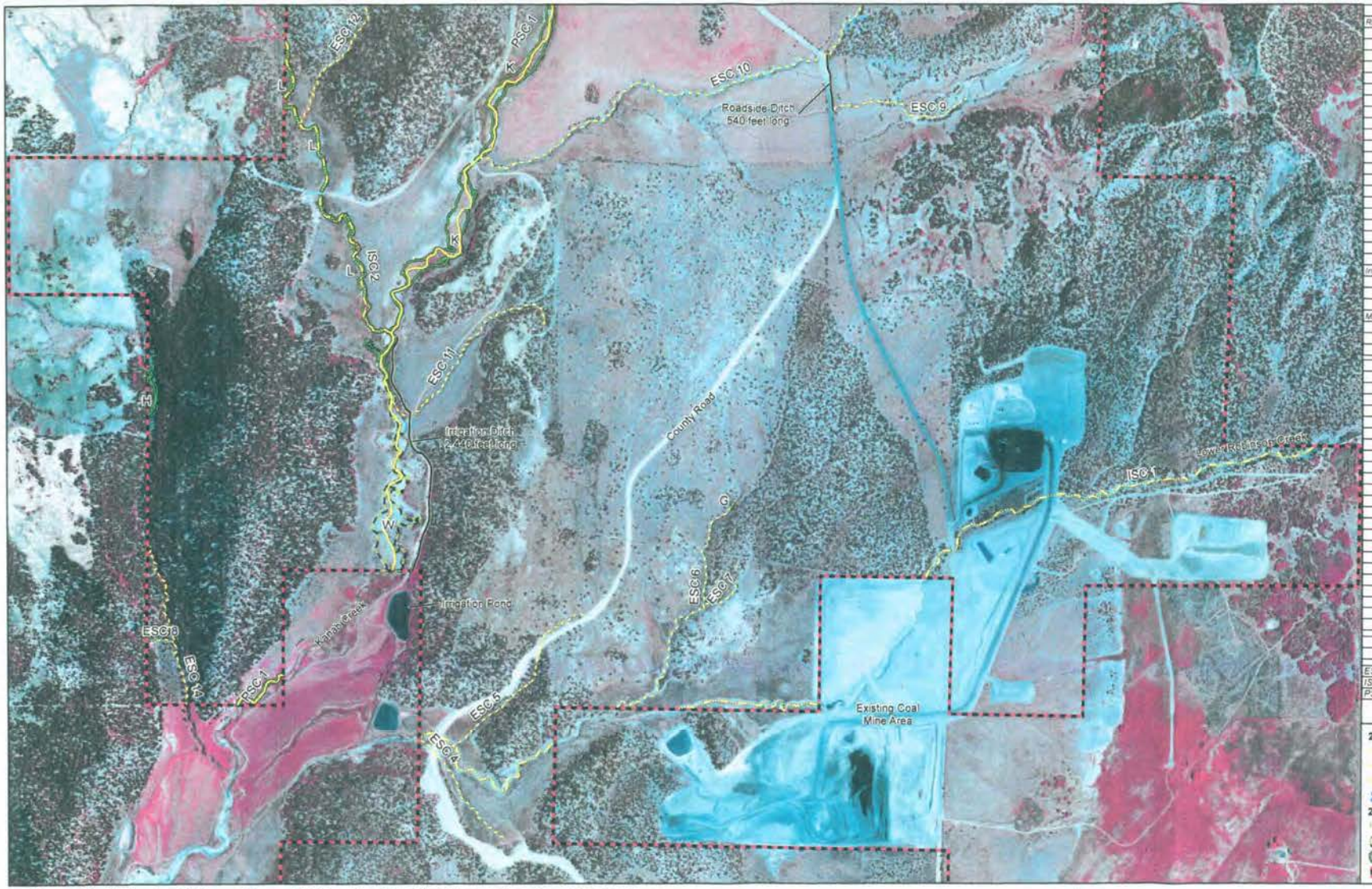
PHONE (435) 753-9502



Wetland	Area (Acres)
Riparian Wet Meadow	
A	0.55
B	0.30
C	0.13
D	0.02
E	0.37
F	0.02
G	0.01
H	0.20
I	0.24
J	0.13
K	6.88
L	1.48
M	0.10
N	1.72
O	2.31
P	2.57
Q	0.26
R	0.80
S	0.22
T	0.23
Total:	**18.52**
Irrigated Wet Meadow	
U	9.40
V	22.23
Total:	**31.63**
Mixed Riparian, Scrub-Shrub/Wet Meadow	
W	3.80
Total:	**3.80**

Stream	Length (feet)
ESC 1	1,564
ESC 2	1,134
ESC 3	1,423
ESC 4	1,438
ESC 5	2,021
ESC 6	2,863
ESC 7	452
ESC 8	290
ESC 9	1,545
ESC 10	8,727
ESC 11	2,492
ESC 12	1,716
ESC 13	1,316
ESC 14	1,893
ESC 15	421
Total:	**29,295**
ISC 1	8,165
ISC 2	5,897
ISC 3	2,105
ISC 4	1,462
Total:	**17,629**
PSC 1	9,110
Total:	**9,110**

Waters	Area (Acres)
Reservoir	4.01

ESC = Ephemeral Stream Channel
ISC = Intermittent Stream Channel
PSC = Perennial Stream Channel

2012 Stream & Waters Delineation
- Ephemeral Stream Channel
- Intermittent Stream Channel
- Perennial Stream Channel, Kanab Creek
- Irrigation Reservoir

2012 Wetland Delineation
- Irrigated Wet Meadow
- Mixed Riparian, Scrub-Shrub/Wet Meadow
- Riparian Wet Meadow
- Project Area Boundary

Figure 4C. Wetland and Stream Channel Delineation, Map 2 of 3, central portion of project area.

Basemap color infrared imagery from 2011 National Agricultural Imagery Program, 1-meter resolution.

Map Date: September 12, 2012
Image Date: June 22, 2011

N

1 inch = 950 feet

0 500 1,000 2,000 Feet

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I.3. Wetland and Stream Delineation Technical Report - Alton Coal Tract Lease by Application Project

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Environmental Consultants

Wetland and Stream Delineation Technical Report

Alton Coal Tract Lease by Application Project

Approximately 3,581-Acre Project Area
Sections 12, 13, 24 & 25, Township 39 South, Range 6 West
Sections 7, 18, 19, 20, 30 & 31, Township 39 South, Range 5 West
Salt Lake Base and Meridian
Near Alton, Kane County, Utah

Prepared For:

Alton Coal Development, LLC
463 North 100 West, Suite 1
Cedar City, UT 84721

Attn: Larry Johnson, Mine Manager

Prepared By:

Frontier Corporation USA
221 N. Gateway Drive, Suite B
Providence, UT 84332

Dennis Wenger, Sr. Wetlands Ecologist
Jeff Boice, Wetlands Scientist
Collin Covington, Wetlands Scientist

July 2012

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Appendix C: Stream Channel Delineation Maps
Appendix D: Arid West Ordinary High Water Data Sheets
Appendix E: Representative Photos of Wetland and Stream Channel Conditions

1.0 INTRODUCTION

1.1 Project Background

Frontier Corporation USA (Frontier) was retained by Alton Coal Development, LLC (Alton Coal) to prepare a wetland and stream delineation technical report for the Alton Coal Tract Lease by Application (LBA) project located approximately 0.1 mile southeast of Alton and 2.9 miles east of U.S. Highway 89 in Kane County, Utah (Figure 1). The project area is approximately 3,581 acres in size and is situated on both public lands and private properties in the Alton Amphitheater (Figures 2A and 2B). The public lands are administered by the U.S. Department of Interior Bureau of Land Management (BLM). The project area can be accessed from U.S. Highway 89 via County Road 136.

The location of the project area can be referenced on the Alton and Bald Knoll, Utah U.S. Geologic Survey (USGS) 7.5-minute quadrangle topographic maps (Figure 2A). The project area covers portions of Sections 12, 13, 24 and 25, Township 39 South, Range 6 West and Sections 7, 18, 19, 20 30 and 31, Township 39 South, Range 5 West, Salt Lake Base Meridian. Kanab Creek flows north to south through the approximate center of the project area. The elevation of the project area ranges from approximately 7,420 feet in the upper foothills northeast of Kanab Creek to 6,580 feet in the lower (southern) Kanab Creek valley bottom (Figure 2A).

The BLM is preparing a supplemental draft environmental impact statement (SDEIS) to analyze and disclose potential impacts that would result from the leasing and mining of coal reserves within the project area. The BLM's decision with respect to the project area will pertain only to leasing the tract; however, the potential impacts of mining the tract will be analyzed in the SDEIS because a coal mine would be a logical extension of the land lease. This technical report identifies and delineates the boundaries of existing wetlands, streams, and other water bodies in the project area for analysis in the SDEIS. The wetland and stream channel delineation has been completed at a sufficient level of detail for the issuance of a preliminary jurisdictional determination (PJD) by the U.S. Army Corps of Engineers (USACE). The PJD will identify the potential limits of wetlands, streams and other water bodies that may be subject to the USACE's regulatory jurisdiction under the federal Clean Water Act.

1.2 Scope of the Wetlands and Stream Channel Delineation

The scope of the wetlands and stream channel delineation included:

- Identification and documentation of existing wetland, stream and water body conditions;
- Delineation and surveying of wetland, stream channel and other water body boundaries;
- Preparation of delineation maps and calculation of delineated channel lengths and wetland and water body acreage; and
- Preparation of this delineation technical report in accordance with USACE reporting standards.

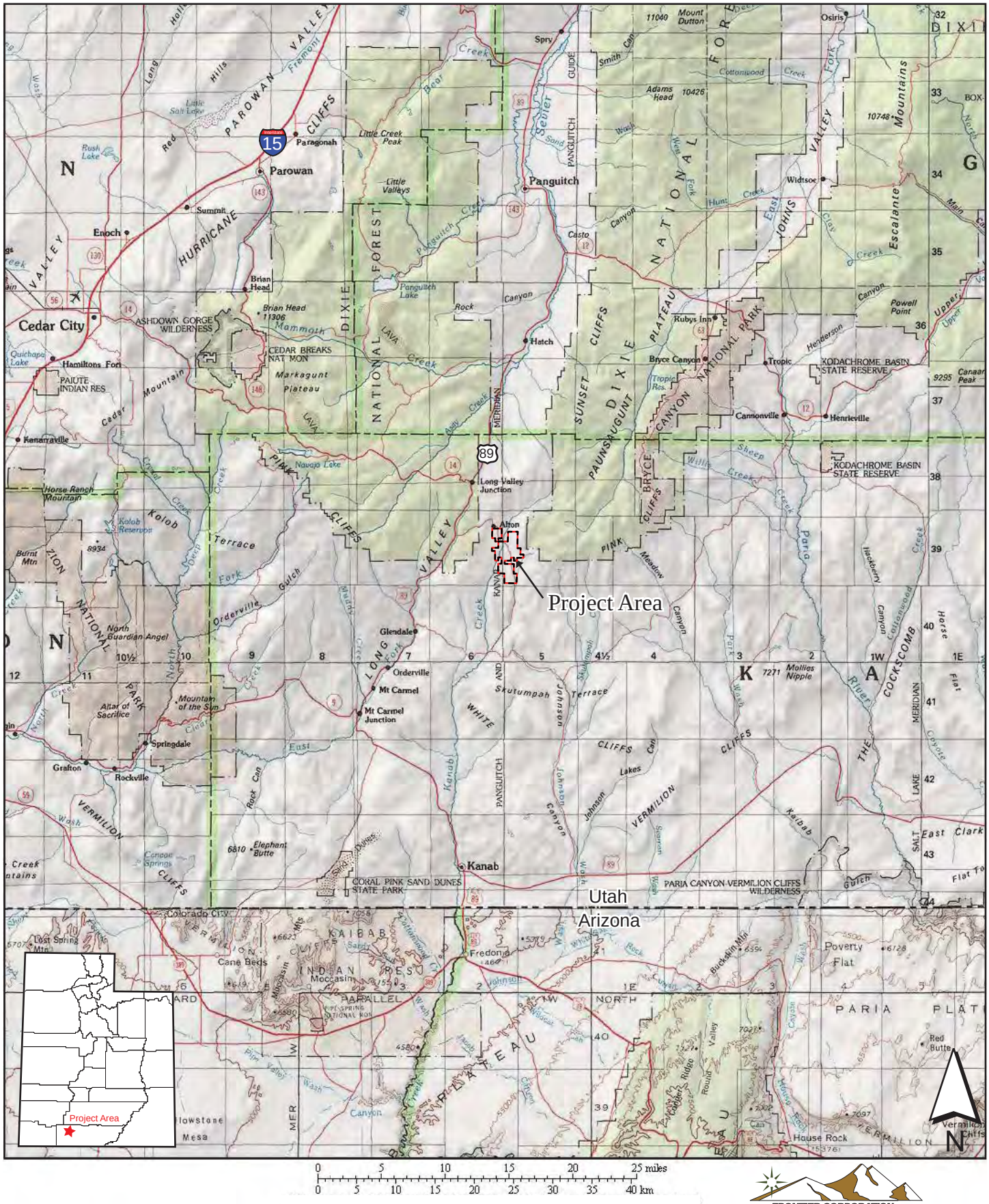

Figure 1. General Site Location Map.

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Base map is 500K topographic map from U.S. Geological Survey

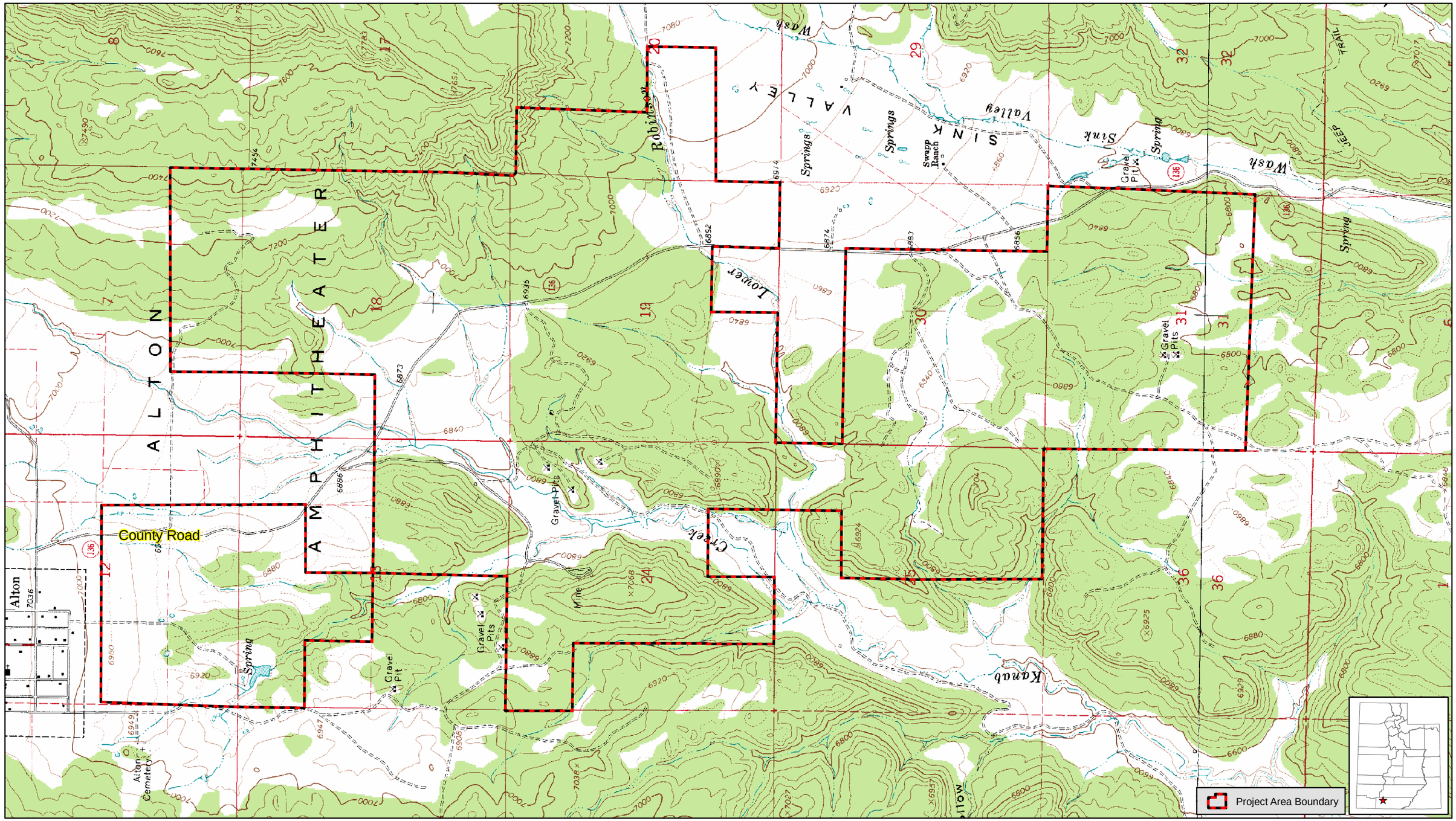

Figure 2A. Project Area Location Map - Topographic Base.

Map Date: July 20, 2012

1 inch = 1,800 feet

0 1,000 2,000 4,000 Feet

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Topographic base adapted from the USGS Alton and Bald Knoll, UT 7.5-minute quadrangles.

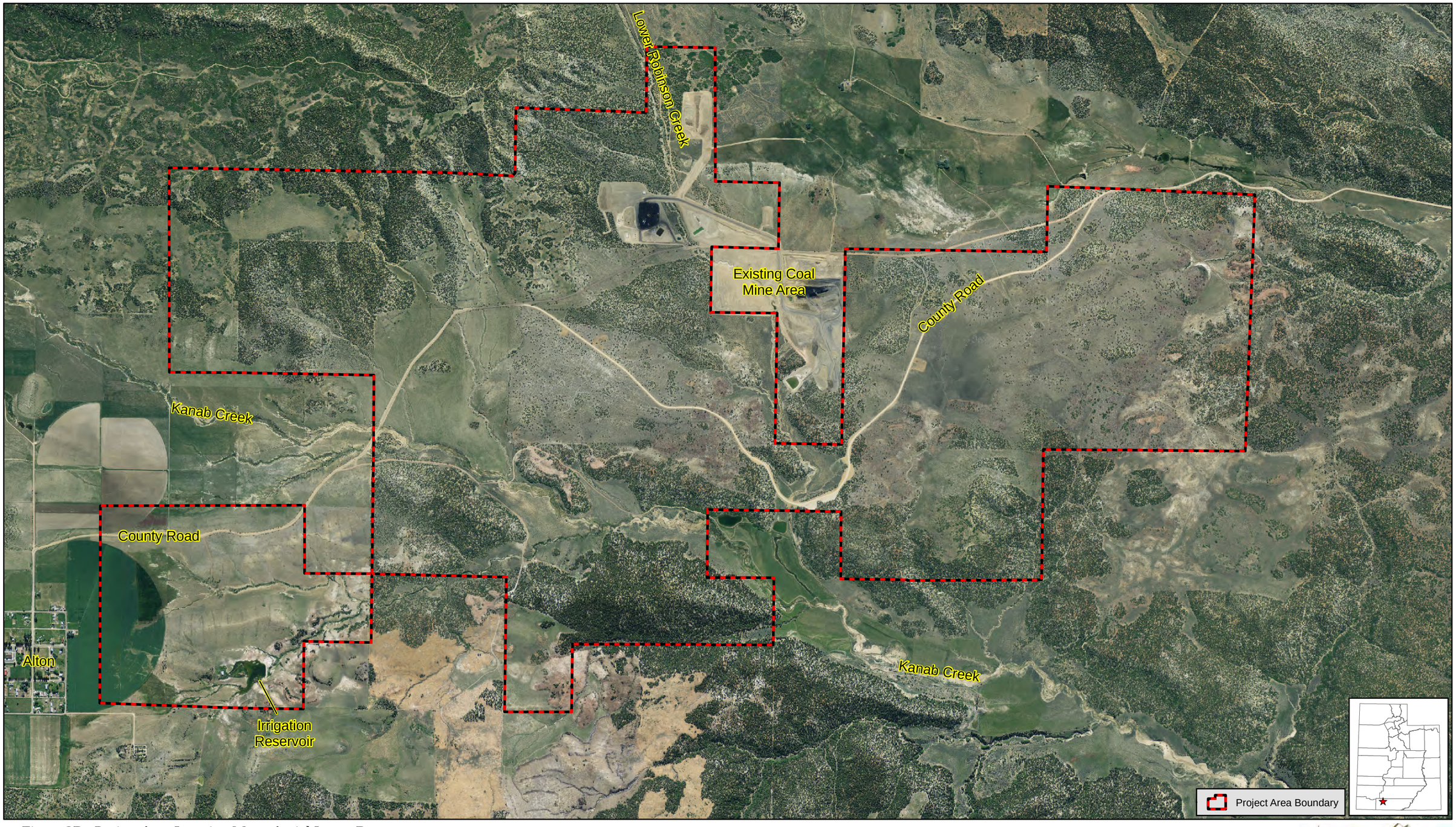

Figure 2B. Project Area Location Map - Aerial Image Base.

Map Date: July 20, 2012
Image Date: June 22, 2011

1 inch = 1,800 feet

0 1,000 2,000 4,000 Feet

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Basemap color imagery from 2011 National Agricultural Imagery Program, 1-meter resolution.

2.0 METHODS

2.1 Wetlands Delineation

Frontier scientists completed wetland field investigations in May and June 2012. Wetlands were identified and delineated in accordance with the three-parameter approach (hydrology, soil, and vegetation) specified in the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (Version 2.0)* (USACE 2008). One meter pixel resolution, 2011 color infrared aerial imagery was used to produce 1-inch = 200-feet field maps, which were used to identify potential wetland areas, stream channels and other water bodies for sampling. The aerial imagery was obtained from the Utah Automated Geo Reference Center (Utah AGRC 2012).

Paired sample points were located on either side of wetland boundaries to contrast wetland/upland conditions. The locations of wetland delineation sample points are shown on the delineation maps provided in Appendix A.

The presence or absence of hydrological indicators (e.g., standing water, fresh alluvial deposits, root zone oxidation, drainage patterns, etc.) was noted at each sample point. Soil pits were excavated to characterize soil profiles and soil/water conditions at each sample point. Soil horizonation, texture, moisture content, depth to saturation, and/or standing water were noted for each soil pit. The presence or absence of particulate organic matter, organic matter staining, redoximorphic features, and gleying were also noted if found. Soil colors were determined with *Munsell Soil Color Charts* (Munsell 2000).

The percent cover of observed plant species was visually estimated and recorded. Dominant plant species were identified in accordance with the USACE's 50/20 Rule and Prevalence Index. Plant identification was determined using *A Utah Flora* (Welsh et al. 2003), *Weeds of the West* (Whitson et al. 2006) and the *USDA-NRCS Plants Database* (USDA-NRCS 2012). The scientific nomenclature and wetland indicator status of plant species was determined using the USACE's *Arid West Final Draft Ratings* (USACE 2012).

The hydrological, soil, and vegetative data recorded at the sample points were transcribed onto the USACE Arid West Region Wetland Determination Data Forms (Appendix B). A total of 123 wetland delineation sample points and data forms were completed. Sample point locations and delineated wetland boundaries were surveyed with a sub-meter Trimble GeoExplorer global positioning system (GPS). The aerial imagery, wetland boundary surveys and sample point locations were incorporated into a geographic information system (GIS) database using ArcGIS 9.3. The GIS was used to produce wetland and stream delineation maps and to calculate wetland and water body acreages and stream channel lengths.

2.2 Stream Channel Delineation

Stream channels and other water bodies were delineated based on the presence of an ordinary high water mark (OHWM). The project area was systematically inspected for stream channels and other water bodies in April and May 2012. This included an inspection of all water bodies and stream drainages denoted on the USGS 7.5-minute topographic quadrangle maps and the

National Hydrography Dataset (NHD); and other potential stream drainages that were interpolated using the USGS topographic contours and aerial imagery (Figure 3). The NHD data was obtained online at: http://nhd.usgs.gov/.

The USGS and NHD stream drainages were shown as blue lines and the potential stream drainages that were interpolated using the topographic contours and aerial imagery were shown as pink lines on the 1-inch = 200-feet aerial field maps. Each drainage was inspected in the field. The entire length of the drainage was walked and a representative reach (or reaches) was sampled and evaluated for the presence of an OHWM stream channel using the USACE's 2010 Arid West OHWM data sheet (USACE 2010). The locations of OHWM sample points are shown on the stream channel delineation maps provided in Appendix C. A total of 62 sample points for OHWM data sheets were completed (Appendix D).

Drainages that had well-defined bed and banks, evidence of alluvial sorting of substrates and an OHWM were delineated as stream channels and surveyed with the GPS. Delineated stream channels were classified as being ephemeral, intermittent or perennial. Ephemeral streams only have flow in response to surface runoff from snow melt and rain events. Intermittent streams typically have seasonal flow from surface runoff and groundwater accretion. Perennial streams have year-round flow. Other water bodies delineated within the project area included an irrigation reservoir and an irrigation ditch. An OHWM was identified and mapped, but the 2010 OHWM datasheets were used for the irrigation reservoir or irrigation ditch because these are not arid west stream features.

A total of 1,405 photos of the project area were taken over the course of the wetland and stream channel delineation field work to document existing site conditions throughout the project area. Electronic copies of the photos, and an overall photo point location map, were provided to the USACE on a DVD. Many of the photos on the DVD are of upland areas that did not meet either the wetland or stream channel delineation criteria. A selection of representative photos of the wetland and stream channels that were delineated in the project area are provided in Appendix E. The photo point locations for the Appendix E photolog are shown on the wetland and stream delineation maps provided in Appendices A and C, respectively.

3.0 LAND USE AND CLIMATE

The project area is situated on semi-arid rangeland dominated by juniper, pinyon pine, sagebrush, rabbitbrush, dry meadows, and irrigated meadows and alfalfa fields. The past and present land use of the project area has been chiefly public lands for livestock grazing and private ranching and farming for beef cattle. Kanab Creek is the only perennial source of surface water within the project area, and the lack of water on this semi-arid landscape is the main factor limiting the amount of livestock grazing and farming that can be sustained.

Precipitation data for Alton, Utah was obtained from the Western Regional Climate Center website: www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?ut0086. Annual precipitation is approximately 16.4 inches. Precipitation occurs almost uniformly over the calendar year. On average, January and February are the wettest months and May and June are the driest months.

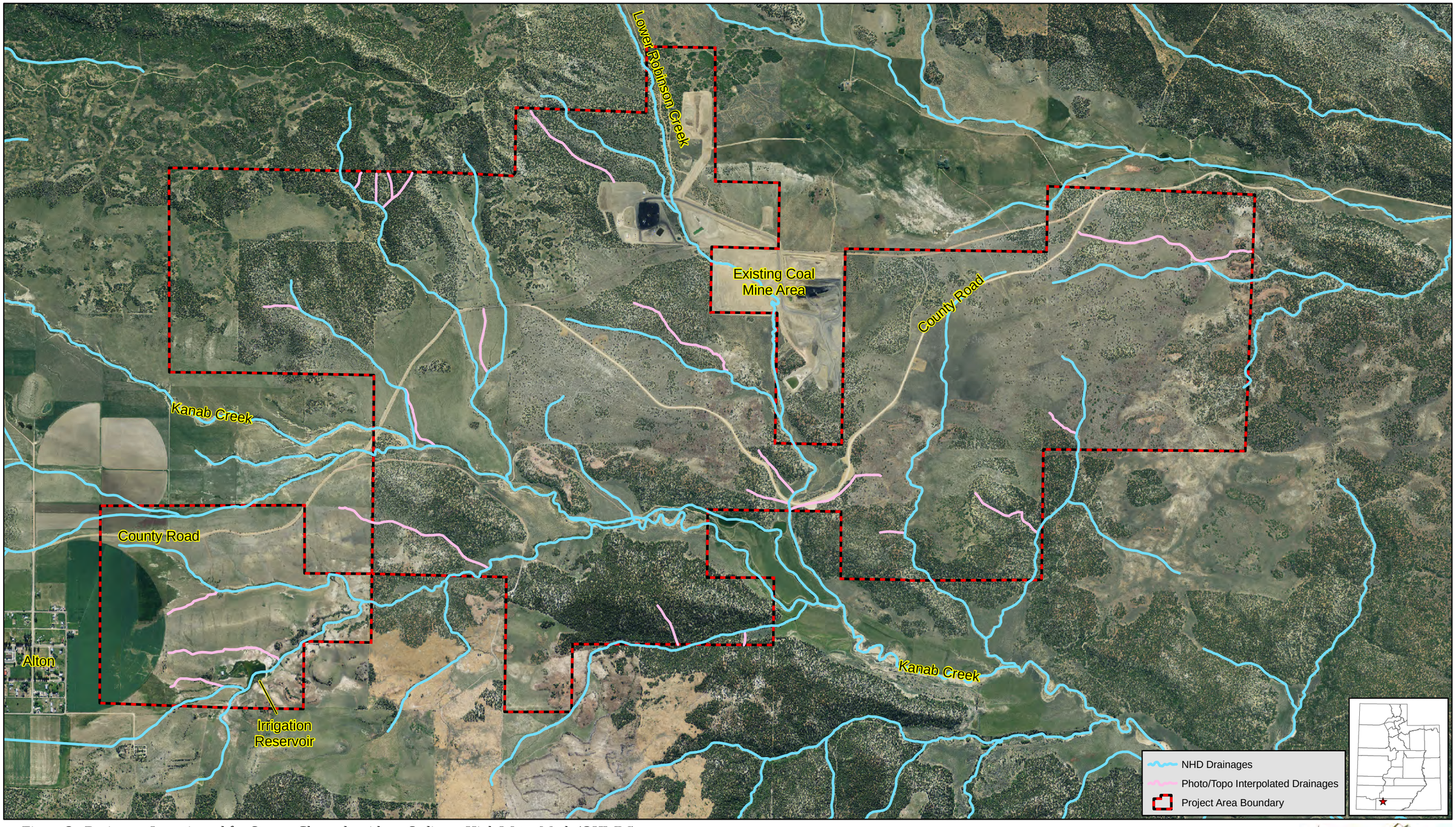

Figure 3. Drainages Investigated for Stream Channels with an Ordinary High Water Mark (OHWM).

Map Date: July 23, 2012
Image Date: June 22, 2011

N

1 inch = 1,800 feet

0 1,000 2,000 4,000 Feet

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Basemap color imagery from 2011 National Agricultural Imagery Program, 1-meter resolution.

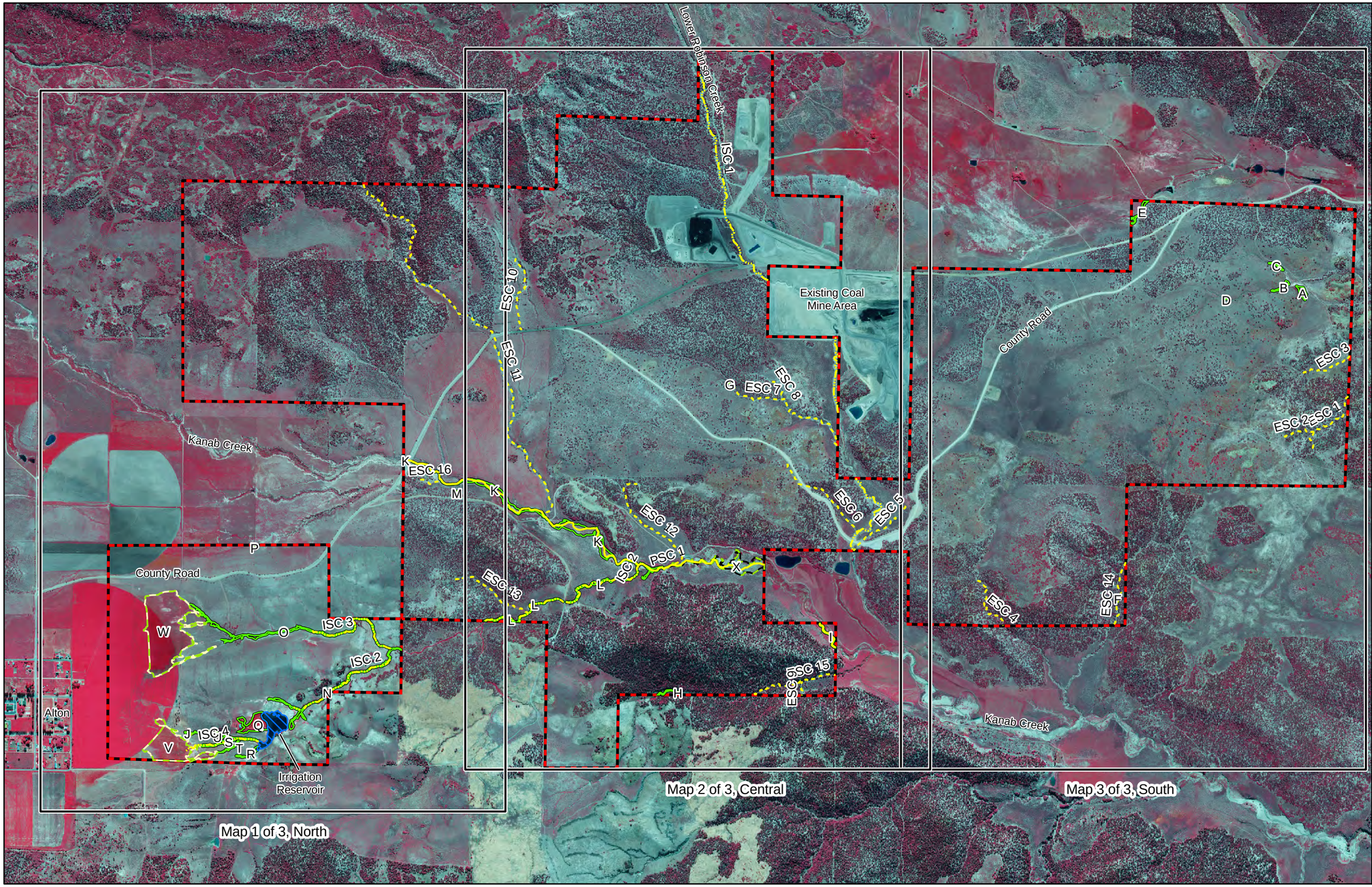
4.0 DELINEATION RESULTS

4.1 Wetlands

A total of 24 individual wetland areas, totaling approximately 53.97 acres in size, were delineated within the project area boundaries (Table 1). The delineated wetlands were classified into three habitat types. Approximately 18.54 acres were classified as riparian wet meadow wetlands, 31.63 acres were classified as irrigated wet meadow wetlands, and 3.80 acres were classified as mixed riparian scrub-shrub/wet meadow wetlands (Table 1) (Figures 4A-4D). Descriptions of the three wetland habitat types are provide in the following report sections. A list of the common wetland and upland plant species observed during the delineation fieldwork is provided in Table 2.

Table 1. Wetlands delineated within the project area.

Wetland	Area (Acres)
Riparian Wet Meadow	
A	0.55
B	0.30
C	0.13
D	0.02
E	0.37
F	0.02
G	0.01
H	0.20
I	0.24
J	0.13
K	6.88
L	1.46
M	0.10
N	1.72
O	2.31
P	0.02
Q	2.57
R	0.26
S	0.80
T	0.22
U	0.23
Total:	**18.54 ac**
Irrigated Wet Meadow	
V	9.40
W	22.23
Total:	**31.63 ac**
Mixed Riparian, Scrub-Shrub/Wet Meadow	
X	3.80
Total:	**3.80 ac**



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Total:	**18.54**
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Total:	**31.63**
Mixed Riparian, Scrub-Shrub/Wet Meadow	
X	3.80
Total:	**3.80**

Stream	Length (feet)
ESC 1	1,564
ESC 2	695
ESC 3	1,134
ESC 4	1,423
ESC 5	1,438
ESC 6	2,021
ESC 7	2,863
ESC 8	452
ESC 9	290
ESC 10	1,545
ESC 11	8,727
ESC 12	2,492
ESC 13	1,716
ESC 14	1,316
ESC 15	1,893
ESC 16	421
Total:	**29,990**
ISC 1	8,165
ISC 2	5,897
ISC 3	2,105
ISC 4	1,462
Total:	**17,629**
PSC 1	9,110
Total:	**9,110**

Waters	Area (Acres)
Reservoir	4.01

ESC = Ephemeral Stream Channel
ISC = Intermittent Stream Channel
PSC = Perennial Stream Channel

2012 Stream & Waters Delineation
- Ephemeral Stream Channel
- Intermittent Stream Channel
- Perennial Stream Channel, Kanab Creek
- Irrigation Reservoir

2012 Wetland Delineation
- Irrigated Wet Meadow
- Mixed Riparian, Scrub-Shrub/Wet Meadow
- Riparian Wet Meadow
- Project Area Boundary

Figure 4A. Wetland and Stream Channel Delineation, Index Map.

Basemap color infrared imagery from 2011 National Agricultural Imagery Program, 1-meter resolution.

Map Date: July 31, 2012
Image Date: June 22, 2011

N

1 inch = 1,800 feet

0 1,000 2,000 4,000 Feet

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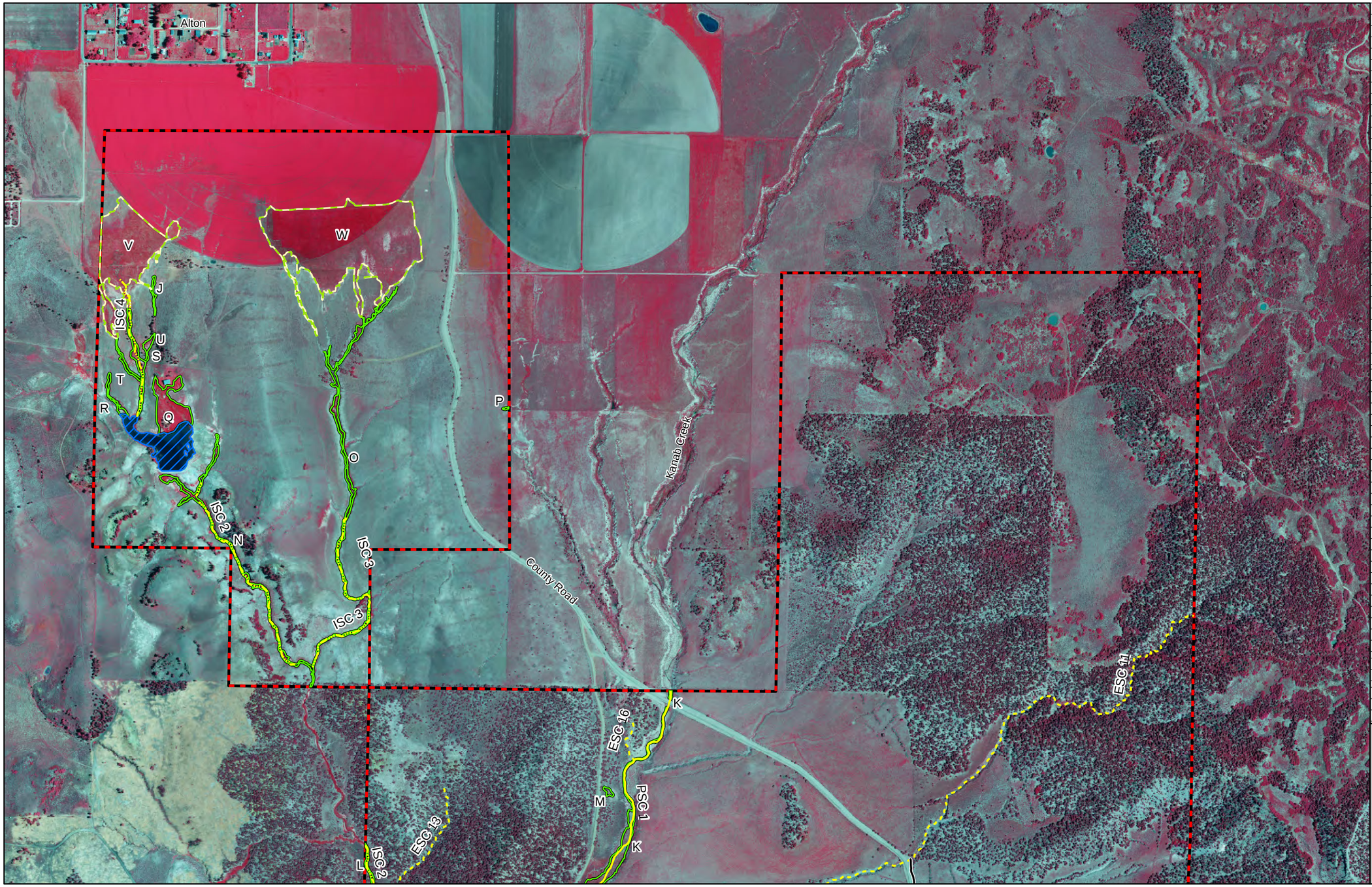

Wetland	Area (Acres)
Riparian Wet Meadow	
A	0.55
B	0.30
C	0.13
D	0.02
E	0.37
F	0.02
G	0.01
H	0.20
I	0.24
J	0.13
K	6.88
L	1.46
M	0.10
N	1.72
O	2.31
P	0.02
Q	2.57
R	0.26
S	0.80
T	0.22
U	0.23
Total:	**18.54**
Irrigated Wet Meadow	
V	9.40
W	22.23
Total:	**31.63**
Mixed Riparian, Scrub-Shrub/Wet Meadow	
X	3.80
Total:	**3.80**

Stream	Length (feet)
ESC 1	1,564
ESC 2	695
ESC 3	1,134
ESC 4	1,423
ESC 5	1,438
ESC 6	2,021
ESC 7	2,863
ESC 8	452
ESC 9	290
ESC 10	1,545
ESC 11	8,727
ESC 12	2,492
ESC 13	1,716
ESC 14	1,316
ESC 15	1,893
ESC 16	421
Total:	**29,990**
ISC 1	8,165
ISC 2	5,897
ISC 3	2,105
ISC 4	1,462
Total:	**17,629**
PSC 1	9,110
Total:	**9,110**

Waters	Area (Acres)
Reservoir	4.01

ESC = Ephemeral Stream Channel
ISC = Intermittent Stream Channel
PSC = Perennial Stream Channel

2012 Stream & Waters Delineation
- Ephemeral Stream Channel
- Intermittent Stream Channel
- Perennial Stream Channel, Kanab Creek
- Irrigation Reservoir

2012 Wetland Delineation
- Irrigated Wet Meadow
- Mixed Riparian, Scrub-Shrub/Wet Meadow
- Riparian Wet Meadow
- Project Area Boundary

Figure 4B. Wetland and Stream Channel Delineation, Map 1 of 3, north portion of project area.

Basemap color infrared imagery from 2011 National Agricultural Imagery Program, 1-meter resolution.

Map Date: July 31, 2012
Image Date: June 22, 2011

N

1 inch = 950 feet

0 500 1,000 2,000 Feet

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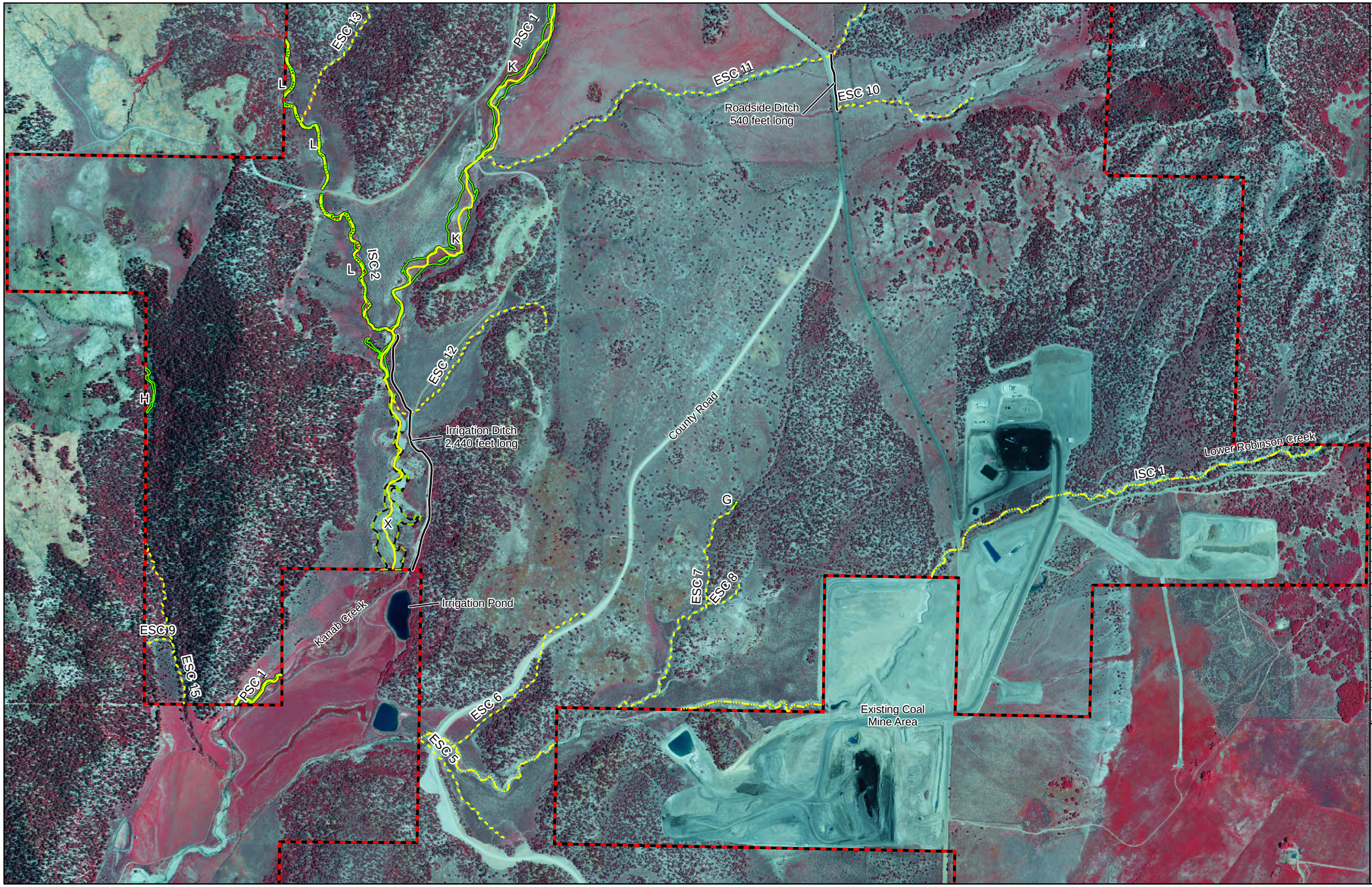

Wetland	Area (Acres)
Riparian Wet Meadow	
A	0.55
B	0.30
C	0.13
D	0.02
E	0.37
F	0.02
G	0.01
H	0.20
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K	6.88
L	1.46
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O	2.31
P	0.02
Q	2.57
R	0.26
S	0.80
T	0.22
U	0.23
Total:	**18.54**
Irrigated Wet Meadow	
V	9.40
W	22.23
Total:	**31.63**
Mixed Riparian, Scrub-Shrub/Wet Meadow	
X	3.80
Total:	**3.80**

Stream	Length (feet)
ESC 1	1,564
ESC 2	695
ESC 3	1,134
ESC 4	1,423
ESC 5	1,438
ESC 6	2,021
ESC 7	2,863
ESC 8	452
ESC 9	290
ESC 10	1,545
ESC 11	8,727
ESC 12	2,492
ESC 13	1,716
ESC 14	1,316
ESC 15	1,893
ESC 16	421
Total:	**29,990**
ISC 1	8,165
ISC 2	5,897
ISC 3	2,105
ISC 4	1,462
Total:	**17,629**
PSC 1	9,110
Total:	**9,110**

Waters	Area (Acres)
Reservoir	4.01

ESC = Ephemeral Stream Channel
ISC = Intermittent Stream Channel
PSC = Perennial Stream Channel

2012 Stream & Waters Delineation
- Ephemeral Stream Channel
- Intermittent Stream Channel
- Perennial Stream Channel, Kanab Creek
- Irrigation Reservoir

2012 Wetland Delineation
- Irrigated Wet Meadow
- Mixed Riparian, Scrub-Shrub/Wet Meadow
- Riparian Wet Meadow
- Project Area Boundary

Figure 4C. Wetland and Stream Channel Delineation, Map 2 of 3, central portion of project area.

Basemap color infrared imagery from 2011 National Agricultural Imagery Program, 1-meter resolution.

Map Date: July 31, 2012
Image Date: June 22, 2011

N

1 inch = 950 feet
0 500 1,000 2,000 Feet

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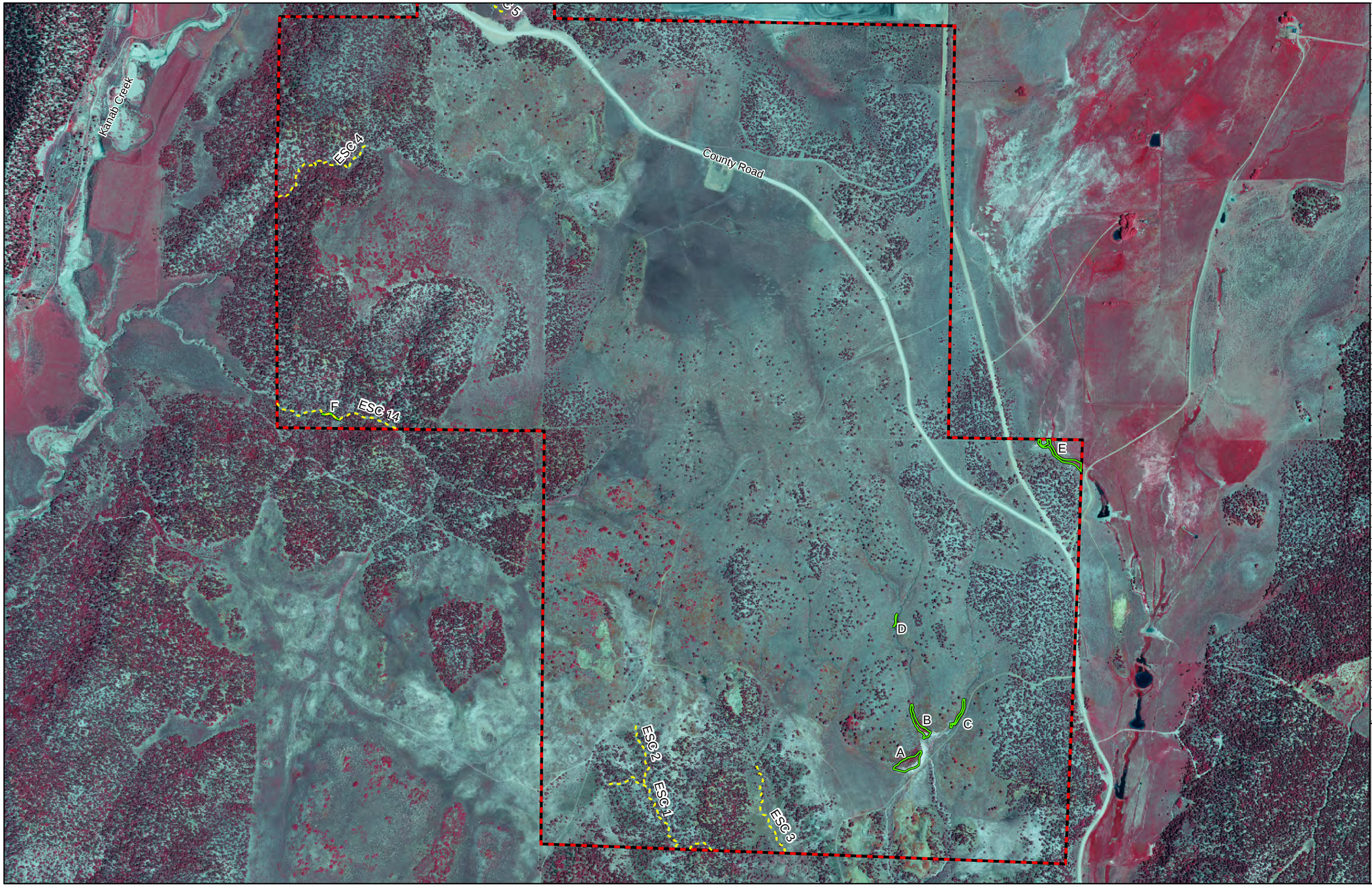

Wetland	Area (Acres)
Riparian Wet Meadow	
A	0.55
B	0.30
C	0.13
D	0.02
E	0.37
F	0.02
G	0.01
H	0.20
I	0.24
J	0.13
K	6.88
L	1.46
M	0.10
N	1.72
O	2.31
P	0.02
Q	2.57
R	0.26
S	0.80
T	0.22
U	0.23
Total:	**18.54**
Irrigated Wet Meadow	
V	9.40
W	22.23
Total:	**31.63**
Mixed Riparian, Scrub-Shrub/Wet Meadow	
X	3.80
Total:	**3.80**

Stream	Length (feet)
ESC 1	1,564
ESC 2	695
ESC 3	1,134
ESC 4	1,423
ESC 5	1,438
ESC 6	2,021
ESC 7	2,863
ESC 8	452
ESC 9	290
ESC 10	1,545
ESC 11	8,727
ESC 12	2,492
ESC 13	1,716
ESC 14	1,316
ESC 15	1,893
ESC 16	421
Total:	**29,990**
ISC 1	8,165
ISC 2	5,897
ISC 3	2,105
ISC 4	1,462
Total:	**17,629**
PSC 1	9,110
Total:	**9,110**

Waters	Area (Acres)
Reservoir	4.01

ESC = Ephemeral Stream Channel
ISC = Intermittent Stream Channel
PSC = Perennial Stream Channel

2012 Stream & Waters Delineation
- Ephemeral Stream Channel
- Intermittent Stream Channel
- Perennial Stream Channel, Kanab Creek
- Irrigation Reservoir

2012 Wetland Delineation
- Irrigated Wet Meadow
- Mixed Riparian, Scrub-Shrub/Wet Meadow
- Riparian Wet Meadow
- Project Area Boundary

Figure 4D. Wetland and Stream Channel Delineation, Map 3 of 3, south portion of project area.

Map Date: July 31, 2012
Image Date: June 22, 2011

N

1 inch = 950 feet

0 500 1,000 2,000 Feet

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Basemap color infrared imagery from 2011 National Agricultural Imagery Program, 1-meter resolution.

Table 2. Common plant species observed in the project area.

*Upland Plant Species	*Scientific Name	USACE Arid West Indicator Status
Alfalfa	*Medicago sativa*	UPL
Bindweed	*Convuluvus arvensis*	UPL
Big sagebrush	*Artemisia tridentata*	UPL
Black sagebrush	*Artemesia nova*	UPL
Blue gramma grass	*Bouteloua gracilis*	UPL
Broom snakeweed	*Gutierrezia sarothrae*	UPL
Cheatgrass	*Bromus tectorum*	UPL
Common snowberry	*Symphoricoarpos albus*	FACU
Common sunflower	*Helianthus annuus*	FACU
Creeping thistle	*Cirsium arvense*	FACU
Crested wheatgrass	*Agropyron cristatum*	UPL
Curly-cup gumweed	*Grindelia squarrosa*	FACU
Dandelion	*Taraxacum officinale*	FACU
Douglas' knotweed	*Polygonum douglasii*	FACU
Gambel's oak	*Quercus gambelii*	UPL
Great mullein	*Verbascum thapsis*	FACU
Hairy vetch	*Vicia villosa*	UPL
Intermediate wheatgrass	*Thinopyrum intermedium*	UPL
Kochia	*Kochia scoparia*	UPL
Lamb's-quarter	*Chenopodium album*	FACU
Lewis Flax	*Linum lewisii*	UPL
Orchardgrass	*Dactylis glomerata*	FACU
Pinyon pine	*Pinus edulis*	UPL
Prickly lettuce	*Lactuca serriola*	FACU
Rubber rabbitbrush	*Ericameria nauseosa*	UPL
Russian thistle	*Salsola tragus*	FACU
Sandberg bluegrass	*Poa secunda*	FACU
Scarlet gilia	*Ipomopsis aggregata*	UPL
Slender wheatgrass	*Elymus trachycaulus*	FACU
Smooth brome	*Bromus inermis*	FACU
Timothy	*Phleum pratense*	FACU
Utah juniper	*Juniperus osteosperma*	UPL
Western bottle-brush grass	*Elymus elymoides*	FACU
White clover	*Trifolium repens*	FACU
Woods' rose	*Rosa woodsii*	FACU
Yarrow	*Achillea millefolium*	FACU
Yellow rabbitbrush	*Chrysothamnus viscidiflorus*	UPL
Yellow salsify	*Tragopogon dubius*	UPL
Yellow sweetclover	*Melilotus officinalis*	FACU
***Wetland Plant Species**	***Scientific Name**	**USACE Arid West Indicator Status**
Alkali muhly	*Muhlenbergia asperifolia*	FACW
Arctic rush	*Juncus arcticus*	FACW
Cattail	*Typha latifolia*	OBL
Cocklebur	*Xanthium strumarium*	FAC
Common silverweed	*Argentina anserina*	OBL
Deer root	*Iva axillaris*	FAC
Field horsetail	*Equisetum arvense*	FAC
Field sedge	*Carex praegracilis*	FACW
Fowl bluegrass	*Poa palustris*	FAC

Foxtail barley	*Hordeum jubatum*	FAC
Fremont cottonwood	*Populus fremontii*	FACW
Kentucky bluegrass	*Poa pratensis*	FAC
Meadow barley	*Hordeum brachyantherum*	FACW
Mexican rush	*Juncus mexicanus*	FACW
Mint	*Mentha piperita*	FACW
Narrow-leaf willow	*Salix exigua*	FACW
Nebraska sedge	*Carex nebrascensis*	OBL
Red-woolly plantain	*Plantago eriopoda*	FACW
Rocky Mountain iris	*Iris missouriensis*	FACW
Seaside arrow-grass	*Triglochin maritima*	OBL
Salt grass	*Distichlis spicata*	FAC
Smallwing sedge	*Carex microptera*	FAC
Spike rush	*Eleocharis palustris*	OBL
Spreading bentgrass	*Agrostis stolonifera*	FACW
Tall scouring rush	*Equisetum hyemale*	FACW
Western American aster	*Symphyotrichum ascendens*	FAC
Western wheatgrass	*Pascopyrum smithii*	FAC
Yard knotweed	*Polygonum aviculare*	FACW

Indicator Category	Indicator Symbol	Definition
Obligate Wetland Plants	OBL	Plants that occur almost always (estimated probability >99 percent) in wetlands under natural conditions, but which may also occur rarely (estimated probability <1 percent in non-wetlands
Facultative Wetland Plants	FACW	Plants that occur usually (estimated probability >67 percent to 99 percent) in wetlands, but also occur (estimated probability 1 percent to 33 percent) in non-wetlands
Facultative	FAC	Plants with a similar likelihood (estimated probability 33 percent to 67 percent) of occurring in both wetlands and non-wetlands.
Facultative Upland Plants	FACU	Plants that occur sometimes (estimated probability 1 percent to <33 percent) in wetlands, but occur more often (estimated probability >67 percent to 99 percent) in non-wetlands.
Upland Plants	UPL	Plants that occur rarely (estimated probability <1 percent) in wetlands, but occur almost always (estimated probability >99 percent) in non-wetlands under natural conditions

*Common names and scientific names as per USACE 2012 Arid West Plants List.

4.1.1 Riparian Wet Meadow

A total of 18.54 acres of riparian wet meadow was delineated. Riparian wet meadows are typically found throughout the project area in topographically distinct drainage bottoms. The drainages may or may not have stream channels present. These are herbaceous plant communities lacking tree and shrub layers. They tend to be heavily grazed. Plant communities are dominated by graminoids. Common plant species include: arctic rush (*Juncus arcticus*), sedges (*Carex* spp.), spike rush (*Eleocharis palustris*), Kentucky bluegrass (*Poa pratensis*), saltgrass (*Distichlis spicata*), foxtail barley (*Hordeum jubatum*), Western wheatgrass (*Pascopyrum smithii*) and Rocky Mountain iris (*Iris missouriensis*). Spring runoff, surface drainage and a seasonally high water table appear to be the main sources of hydrology for these wetlands.

4.1.2 Irrigated Wet Meadow

A total of 31.63 acres irrigated wet meadow was delineated. These wetlands basically have the same plant community composition as the riparian wet meadow wetlands, but they do not occur in distinct drainages. Rather, these are slope wetlands found in association with drainage coming off irrigated alfalfa fields in the northwestern portion of the project area. The portions of these wet meadows that were situated inside livestock exclosure fences for the alfalfa fields were not heavily grazed. Irrigation return flows, natural surface drainage, and a seasonally high water table appear to be the main sources of hydrology for these wetlands.

4.1.3 Mixed Riparian, Scrub-Shrub/Wet Meadow

A total of 3.80 acres of mixed riparian, scrub-shrub/wet meadow was delineated. This wetland type was only identified along the south reach of Kanab Creek. The creek's active floodplain in this reach is comprised chiefly of cobble, gravel and sand. These alluvial substrates have sparse amounts of soil present in scattered small depositional pockets and abandoned channel meanders. The cobble/gravel/sand areas are dominated by a scrub-shrub layer of narrow-leaf willow (*Salix exigua*), and the smaller depositional pockets and abandoned channel meanders are typically vegetated with herbaceous wet meadow species, including: artic rush, sedges, spike rush, and field horsetail (*Equisetum arvense*). Seasonal flooding and near-surface groundwater associated with the alluvial aquifer appear to be the main sources of hydrology for these wetlands.

5.1 Streams and other Water Bodies

One perennial stream channel, four intermittent stream channels, 16 ephemeral stream channels, one irrigation reservoir and one irrigation ditch were delineated within the project area boundaries (Table 3) (Figures 4A-4D).

Table 3. Stream channels and water bodies delineated within the project area.

Ephemeral Stream	Length (feet)	Intermittent Stream	Length (feet)	*Perennial Stream*	*Length (feet)*	Irrigation Ditch	Length (feet)	Irrigation Reservoir	Area (acres)
ESC 1	1,564	ISC 1	8,165	PSC 1	9,110	Ditch 1	2,440	Reservoir 1	4.01
ESC 2	695	ISC 2	5,897	**Total:**	**9,110 ft**	**Total:**	**2,440 ft**	**Total:**	**4.01 ac**
ESC 3	1,134	ISC 3	2,105						
ESC 4	1,423	ISC 4	1,462						
ESC 5	1,438	**Total:**	**17,629 ft**						
ESC 6	2,021								
ESC 7	2,863								
ESC 8	452								
ESC 9	290								
ESC 10	1,545								
ESC 11	8,727								
ESC 12	2,492								
ESC 13	1,716								
ESC 14	1,316								
ESC 15	1,893								
ESC 16	421								
Total:	**29,990 ft**								

A summary table is provided with the stream channel delineations maps in Appendix C. For each delineated stream channel, the summary table identifies the OHWM data sheet(s) in Appendix D that corresponds to the stream channel delineation; width of the stream channel's OHWM; and the length and acreage of the stream channel that was delineated in the project area. Where stream channels flow through delineated wetlands, the delineated wetland acreage does not included the delineated stream channel acreage.

5.1.1 Perennial Stream Channels

Kanab Creek is the only perennial stream channel within the project area. It is identified as PSC 1 on the delineation maps (Figure 4A). Approximately 9,110 linear feet of the stream channel flows southward across the central portion the project area. The OHWM of the active stream channel varies from about 4- to 9-feet wide depending on the valley bottom slope gradient and channel sinuoisty. Within the project area, the majority of the stream channel is bordered by riparian wet meadow, except for the southern-most channel segment, which is bordered by mixed riparian, scrub-shrub/wet meadow wetland (Figure 4A). Kanab Creek eventually drains into the Colorado River approximately 70 miles south of the project area.

5.1.2 Intermittent Stream Channels

Four intermittent stream channels were delineated within the project area, totaling approximately 17,629 linear feet in channel length (Table 3). These are single thread channels. All of the intermittent stream channels have drainage connections to Kanab Creek. All of the intermittent channels had some amount of flow when the spring 2012 delineation fieldwork was completed.

The largest is Lower Robinson Creek, which enters the project area from the east, flows westward across the center portion of the project area, and drains into Kanab Creek west of the project area boundary. Lower Robinson Creek is identified as ISC 1 on the delineation maps (Figure 4A). The creek has a wide, but shallow stream channel. The active floodplain has less than 5 percent vegetative cover (see Photos 44 and 45, Appendix E). According to the USACE's delineation procedures, the OHWM of the stream channel corresponds with the dimensions of the active floodplain, which is generally 6- to 8-feet wide and 1 foot-deep. The low-flow channel within the active floodplain is generally 1- to 3-feet wide and less than 0.5-feet deep. Within the project area, no wetlands were delineated in association with the active floodplain of Lower Robinson Creek.

A portion of Lower Robinson Creek flows through the existing coal mine, which is located on private land outside of the project area boundaries (Figure 4C). The existing coal mine obtained a Clean Water Act Section 404 permit from the USACE in October 2010 (USACE# SPK-2009-01008) to temporarily impact a total of 2,440 feet of Lower Robinson Creek for the temporary relocation of the stream channel for coal recovery, and the installation of two temporary road crossings. The two temporary road crossings area situated within the Alton Coal Tract LBA project area boundaries, whereas the temporary channel relocation is situated outside the project area boundaries.

Three unnamed intermittent stream channels were delineated in the northwestern portion of the project area. They are identified as ISC 2, ISC 3 and ISC 4 on the delineation maps (Figure 4A).

All of these streams have very similar channel geomorphology. They are situated in topographically distinct drainages that receive natural runoff and groundwater accretion, irrigation return flows from the alfalfa fields and/or seepage from the irrigation reservoir. The active floodplains are vegetated with riparian wet meadow wetlands. Stream channels are incised about 1- to 2-feet lower than the active floodplain. The OHWMs of the active stream channels are 1- to 3-feet wide, and typically correspond to the low-flow channel width due to channel incision (see Photos 46-49, Appendix E). Within the project area, the active floodplains of these intermittent stream channels are typically vegetated with riparian wet meadow wetlands.

5.1.3 Ephemeral Stream Channels

Sixteen unnamed ephemeral stream channels were delineated within the project area, totaling approximately 29,990 linear feet in channel length (Figure 4A). These are single thread channels. All of the ephemeral stream channels appear to have drainage connections to Kanab Creek. None of these stream channels had flow when the spring 2012 delineation fieldwork was conducted.

The ephemeral stream channels are also situated in topographically distinct drainages; however, channel geomorphology is variable. Most of the ephemeral streams have wide but very shallow channels with minimal indicators of an OHWM. According to the USACE's delineation procedures, the OHWMs of these ephemeral channels correspond with the dimensions of the active floodplains, which range between 3- to 8-feet wide and less than 1 foot deep. Low-flow channels within the active floodplain are typically 1-foot wide and less than 0.5 feet deep. Ephemeral streams 2 and 3 are typical examples of this type of ephemeral channel geomorphology (see Photos 28 and 29, Appendix E).

Several of the ephemeral stream channels are situated in deeply incised U- or V-shaped drainages where the widths of the active floodplain and low-flow channel are essentially confined within the width of the active stream channel. In these situations, the OHWM is typically 2- to 3-feet wide and less than 1 foot deep. Ephemeral streams 8 and 10 are typical examples of this type of ephemeral channel geomorphology (see Photos 34 and 36, Appendix E).

Flow diversion was observed on one of the ephemeral stream channels. Surface drainage in ESC 10 is diverted into an approximately 540-foot long road ditch that runs along the east side of the County Road (Figure 4C). This is because there is no culvert where ESC 10 intersects the road. The road ditch conveys the surface drainage northward to a culvert at the ESC 11 road crossing. At this point, ESC 11 conveys the combined drainage of both ephemeral stream channels through the road culvert and westward to Kanab Creek (PSC 1).

5.1.4 Irrigation Reservoir

One irrigation reservoir covering approximately 4.01 acres of open water was delineated in the northwest corner of the project area. This is a man-made reservoir with an earthen dam that was constructed on the upper portion of intermittent stream channel 2 (Figure 4B). This is a deep-water reservoir. Most of the shoreline has steep banks with no fringing wetlands, except for the east arm. The east arm appears to impound a shallow drainage that contains approximately 2.57 acres of riparian wetland labeled as wetland Q on the delineation maps (Figure 4B). The west

arm of the reservoir is fed by intermittent stream channel 4 and a small riparian wet meadow drainage, labeled as wetland R on the delineation maps (Figure 4B).

5.1.5 Irrigation Ditch

Approximately 2,440 feet of irrigation ditch was delineated in the project area (Figure 4C). The ditch is fed by a diversion dam that was built on the Kanab Creek stream channel. It appears that the majority of the creek flow is diverted into the irrigation ditch. The ditch flows southward through semi-desert uplands, crosses ephemeral stream channel 12, and discharges into an irrigation holding pond located outside the project area boundary. The pond appears to be used to irrigate meadows that border Kanab Creek. The ditch is about 3-feet wide. Cattail (*Typha latifolia*), sedges and artic rush were growing in the ditch, although it appears that the ditch is periodically cleaned to maintain irrigation conveyance efficiency.

6.0 SUMMARY

The approximately 5,281-acre Alton Coal Tract LBA project area was delineated for wetlands, stream channels and other water bodies by Frontier Corporation USA in the spring of 2012. The work was conducted following current U.S. Army Corps of Engineers delineation procedures and protocols.

A total of 24 individual wetland areas, totaling approximately 53.97 acres in size, were delineated within the project area boundaries (Table 1). The delineated wetlands were classified into three habitat types. Approximately 18.54 acres were classified as riparian wet meadow wetlands, 31.63 acres were classified as irrigated wet meadow wetlands, and 3.80 acres were classified as mixed riparian scrub-shrub/wet meadow wetlands (Figures 4A-4D).

One perennial stream channel, four intermittent stream channels, 16 ephemeral stream channels, one irrigation reservoir and one irrigation ditch were also delineated within the project area boundaries (Table 3) (Figures 4A-4D). Kanab Creek is the only perennial stream channel that was delineated. Approximately 9,110 linear feet of Kanab Creek flows southward across the central portion of the project area. Kanab Creek eventually drains into the Colorado River approximately 70 miles south of the project area.

Four intermittent stream channels were delineated within the project area, totaling approximately 17,629 linear feet in channel length (Table 3) (Figures 4A-4D). These are single thread channels. All of the intermittent stream channels have drainage connections to Kanab Creek. All of the intermittent channels had some amount of flow when the spring 2012 delineation fieldwork was completed. The largest of the intermittent streams is Lower Robinson Creek. No wetlands were delineated in association with the active floodplain of Lower Robinson Creek. The three other unnamed intermittent streams have channels that are deeply incised within the actives floodplains that are typically vegetated with riparian wet meadow wetlands.

Sixteen unnamed ephemeral stream channels were delineated within the project area, totaling approximately 29,990 linear feet in channel length (Table 3) (Figure 4A). These are single thread channels. All of the ephemeral stream channels appear to have drainage connections to

Kanab Creek. None of these stream channels had flow when the spring 2012 delineation fieldwork was conducted, and most of these stream channels had minimal indicators of an OHWM. Flow diversion was observed on one of the ephemeral stream channels. Surface drainage in ESC 10 is diverted into an approximately 540-foot long road ditch that drains into ESC 11 (Figure 4C). This is because there is no culvert where ESC 10 intersects the County Road.

One irrigation reservoir covering approximately 4.01 acres of open water was delineated in the northwest corner of the project area. This is a man-made reservoir with an earthen dam that was constructed on the upper portion of intermittent stream channel 2 (Figure 4B).

Approximately 2,440 feet of irrigation ditch was delineated in the project area (Figure 4C). The ditch is fed by a diversion dam that was built on the Kanab Creek stream channel. It appears that the majority of the creek flow is diverted into the irrigation ditch. The ditch flows southward through semi-desert uplands, crosses ephemeral stream channel 12, and discharges into an irrigation holding pond located outside the project area boundary.

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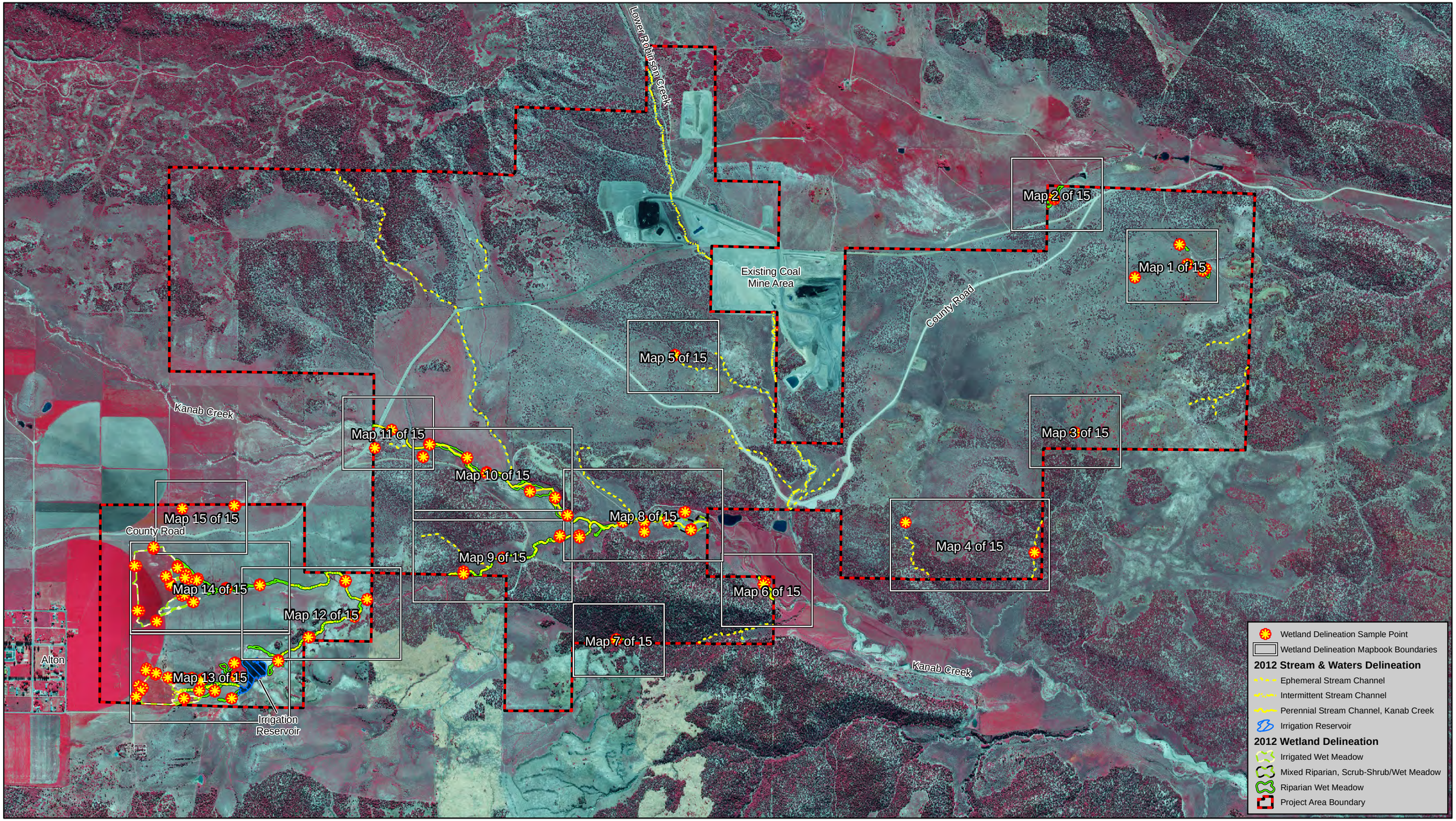
APPENDIX A

Wetland Delineation Maps



Appendix A. Wetland Delineation Index Map.

Basemap color infrared imagery from 2011 National Agricultural Imagery Program, 1-meter resolution.

Map Date: July 2, 2012
Image Date: June 22, 2011

N

1 inch = 1,800 feet

0 1,000 2,000 4,000 Feet

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Environmental Consultants
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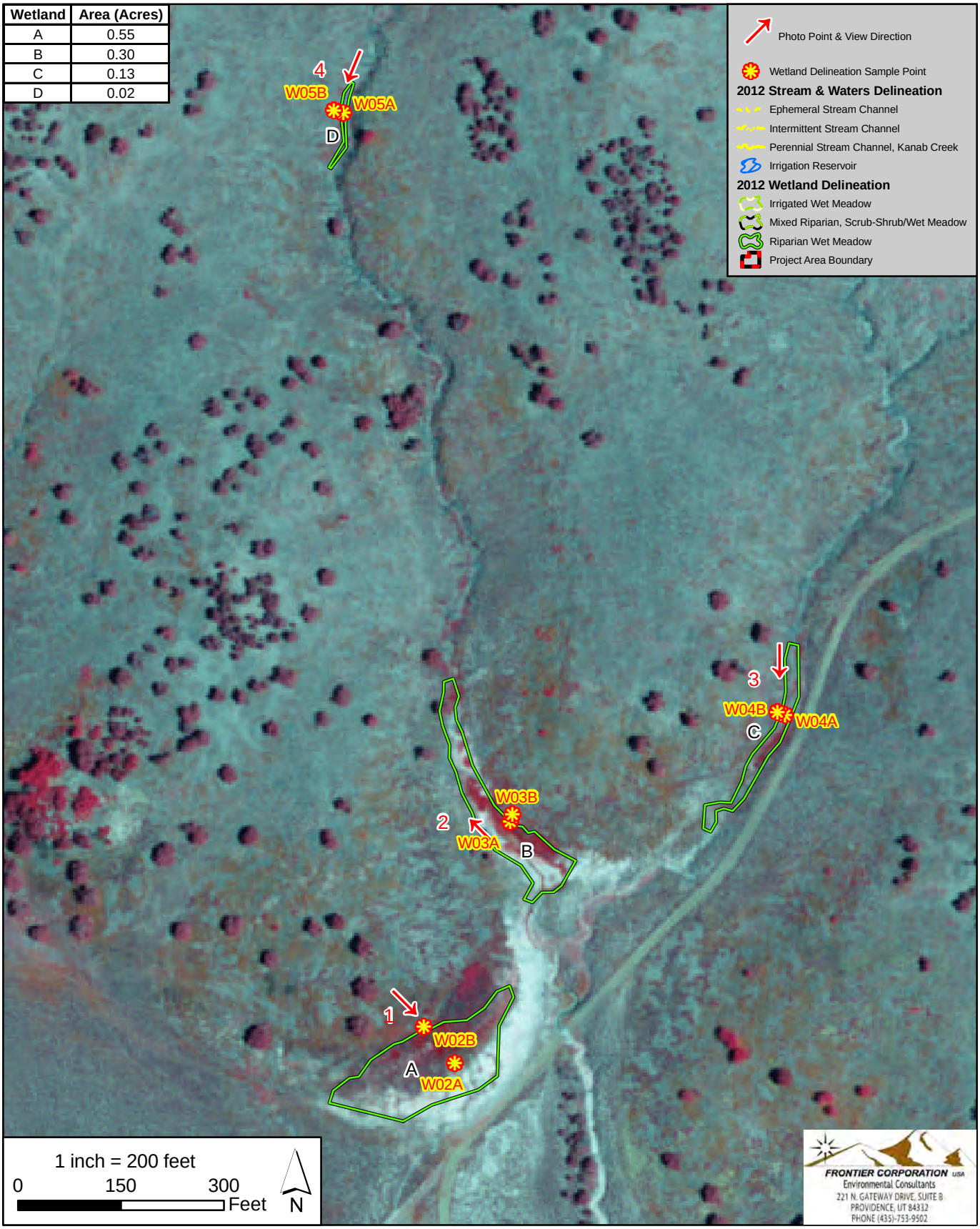
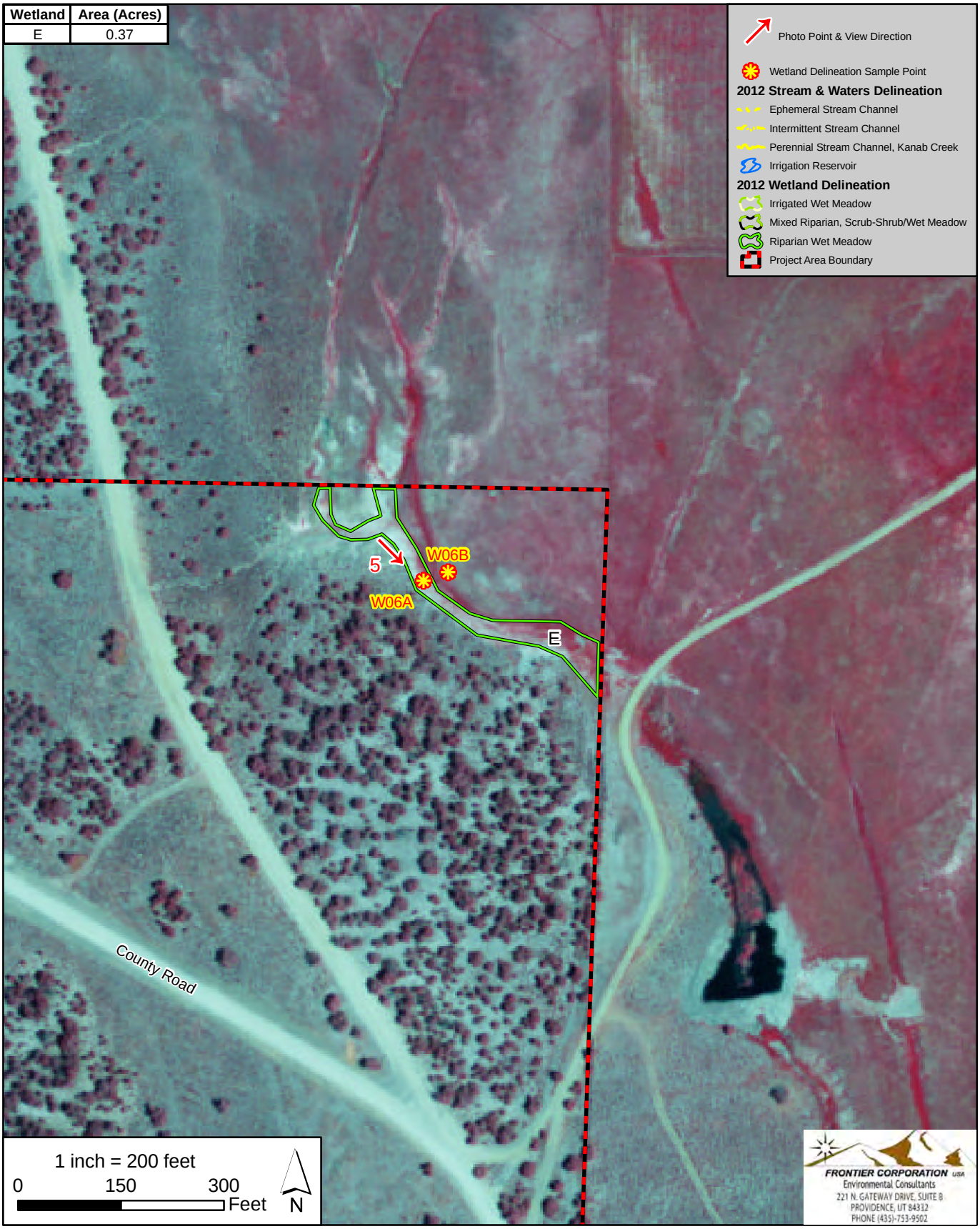
PROVIDENCE, UT 84332
PHONE (435)-753-9502



Appendix A. Wetland Delineation, Map 1 of 15.

Map Date: July 2, 2012
Image Date: June 22, 2011

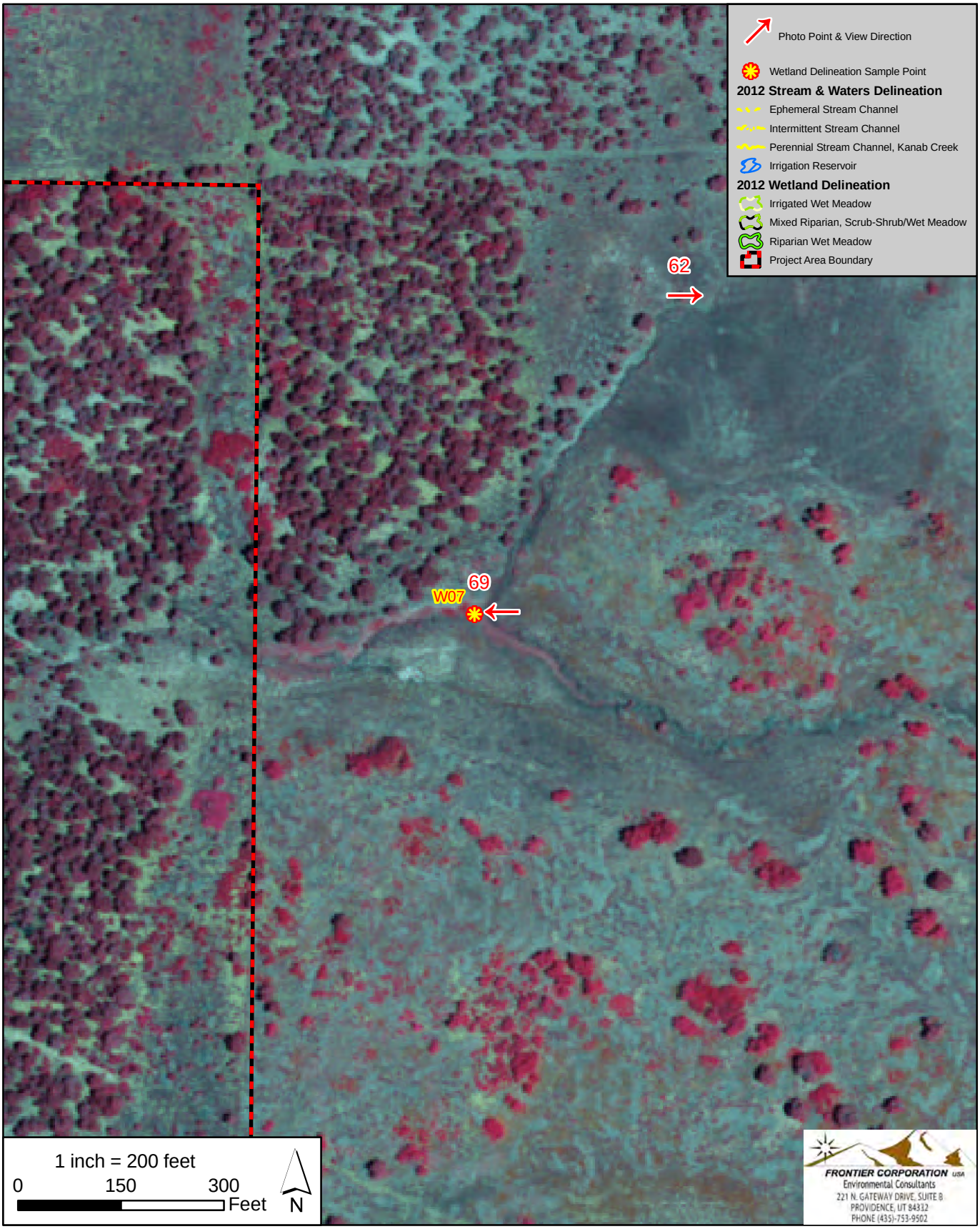
Basemap color infrared imagery from 2011 National Agricultural Imagery Program, 1-meter resolution.



Appendix A. Wetland Delineation, Map 2 of 15.

Map Date: July 2, 2012
Image Date: June 22, 2011

Basemap color infrared imagery from 2011 National Agricultural Imagery Program, 1-meter resolution.

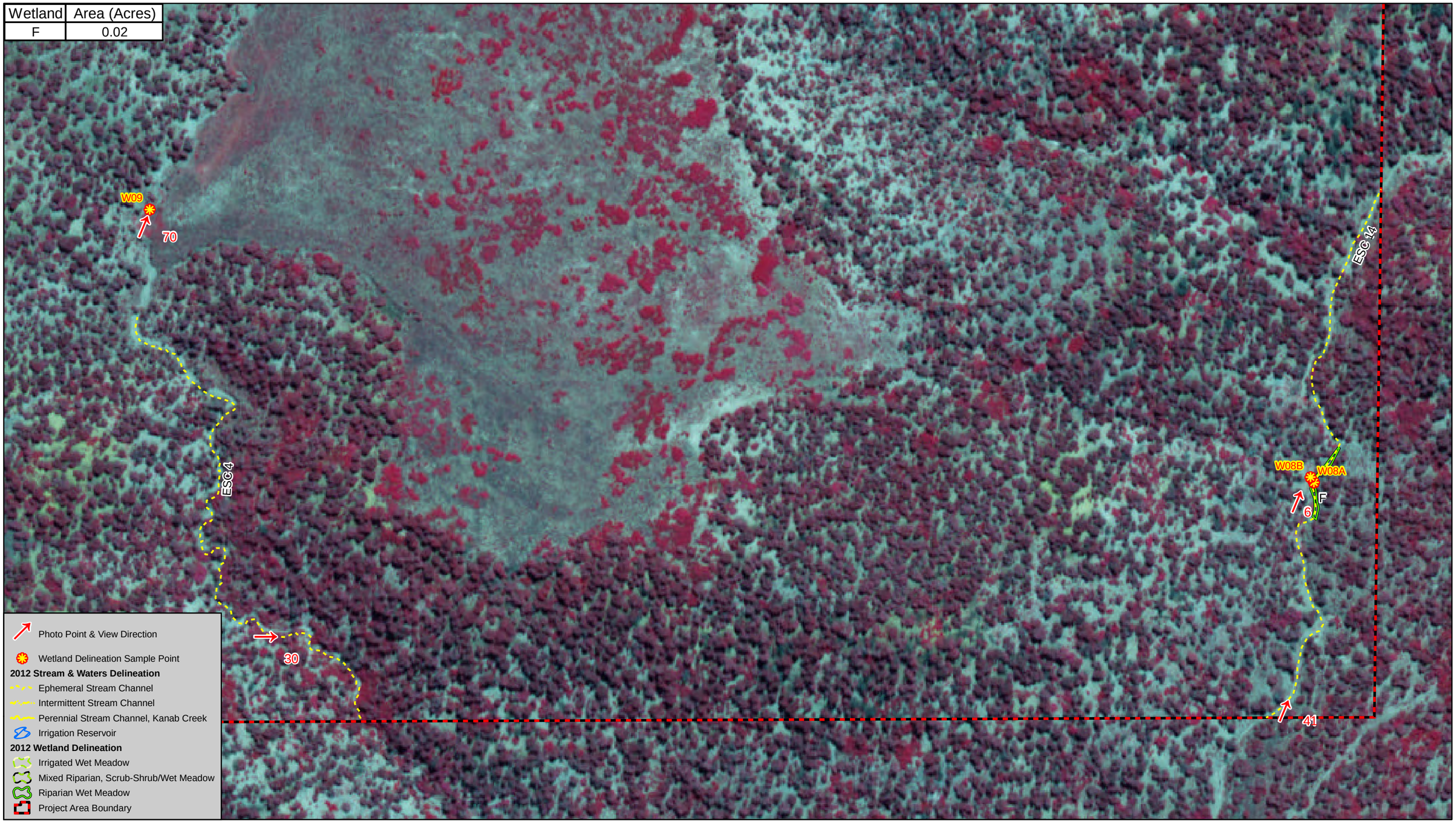


Appendix A. Wetland Delineation, Map 3 of 15.

Map Date: July 2, 2012
Image Date: June 22, 2011

Basemap color infrared imagery from 2011 National Agricultural Imagery Program, 1-meter resolution.

Wetland	Area (Acres)
F	0.02



Appendix A. Wetland Delineation, Map 4 of 15.

Basemap color infrared imagery from 2011 National Agricultural Imagery Program, 1-meter resolution.

Map Date: July 31, 2012
Image Date: June 22, 2011

N

1 inch = 200 feet

0 100 200 400 Feet

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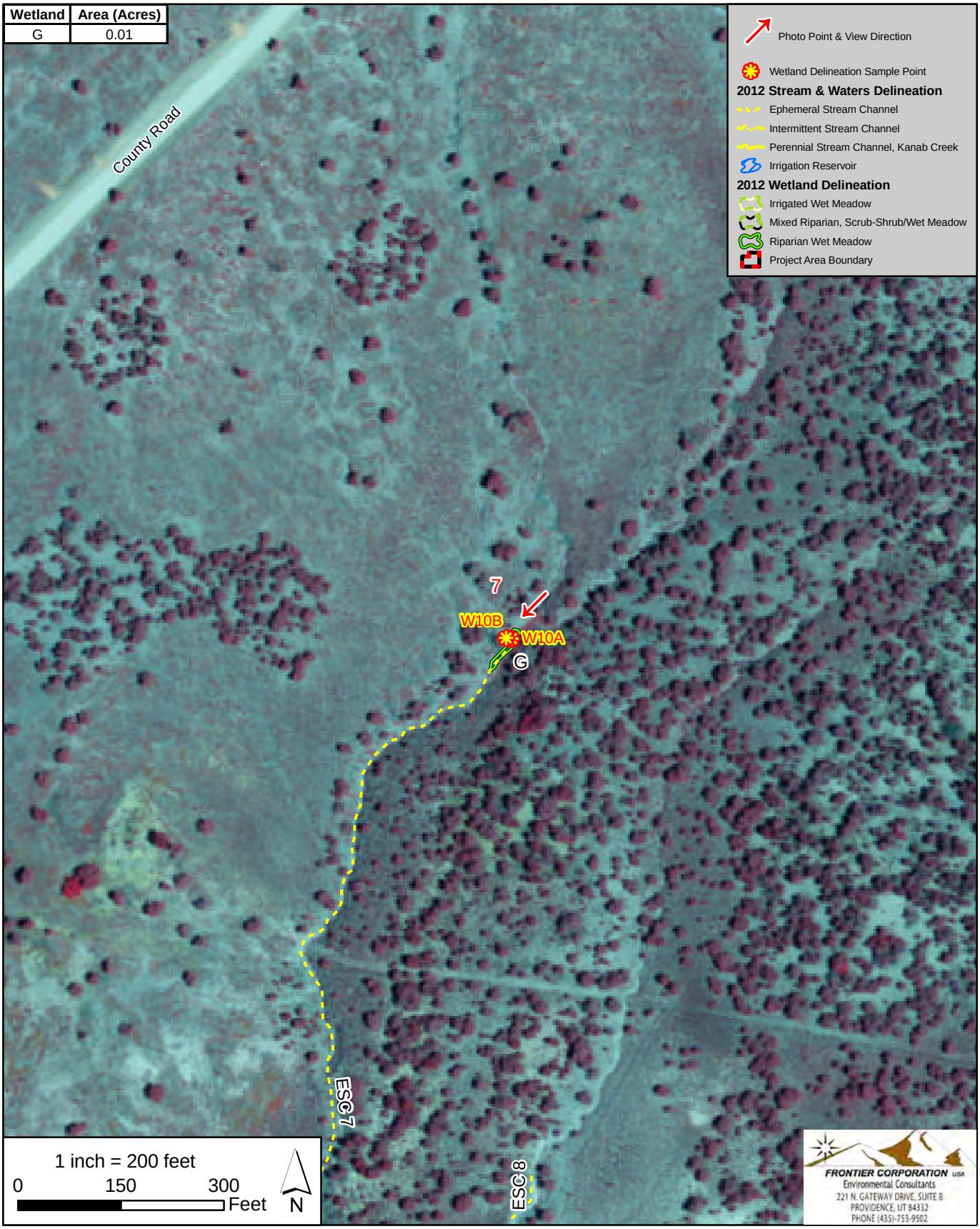
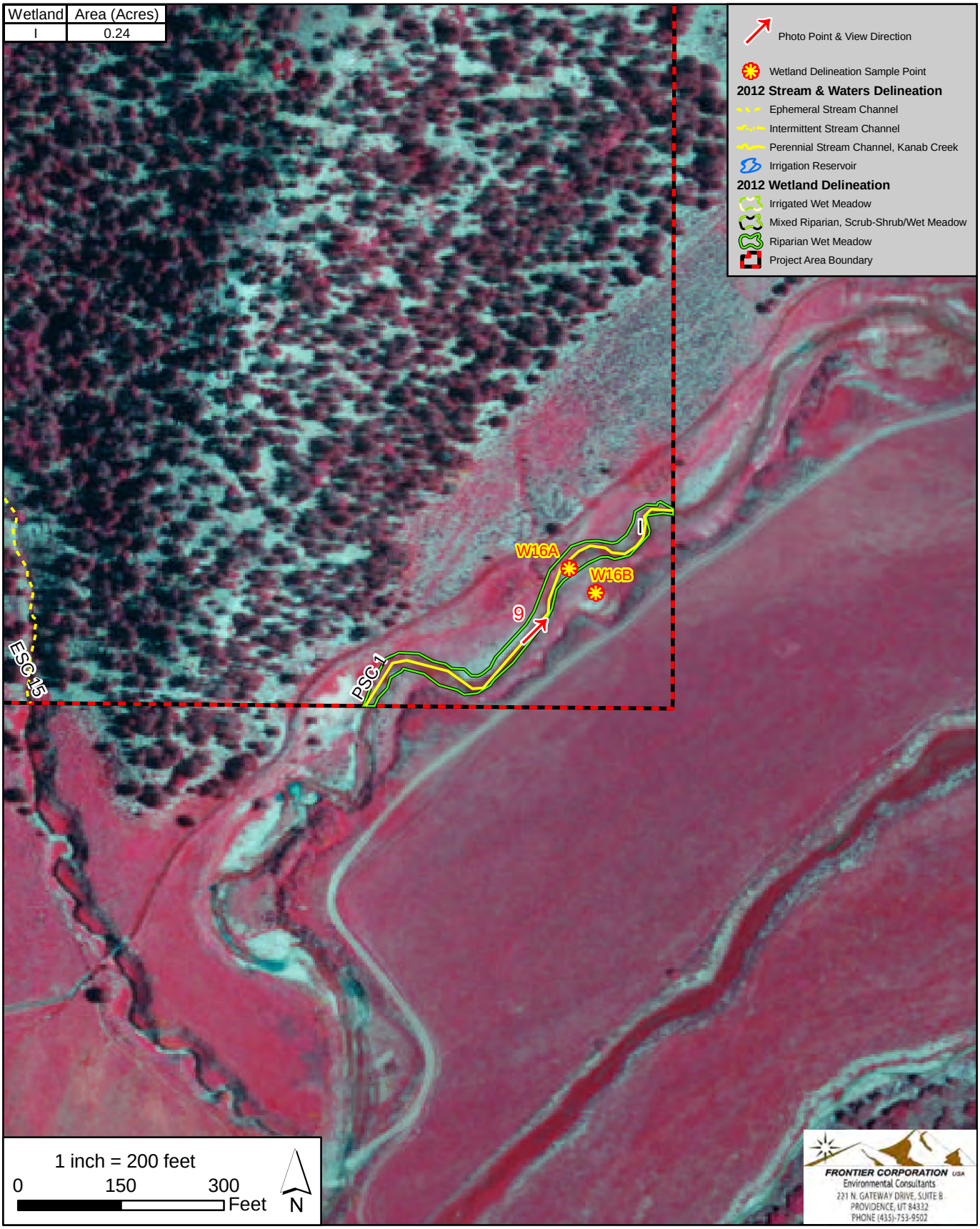


Appendix A. Wetland Delineation, Map 5 of 15.

Map Date: July 2, 2012
Image Date: June 22, 2011

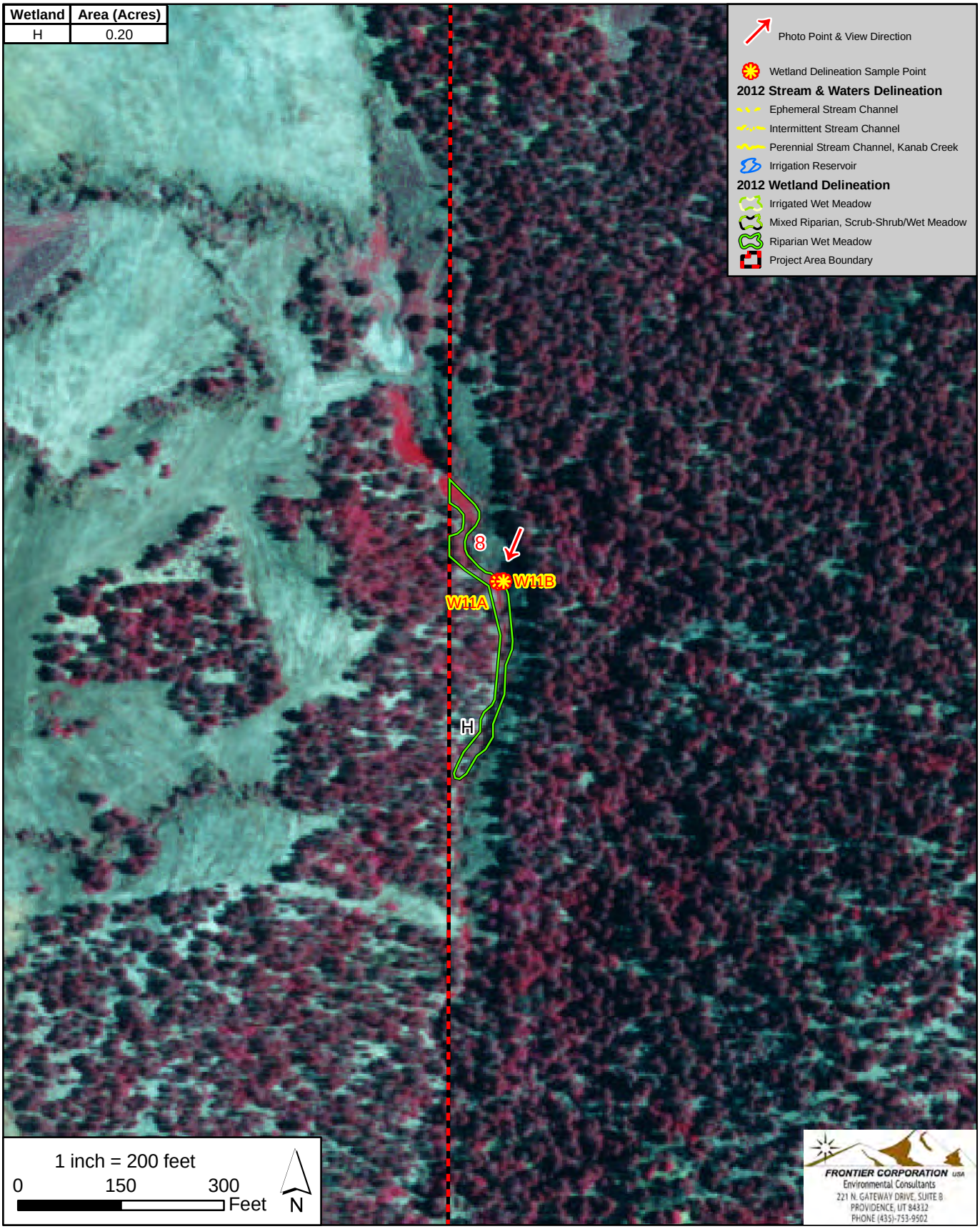
Basemap color infrared imagery from 2011 National Agricultural Imagery Program, 1-meter resolution.



Appendix A. Wetland Delineation, Map 6 of 15.

Map Date: July 31, 2012
Image Date: June 22, 2011

Basemap color infrared imagery from 2011 National Agricultural Imagery Program, 1-meter resolution.



Appendix A. Wetland Delineation, Map 7 of 15.

Map Date: July 2, 2012
Image Date: June 22, 2011

Basemap color infrared imagery from 2011 National Agricultural Imagery Program, 1-meter resolution.

Wetland	Area (Acres)
K	6.88
L	1.46
X	3.80

Acreage includes portions of Wetland K & L that are not shown on the map.

Photo Point & View Direction

Wetland Delineation Sample Point

2012 Stream & Waters Delineation

Ephemeral Stream Channel

Intermittent Stream Channel

Perennial Stream Channel, Kanab Creek

Irrigation Reservoir

2012 Wetland Delineation

Irrigated Wet Meadow

Mixed Riparian, Scrub-Shrub/Wet Meadow

Riparian Wet Meadow

Project Area Boundary

39

ESC 12

Irrigation Pond

W18A

W18B

W24A

W24B

Irrigation Diversion Point

Irrigation Ditch
2,440 feet long

W22A

W22B

W20A

W20B

52

W19A

W19B

X

PSC 1

53

K

W17A

W17B

10

W21

Kanab Creek

W15B

W15A

13

W15C

ISC 2

46

Appendix A. Wetland Delineation, Map 8 of 15.

Map Date: July 31, 2012
Image Date: June 22, 2011

N

1 inch = 200 feet

0 100 200 400 Feet

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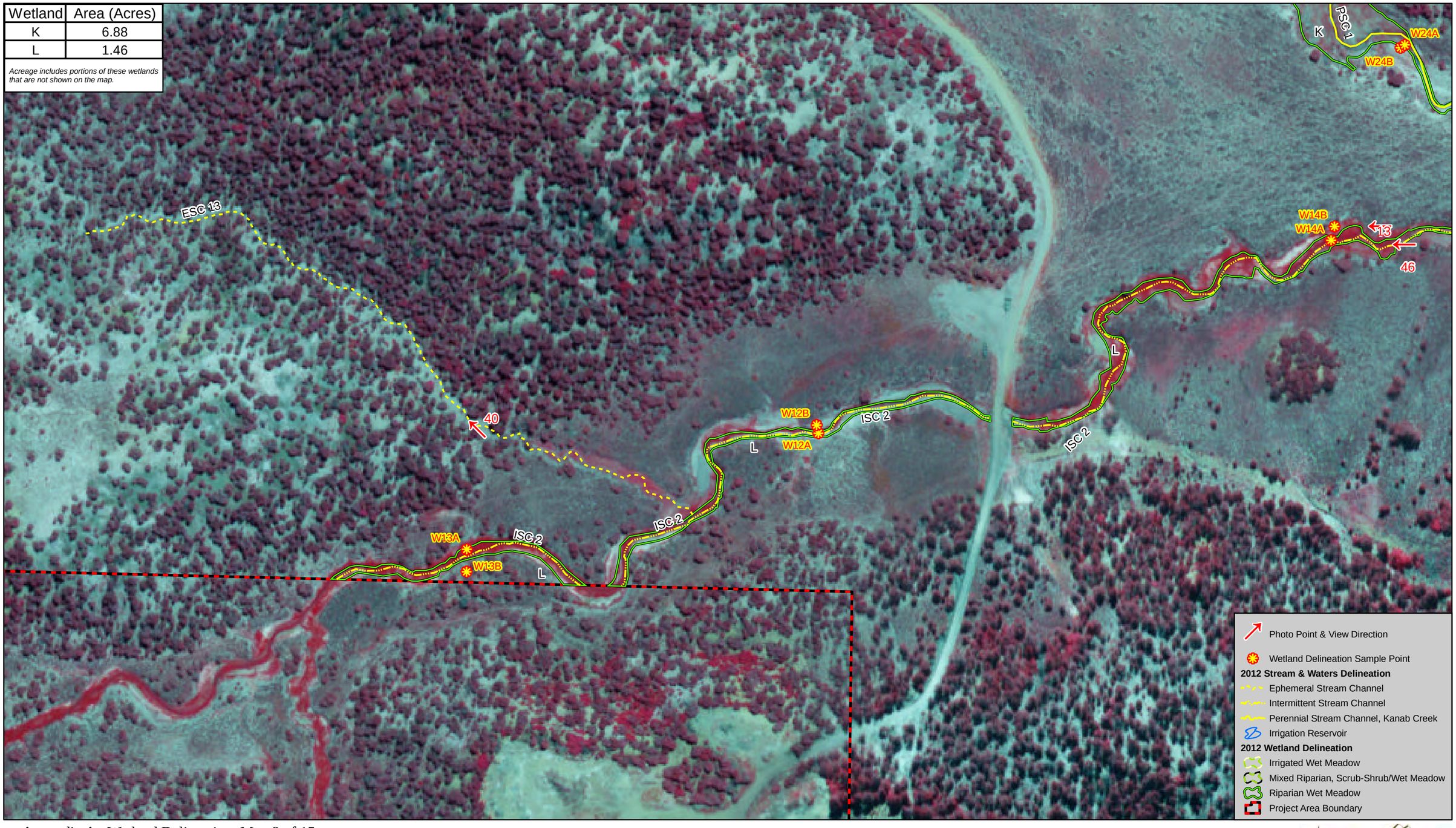
Basemap color infrared imagery from 2011 National Agricultural Imagery Program, 1-meter resolution.

Wetland	Area (Acres)
K	6.88
L	1.46

Acreage includes portions of these wetlands that are not shown on the map.



Appendix A. Wetland Delineation, Map 9 of 15.

Map Date: July 31, 2012
Image Date: June 22, 2011

N

1 inch = 200 feet

0 100 200 400 Feet

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Basemap color infrared imagery from 2011 National Agricultural Imagery Program, 1-meter resolution.

Wetland	Area (Acres)
K	6.88
M	0.10

Acreage includes portion of Wetland K that is not shown on the map.

W28A
W28B
M
W29A
W29B
14
W27A
W27B
K
W26A
W26B
11
ESC 11
50
W23A
W23B
K
PSC 1
12
W25B
W25A
W24A
W24B

Photo Point & View Direction

Wetland Delineation Sample Point

2012 Stream & Waters Delineation

Ephemeral Stream Channel

Intermittent Stream Channel

Perennial Stream Channel, Kanab Creek

Irrigation Reservoir

2012 Wetland Delineation

Irrigated Wet Meadow

Mixed Riparian, Scrub-Shrub/Wet Meadow

Riparian Wet Meadow

Project Area Boundary

Appendix A. Wetland Delineation, Map 10 of 15.

Map Date: July 31, 2012
Image Date: June 22, 2011

N

1 inch = 200 feet

0 100 200 400 Feet

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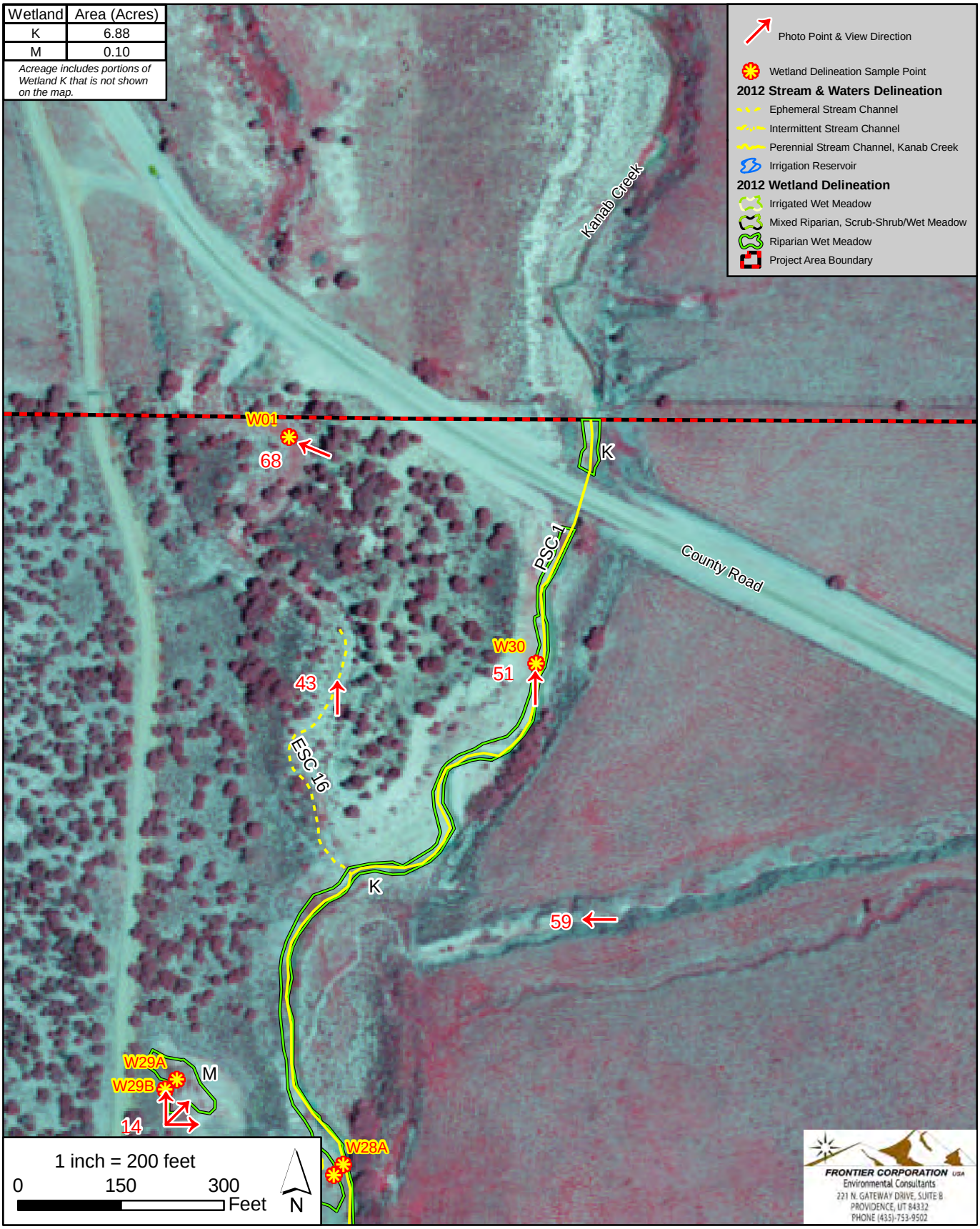
Basemap color infrared imagery from 2011 National Agricultural Imagery Program, 1-meter resolution.



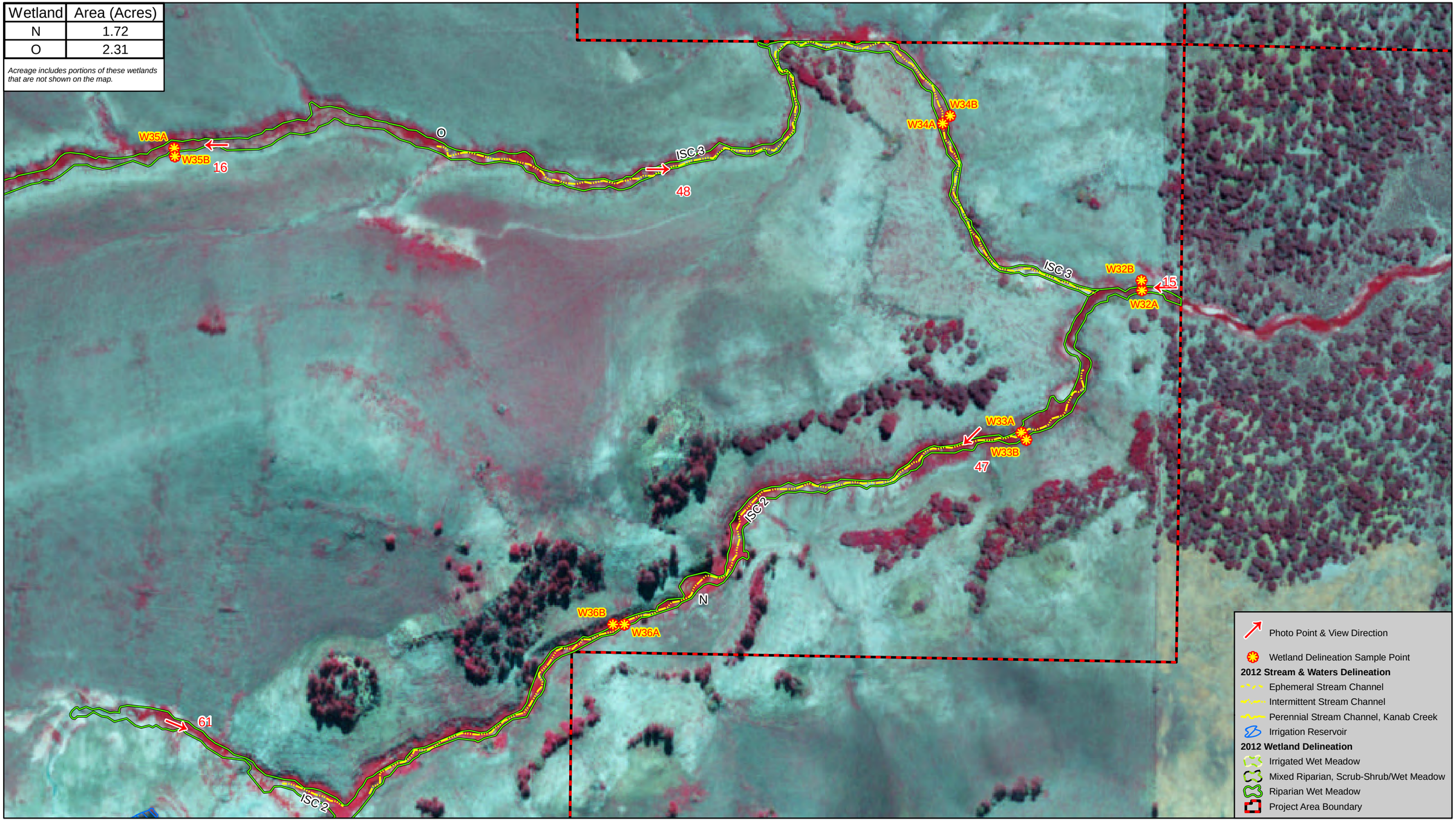
Appendix A. Wetland Delineation, Map 11 of 15.

Map Date: July 31, 2012
Image Date: June 22, 2011

Basemap color infrared imagery from 2011 National Agricultural Imagery Program, 1-meter resolution.

Wetland	Area (Acres)
N	1.72
O	2.31

Acreage includes portions of these wetlands that are not shown on the map.



Appendix A. Wetland Delineation, Map 12 of 15.

Map Date: July 31, 2012
Image Date: June 22, 2011

N

1 inch = 200 feet

0 100 200 400 Feet

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Environmental Consultants
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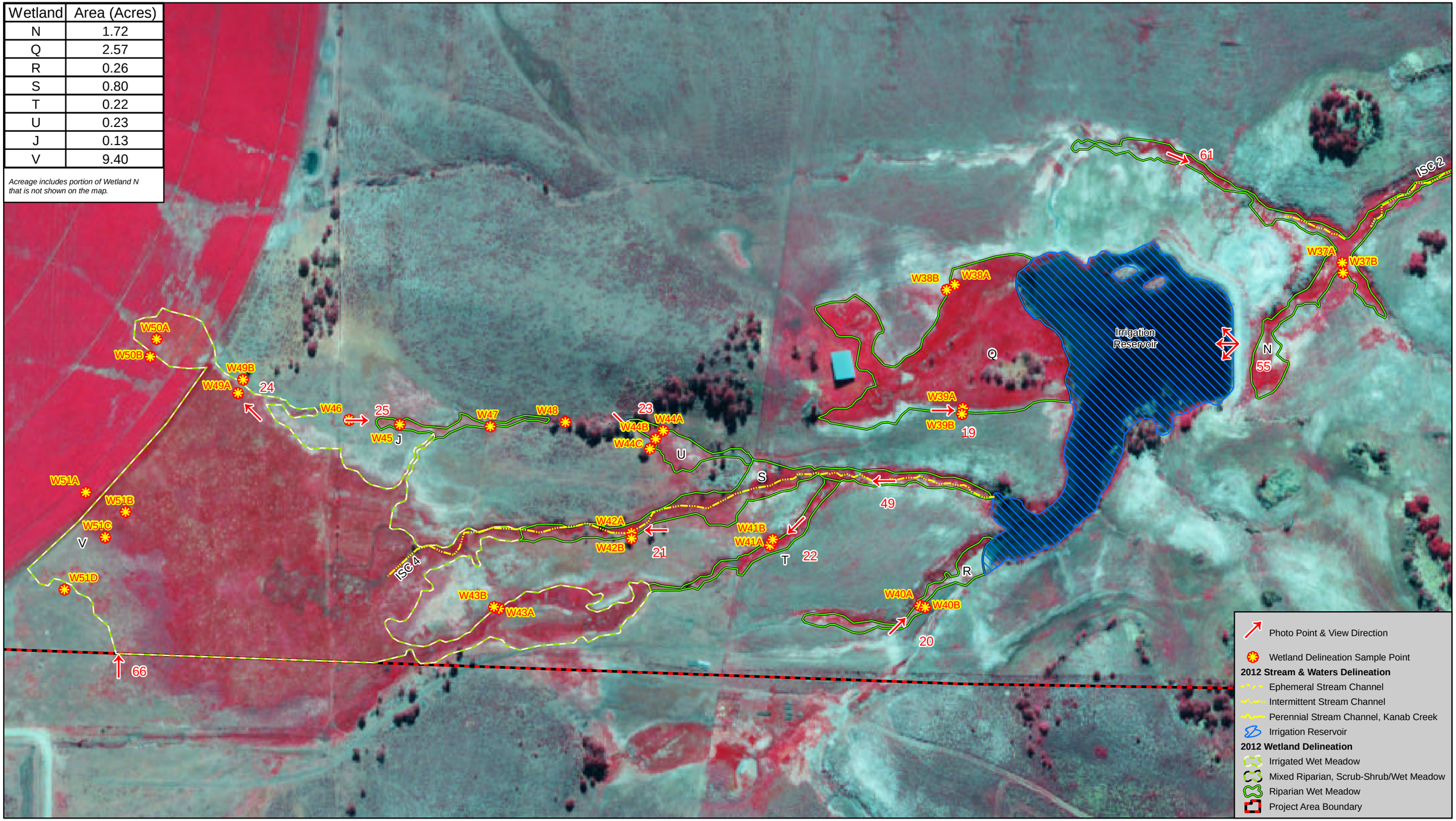
PROVIDENCE, UT 84332
PHONE (435)-753-9502

Basemap color infrared imagery from 2011 National Agricultural Imagery Program, 1-meter resolution.

Wetland	Area (Acres)
N	1.72
Q	2.57
R	0.26
S	0.80
T	0.22
U	0.23
J	0.13
V	9.40

Acreage includes portion of Wetland N that is not shown on the map.



Appendix A. Wetland Delineation, Map 13 of 15.

Map Date: July 31, 2012
Image Date: June 22, 2011

N

1 inch = 200 feet

0 100 200 400 Feet

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Environmental Consultants
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PROVIDENCE, UT 84332
PHONE (435)-753-9502

Basemap color infrared imagery from 2011 National Agricultural Imagery Program, 1-meter resolution.

Wetland	Area (Acres)
O	2.31
W	22.23

Acreage includes portion of Wetland O that is not shown on the map.

W63B
W63A
W64B
W64A
W61A
W61B
W54B
W62B
W54C
W62A
W53A
W54A
W53B
W59B
W59A
W
18
W35A
W35B
16
W60A
W60B
O
W58B
W58A
W55A
W55B
W57B
W57A
17
W56A
W56B

Photo Point & View Direction
Wetland Delineation Sample Point
2012 Stream & Waters Delineation
Ephemeral Stream Channel
Intermittent Stream Channel
Perennial Stream Channel, Kanab Creek
Irrigation Reservoir
2012 Wetland Delineation
Irrigated Wet Meadow
Mixed Riparian, Scrub-Shrub/Wet Meadow
Riparian Wet Meadow
Project Area Boundary

Appendix A. Wetland Delineation, Map 14 of 15.

Map Date: July 31, 2012
Image Date: June 22, 2011

N

1 inch = 200 feet
0 100 200 400 Feet

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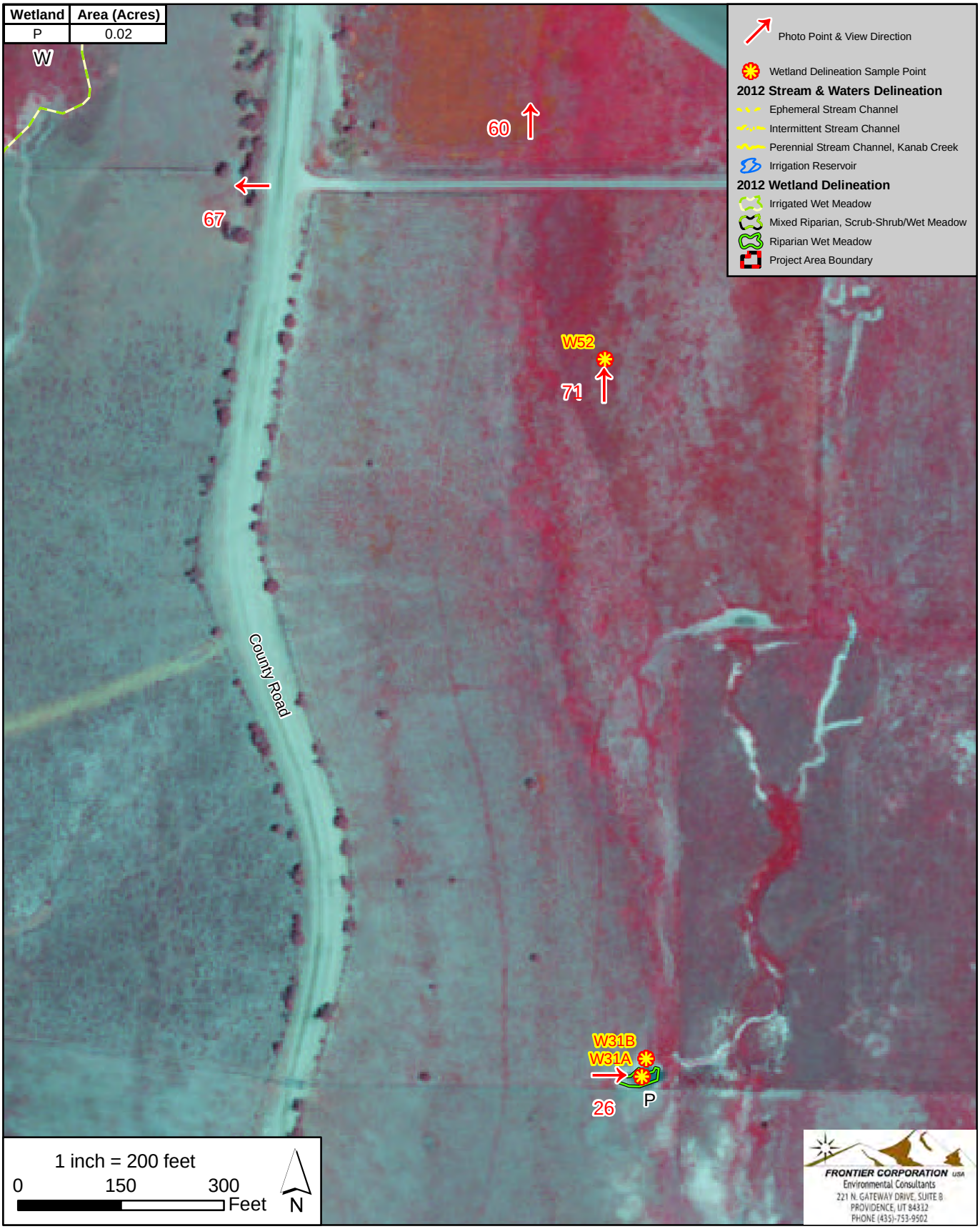
PROVIDENCE, UT 84332
PHONE (435)-753-9502

Basemap color infrared imagery from 2011 National Agricultural Imagery Program, 1-meter resolution.



Appendix A. Wetland Delineation, Map 15 of 15.

Map Date: July 2, 2012
Image Date: June 22, 2011

Basemap color infrared imagery from 2011 National Agricultural Imagery Program, 1-meter resolution.

APPENDIX B

Wetland Delineation Data Sheets

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: May 21, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W01
Investigator(s): Jeff Boice, Dennis Wenger, Collin Covington	Section, Township, Range: 13, 39S, 6W	
Landform (hillslope, terrace, etc.): drainage floor	Local relief (concave, convex, none): none	Slope (%): 0
Subregion (LRR): D	Easting: 370018	Northing: 4142433 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X No: (If no, explain in Remarks.)		
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X No:	
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes:	No: X	**Is the Sampled Area within a Wetland? Yes: No: X**
Hydric Soil Present?	Yes:	No: X	
Wetland Hydrology Present?	Yes:	No: X	

Remarks: In bottom of vegetated drainage, no channel characteristics present. Photos of site: 832 - soil, 833 - northwest, 834 - west

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size: 6' x 6')			
1. Rosa woodsii	2	Y	FACU
2.			
3.			
4.			
	2	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Poa pratensis	30	Y	FAC
2. Iris missouriensis	20	Y	FACW
3. Medicago sativa	20	Y	UPL
4. Juncus arcticus	10	N	FACW
5. Pascopyrum smithii	10	N	FAC
6. Convolvulus arvensis	5	N	UPL
7. Achillea millefolium	1	N	FACU
8. Bromus inermis	1	N	FACU
	97	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
Total Cover:	0		

% Bare Ground in Herb Stratum 3 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:	30	x 2 =	60
FAC species:	40	x 3 =	120
FACU species:	4	x 4 =	16
UPL species:	25	x 5 =	125
Column Totals:	99 (A)		321 (B)

Prevalence Index = B/A = 3.24

Hydrophytic Vegetation Indicators:

- Dominance Test >50%
- Prevalence Index is ≤3.0[1]
- Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes: No: X

Remarks: Mixed vegetation

SOILS

Sampling Point: W01

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features					
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 10	10YR 6/3	100	-	-	-	-	silty loam	gravels present
10 - 18	10YR 6/3	100	-	-	-	-	sandy loam	-

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) **(LRR C)**
- ____ 1 cm Muck (A9) **(LRR D)**
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) **(LRR C)**
- ____ 2 cm Muck (A10) **(LRR B)**
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: No: X

Remarks: Recent alluvial deposits. No redox observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- _____ Water Marks (B1) **(Riverine)**
- _____ Sediment Deposits (B2) **(Riverine)**
- _____ Drift Deposits (B3) **(Riverine)**
- _____ Drainage patterns (B10)
- _____ Dry-Season Water Table (C2)
- _____ Crayfish Burrows (C8)
- _____ Saturation Visible on Aerial Imagery (C9)
- _____ Shallow Aquitard (D3)
- _____ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ____ No X Depth (inches): _____

Water Table Present? Yes: ____ No X Depth (inches): _____

Saturation Present? (incl. capillary fringe) Yes: ____ No X Depth (inches): _____

Wetland Hydrology Present? Yes: No: X

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Site is dry. The sample point is placed in the lowest portion of the drainage swale.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: May 22, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W02A
Investigator(s): Jeff Boice, Dennis Wenger, Collin Covington	Section, Township, Range: 31, 39S, 5W	
Landform (hillslope, terrace, etc.): terrace	Local relief (concave, convex, none): none	Slope (%): 0
Subregion (LRR): D	Easting: 371092	Northing: 4137461 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X	No: (If no, explain in Remarks.)	
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X	No:
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes: X	No:	**Is the Sampled Area within a Wetland? Yes: X No:**
Hydric Soil Present?	Yes: X	No:	
Wetland Hydrology Present?	Yes: X	No:	

Remarks: Terrace area of hillside seep. The area is flat and is covered in an alkaline crust that is very prevalent and powdery. Photos of site: 835 - soil, 836 - southeast, 837 - northwest

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Juncus arcticus	75	Y	FACW
2. Carex praegracilis	10	N	FACW
3.			
4.			
5.			
6.			
7.			
8.			
	85	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
Total Cover: 0			

% Bare Ground in Herb Stratum 15 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:	Multiply by:	
OBL species:	x 1=	0
FACW species: 85	x 2 =	170
FAC species:	x 3 =	0
FACU species:	x 4 =	0
UPL species:	x 5 =	0
Column Totals: 85 (A)		170 (B)

Prevalence Index = B/A = 2.00

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

X Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes: X No:

Remarks: Wetland vegetation

SOILS

Sampling Point: W02A

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features					
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 18	10YR 2/1	100	-	-	-	-	fine sand	sandy loam

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- X Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) **(LRR C)**
- ____ 1 cm Muck (A9) **(LRR D)**
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) **(LRR C)**
- ____ 2 cm Muck (A10) **(LRR B)**
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: X No:

Remarks: Dark soil with prevalent hydrogen sulfide smell. No redox observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- X Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- _____ Water Marks (B1) **(Riverine)**
- _____ Sediment Deposits (B2) **(Riverine)**
- _____ Drift Deposits (B3) **(Riverine)**
- _____ Drainage patterns (B10)
- _____ Dry-Season Water Table (C2)
- _____ Crayfish Burrows (C8)
- _____ Saturation Visible on Aerial Imagery (C9)
- _____ Shallow Aquitard (D3)
- _____ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ____ No X Depth (inches): _____

Water Table Present? Yes: ____ No X Depth (inches): _____

Saturation Present? (incl. capillary fringe) Yes: X No ____ Depth (inches): 0

Wetland Hydrology Present? Yes: X No:

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Saturated to the surface. The water table was not present.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: May 22, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W02B
Investigator(s): Jeff Boice, Dennis Wenger, Collin Covington	Section, Township, Range: 31, 39S, 5W	
Landform (hillslope, terrace, etc.): hillslope	Local relief (concave, convex, none): concave	Slope (%): 5
Subregion (LRR): D	Easting: 371078	Northing: 4137477	Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X	No:	(If no, explain in Remarks.)	
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X	No:
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes:	No: X	**Is the Sampled Area within a Wetland?** **Yes:** **No: X**
Hydric Soil Present?	Yes:	No: X	
Wetland Hydrology Present?	Yes:	No: X	

Remarks: Hillside transitional area. Photos of site: 838 - soil, 839 - southeast, 840 - southwest, 841 - northwest, 842 - soil

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size: 6' x 6')			
1. Artemisia tridentata	25	Y	UPL
2.			
3.			
4.			
	25	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Bromus tectorum	40	Y	UPL
2. Iva axillaris	40	Y	FAC
3. Juncus arcticus	7	N	FACW
4. Verbascum thapsus	3	N	FACU
5. Cirsium sp.	TR	N	-
6. Tragopogon dubius	TR	N	UPL
7.			
8.			
	90	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
	Total Cover: 0		

% Bare Ground in Herb Stratum 10 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 33.3 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:	7	x 2 =	14
FAC species:	40	x 3 =	120
FACU species:	3	x 4 =	12
UPL species:	65	x 5 =	325
Column Totals:	115 (A)		471 (B)

Prevalence Index = B/A = 4.10

Hydrophytic Vegetation Indicators:

Dominance Test >50%

Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes:** **No: X**

Remarks: Upland vegetation community.

SOILS

Sampling Point: W02B

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features					
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 1	10YR 3/2	100	-	-	-	-	sandy loam	root zone
1 - 18	10YR 2/2	100	-	-	-	-	sand	-

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) **(LRR C)**
- ____ 1 cm Muck (A9) **(LRR D)**
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) **(LRR C)**
- ____ 2 cm Muck (A10) **(LRR B)**
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: No: X

Remarks: No redox observed

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- _____ Water Marks (B1) **(Riverine)**
- _____ Sediment Deposits (B2) **(Riverine)**
- _____ Drift Deposits (B3) **(Riverine)**
- _____ Drainage patterns (B10)
- _____ Dry-Season Water Table (C2)
- _____ Crayfish Burrows (C8)
- _____ Saturation Visible on Aerial Imagery (C9)
- _____ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ____ No X Depth (inches): _____

Water Table Present? Yes: ____ No X Depth (inches): _____

Saturation Present? (incl. capillary fringe) Yes: ____ No X Depth (inches): _____

Wetland Hydrology Present? Yes: No: X

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Dry and friable no evidence of saturation

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: May 22, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W03A
Investigator(s): Jeff Boice, Dennis Wenger, Collin Covington	Section, Township, Range: 31, 39S, 5W	
Landform (hillslope, terrace, etc.): hillslope to drainage	Local relief (concave, convex, none): concave	Slope (%): >5
Subregion (LRR): D	Easting: 371116	Northing: 4137568 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X	No: (If no, explain in Remarks.)	
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X	No:
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes: X	No:	**Is the Sampled Area within a Wetland?**	**Yes: X** **No:**
Hydric Soil Present?	Yes: X	No:		
Wetland Hydrology Present?	Yes: X	No:		

Remarks: Edge of drainage swale in the wetland on the hillslope. Photos of site: 850 - soil, 851 - northeast, 852 - south

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:_____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:_____)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Juncus arcticus	85	Y	FACW
2. Poa secunda	5	N	FACU
3. Carex praegracilis	TR	N	FACW
4. Juncus sp.	TR	N	-
5.			
6.			
7.			
8.			
	90	= Total Cover	
Woody Vine Stratum (Plot Size:_____)			
1.			
2.			
Total Cover: 0			

% Bare Ground in Herb Stratum 10 % Cover of Biotic Crust_____

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:	Multiply by:	
OBL species:	x 1=	0
FACW species: 85	x 2 =	170
FAC species:	x 3 =	0
FACU species: 5	x 4 =	20
UPL species:	x 5 =	0
Column Totals: 90 (A)		190 (B)

Prevalence Index = B/A = 2.11

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

X Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes: X No:

Remarks: -

SOILS

Sampling Point: W03A

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 4	5Y 4/1	98	10YR 5/4	2	C	M	sandy loam	-
4 - 18	5Y 4/1	50	10YR 5/4	50	C	M	sandy loam	-

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___ Histosol (A1)	___ Sandy Redox (S5)	___ 1 cm Muck (A9) (**LRR C**)
___ Histic Epipedon (A2)	___ Stripped Matrix (S6)	___ 2 cm Muck (A10) (**LRR B**)
___ Black Histic (A3)	___ Loamy Mucky Mineral (F1)	___ Reduced Vertic (F18)
X Hydrogen Sulfide (A4)	___ Loamy Gleyed Matrix (F2)	___ Red Parent Material (TF2)
___ Stratified Layers (A5) (**LRR C**)	X Depleted Matrix (F3)	___ Other (Explain in Remarks)
___ 1 cm Muck (A9) (**LRR D**)	___ Redox Dark Surface (F6)	
___ Depleted Below Dark Surface (A11)	___ Depleted Dark Surface (F7)	
___ Thick Dark Surface (A12)	___ Redox Depressions (F8)	
___ Sandy Mucky Mineral (S1)	___ Vernal Pools (F9)	
___ Sandy Gleyed Matrix (S4)		

Indicators for Problematic Hydric Soils[3]:

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: X No:

Remarks: -

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)		Secondary Indicators (2 or more required)
___ Surface Water (A1)	X Salt Crust (B11)	___ Water Marks (B1) (**Riverine**)
___ High Water Table (A2)	___ Biotic Crust (B12)	___ Sediment Deposits (B2) (**Riverine**)
X Saturation (A3)	___ Aquatic Invertebrates (B13)	___ Drift Deposits (B3) (**Riverine**)
___ Water Marks (B1) (**Nonriverine**)	X Hydrogen Sulfide Odor (C1)	___ Drainage patterns (**B10**)
___ Sediment Deposits (B2) (**Nonriverine**)	___ Oxidized Rhizospheres along Living **Roots**	___ Dry-Season Water Table (C2)
___ Drift Deposits (B3) (**Nonriverine**)	___ Presence of Reduced Iron (C4)	___ Crayfish Burrows (C8)
___ Surface Soil Cracks (B6)	___ Recent Iron Reduction in Plowed Soils (C6)	___ Saturation Visible on Aerial Imagery (C9)
___ Inundation Visible on Aerial Imagery (B7)	___ Thin Muck Surface (C7)	___ Shallow Aquitard (D3)
___ Water-Stained Leaves (B9)	___ Other (Explain in Remarks)	___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes: ___	No X	Depth (inches): ___		
Water Table Present?	Yes: ___	No X	Depth (inches): ___	**Wetland Hydrology Present?**	**Yes: X No:**
Saturation Present? (incl. capillary fringe)	Yes: X	No ___	Depth (inches): 0		

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: -

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: May 22, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W03B
Investigator(s): Jeff Boice, Dennis Wenger, Collin Covington	Section, Township, Range: 31, 39S, 5W	
Landform (hillslope, terrace, etc.): hillslope	Local relief (concave, convex, none):	Slope (%): 5
Subregion (LRR): D	Easting: 371117	Northing: 4137572 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X	No: (If no, explain in Remarks.)	
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X	No:
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes:	No: X	**Is the Sampled Area within a Wetland?** **Yes:** **No: X**
Hydric Soil Present?	Yes:	No: X	
Wetland Hydrology Present?	Yes:	No: X	

Remarks: Hillslope upland terrace. Photos of site: 852 - south, 853 - soil, 854 - east

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size: 6' x 6')			
1. Artemisia tridentata	5	Y	UPL
2. Chrysothamnus nauseosus	5	Y	UPL
3.			
4.			
	10	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Bromus tectorum	40	Y	UPL
2. Iva axillaris	20	Y	FAC
3. Poa pratensis	20	Y	FAC
4. Hordeum jubatum	10	N	FAC
5. Aster sp.	5	N	-
6. Cirsium sp.	1	N	-
7.			
8.			
	96	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
	Total Cover: 0		

% Bare Ground in Herb Stratum 4 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 40 (A/B)

Prevalence Index Worksheet:

Total % Cover of:	Multiply by:	
OBL species:	x 1=	0
FACW species:	x 2 =	0
FAC species: 50	x 3 =	150
FACU species:	x 4 =	0
UPL species: 50	x 5 =	250
Column Totals: 100 (A)		400 (B)

Prevalence Index = B/A = 4.00

Hydrophytic Vegetation Indicators:

- Dominance Test >50%
- Prevalence Index is ≤3.0[1]
- Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes:** **No: X**

Remarks: Upland vegetation community.

SOILS

Sampling Point: W03B

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features					
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 18	10YR 3/2	100	-	-	-	-	fine sand	platy structure

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: No: X

Remarks: Soil column fell apart. No redox observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ___ No X Depth (inches): ___

Water Table Present? Yes: ___ No X Depth (inches): ___

Saturation Present? (incl. capillary fringe) Yes: No X Depth (inches):

Wetland Hydrology Present? Yes: No: X

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Dry and friable

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: May 22, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W04A
Investigator(s): Jeff Boice, Dennis Wenger, Collin Covington	Section, Township, Range: 31, 39S, 5W	
Landform (hillslope, terrace, etc.): drainage swale	Local relief (concave, convex, none): none	Slope (%): 1
Subregion (LRR): D	Easting: 371238	Northing: 4137616	Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X No: (If no, explain in Remarks.)		
Are Vegetation: , Soil: , or Hydrology: significantly disturbed? Are "Normal Circumstances" present? Yes: X No:		
Are Vegetation: , Soil: , or Hydrology: naturally disturbed? (If needed, explain any answers in Remarks.)		

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes: X No:	Is the Sampled Area within a Wetland? Yes: X No:	
Hydric Soil Present? Yes: X No:		
Wetland Hydrology Present? Yes: X No:		

Remarks: Wetland located in a drainage swale. Photos of site: 863 - soil, 864 - north, 865 - south

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Juncus arcticus	80	Y	FACW
2. Hordeum jubatum	5	N	FAC
3. Poa pratensis	5	N	FAC
4. Pascopyrum smithii	5	N	FAC
5. Achillea millefolium	3	N	FACU
6. Taraxacum officinale	2	N	FACU
7.			
8.			
	100	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
	Total Cover: 0		

% Bare Ground in Herb Stratum 0 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:	Multiply by:	
OBL species:	x 1=	0
FACW species: 80	x 2 =	160
FAC species: 15	x 3 =	45
FACU species: 5	x 4 =	20
UPL species:	x 5 =	0
Column Totals: 100 (A)		225 (B)

Prevalence Index = B/A = 2.25

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

X Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes: X No:

Remarks: -

SOILS

Sampling Point: W04A

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features					
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 18	2.5Y 5/2	98	10YR 5/6	2	D	M	clay	sandstone fragments present

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) **(LRR C)**
- ____ 1 cm Muck (A9) **(LRR D)**
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) **(LRR C)**
- ____ 2 cm Muck (A10) **(LRR B)**
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: X No:

Remarks: *Juncus* rhizomes present throughout the column.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- X Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- Water-Stained Leaves (B9)
- X Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- _____ Water Marks (B1) **(Riverine)**
- _____ Sediment Deposits (B2) **(Riverine)**
- _____ Drift Deposits (B3) **(Riverine)**
- _____ Drainage patterns (B10)
- _____ Dry-Season Water Table (C2)
- _____ Crayfish Burrows (C8)
- _____ Saturation Visible on Aerial Imagery (C9)
- _____ Shallow Aquitard (D3)
- FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ____ No X Depth (inches): _____

Water Table Present? Yes: ____ No X Depth (inches): _____

Saturation Present? (incl. capillary fringe) Yes: ____ No X Depth (inches): _____

Wetland Hydrology Present? Yes: X No:

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Soil column is moist but not saturated. It is assumed that early season water levels are sufficient to support wetland conditions.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: May 22, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W04B
Investigator(s): Jeff Boice, Dennis Wenger, Collin Covington	Section, Township, Range: 31, 39S, 5W	
Landform (hillslope, terrace, etc.): hillslope	Local relief (concave, convex, none): concave	Slope (%): 5
Subregion (LRR): D	Easting: 371235	Northing: 4137617	Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X	No: (If no, explain in Remarks.)	
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X	No:
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes:	No: X	**Is the Sampled Area within a Wetland?** **Yes:** **No: X**
Hydric Soil Present?	Yes:	No: X	
Wetland Hydrology Present?	Yes:	No: X	

Remarks: On hillslope approximately 3 feet higher in elevation than the W04A. Photos of site: 866 - soil, 867 - east, 868 - south

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size: 6' x 6')			
1. Artemisia tridentata	15	Y	UPL
2.			
3.			
4.			
	15	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Bromus tectorum	20	Y	UPL
2. Iva axillaris	15	Y	FAC
3. Hordeum jubatum	7	N	FAC
4. Aster sp.	2	N	-
5. Ipomopsis aggregata	1	N	UPL
6.			
7.			
8.			
	45	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
Total Cover: 0			

% Bare Ground in Herb Stratum 55 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 33.3 (A/B)

Prevalence Index Worksheet:

Total % Cover of:	Multiply by:	
OBL species:	x 1=	0
FACW species:	x 2 =	0
FAC species: 22	x 3 =	66
FACU species:	x 4 =	0
UPL species: 36	x 5 =	180
Column Totals: 58 (A)		246 (B)

Prevalence Index = B/A = 4.24

Hydrophytic Vegetation Indicators:

- Dominance Test >50%
- Prevalence Index is ≤3.0[1]
- Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes:** **No: X**

Remarks: A lot of bare ground and upland plant community.

SOILS

Sampling Point: W04B

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type[1]	Redox Features Loc[2]	Texture	Remarks
0 - 18	10YR 3/2	100	-	-	-	-	find sand	-

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) (**LRR C**)
- ____ 1 cm Muck (A9) (**LRR D**)
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) (**LRR C**)
- ____ 2 cm Muck (A10) (**LRR B**)
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: No: X

Remarks: No redox observed

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- _____ Water Marks (B1) (**Riverine**)
- _____ Sediment Deposits (B2) (**Riverine**)
- _____ Drift Deposits (B3) (**Riverine**)
- _____ Drainage patterns (B10)
- _____ Dry-Season Water Table (C2)
- _____ Crayfish Burrows (C8)
- _____ Saturation Visible on Aerial Imagery (C9)
- _____ Shallow Aquitard (D3)
- FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ____ No X Depth (inches): _____

Water Table Present? Yes: ____ No X Depth (inches): _____

Saturation Present? (incl. capillary fringe) Yes: ____ No X Depth (inches):

Wetland Hydrology Present? Yes: No: X

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Dry and friable

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: May 22, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W05A
Investigator(s): Jeff Boice, Dennis Wenger, Collin Covington	Section, Township, Range: 31, 39S, 5W	
Landform (hillslope, terrace, etc.): drainage floor	Local relief (concave, convex, none): none	Slope (%): >1
Subregion (LRR): D	Easting: 371042	Northing: 4137883 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X	No: (If no, explain in Remarks.)	
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X	No:
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes: X No:	**Is the Sampled Area within a Wetland? Yes: X No:**
Hydric Soil Present?	Yes: X No:	
Wetland Hydrology Present?	Yes: X No:	

Remarks: In the bottom of a drainage swale. Photos of site: 873 - soil, 874 - south, 875 - north

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Juncus arcticus	65	Y	FACW
2. Carex praegracilis	7	N	FACW
3. Hordeum jubatum	7	N	FAC
4. Poa pratensis	7	N	FAC
5. Taraxacum officinale	2	N	FACU
6.			
7.			
8.			
	88	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
	Total Cover: 0		
% Bare Ground in Herb Stratum 12	% Cover of Biotic Crust		

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:	72	x 2 =	144
FAC species:	14	x 3 =	42
FACU species:	2	x 4 =	8
UPL species:		x 5 =	0
Column Totals:	88 (A)		194 (B)

Prevalence Index = B/A = 2.20

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

X Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes: X No:

Remarks: Wetland vegetation community

SOILS

Sampling Point: W05A

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0 - 18	2.5Y 5/2	70	10YR 5/6	30	C	M	clay	-

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___ Histosol (A1)	___ Sandy Redox (S5)	___ 1 cm Muck (A9) (**LRR C**)
___ Histic Epipedon (A2)	___ Stripped Matrix (S6)	___ 2 cm Muck (A10) (**LRR B**)
___ Black Histic (A3)	___ Loamy Mucky Mineral (F1)	___ Reduced Vertic (F18)
___ Hydrogen Sulfide (A4)	___ Loamy Gleyed Matrix (F2)	___ Red Parent Material (TF2)
___ Stratified Layers (A5) (**LRR C**)	_X_ Depleted Matrix (F3)	___ Other (Explain in Remarks)
___ 1 cm Muck (A9) (**LRR D**)	___ Redox Dark Surface (F6)	
___ Depleted Below Dark Surface (A11)	___ Depleted Dark Surface (F7)	
___ Thick Dark Surface (A12)	___ Redox Depressions (F8)	
___ Sandy Mucky Mineral (S1)	___ Vernal Pools (F9)	
___ Sandy Gleyed Matrix (S4)		

Indicators for Problematic Hydric Soils[3]:

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: X No:

Remarks: High amounts of root material present throughout the column

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)		Secondary Indicators (2 or more required)
___ Surface Water (A1)	___ Salt Crust (B11)	___ Water Marks (B1) (**Riverine**)
___ High Water Table (A2)	___ Biotic Crust (B12)	___ Sediment Deposits (B2) (**Riverine**)
___ Saturation (A3)	___ Aquatic Invertebrates (B13)	___ Drift Deposits (B3) (**Riverine**)
___ Water Marks (B1) (**Nonriverine**)	___ Hydrogen Sulfide Odor (C1)	___ Drainage patterns (B10)
___ Sediment Deposits (B2) (**Nonriverine**)	___ Oxidized Rhizospheres along Living Roots	___ Dry-Season Water Table (C2)
___ Drift Deposits (B3) (**Nonriverine**)	___ Presence of Reduced Iron (C4)	___ Crayfish Burrows (C8)
___ Surface Soil Cracks (B6)	___ Recent Iron Reduction in Plowed Soils (C6)	___ Saturation Visible on Aerial Imagery (C9)
___ Inundation Visible on Aerial Imagery (B7)	___ Thin Muck Surface (C7)	___ Shallow Aquitard (D3)
___ Water-Stained Leaves (B9)	___ Other (Explain in Remarks)	___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes: ___	No _X_	Depth (inches): ___		
Water Table Present?	Yes: ___	No _X_	Depth (inches): ___	**Wetland Hydrology Present?**	**Yes: X No:**
Saturation Present? (incl. capillary fringe)	Yes:	No X	Depth (inches):		

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Alkali powder on surface. Soil is moist, not saturated. It is assumed that early season hydrology is responsible for wetland characteristics.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: May 22, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W05B
Investigator(s): Jeff Boice, Dennis Wenger, Collin Covington	Section, Township, Range: 31, 39S, 5W	
Landform (hillslope, terrace, etc.): hillslope	Local relief (concave, convex, none): convex	Slope (%): 70
Subregion (LRR): D	Easting: 371038 Northing: 4137885	Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X No: (If no, explain in Remarks.)		
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X No:	
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes: X	No:	**Is the Sampled Area within a Wetland?** Yes: No: X
Hydric Soil Present?	Yes:	No: X	
Wetland Hydrology Present?	Yes:	No: X	

Remarks: Mostly unvegetated hillslope that is approximately 3 feet above the drainage bottom. Photos of site: 876 - soil and 877 - east

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Poa pratensis	3	Y	FAC
2. Juncus arcticus	3	Y	FACW
3.			
4.			
5.			
6.			
7.			
8.			
	6	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
Total Cover:	0		

% Bare Ground in Herb Stratum 94 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:	3	x 2 =	6
FAC species:	3	x 3 =	9
FACU species:		x 4 =	0
UPL species:		x 5 =	0
Column Totals:	6 (A)		15 (B)

Prevalence Index = B/A = 2.50

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

X Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes: X No:

Remarks: Marginal vegetation community that is having difficulty becoming established due to the steepness of the slope.

SOILS

Sampling Point: W05B

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 18	10YR 5/3	100	-	-	-	-	clay loam	Mixed profile on the crumbling slope that has white calcium nodules present that are non-hydric

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) **(LRR C)**
- ____ 1 cm Muck (A9) **(LRR D)**
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) **(LRR C)**
- ____ 2 cm Muck (A10) **(LRR B)**
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: No: X

Remarks: No redox observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- _____ Water Marks (B1) **(Riverine)**
- _____ Sediment Deposits (B2) **(Riverine)**
- _____ Drift Deposits (B3) **(Riverine)**
- _____ Drainage patterns (B10)
- _____ Dry-Season Water Table (C2)
- _____ Crayfish Burrows (C8)
- _____ Saturation Visible on Aerial Imagery (C9)
- _____ Shallow Aquitard (D3)
- FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ____ No X Depth (inches): _____

Water Table Present? Yes: ____ No X Depth (inches): _____

Saturation Present? (incl. capillary fringe) Yes: No X Depth (inches):

Wetland Hydrology Present? Yes: No: X

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Soil column was dry and friable. Approximately 3 feet above wetland sample point and does receive the same hydrology as the bottom of the drainage.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: May 22, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W06A
Investigator(s): Jeff Boice, Dennis Wenger, Collin Covington	Section, Township, Range: 31, 39S, 5W	
Landform (hillslope, terrace, etc.): drainage swale	Local relief (concave, convex, none): concave	Slope (%): 1
Subregion (LRR): D	Easting: 371507	Northing: 4138366 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X	No: (If no, explain in Remarks.)	
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X	No:
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes: X	No:	**Is the Sampled Area within a Wetland?** **Yes: X** **No:**
Hydric Soil Present?	Yes: X	No:	
Wetland Hydrology Present?	Yes: X	No:	

Remarks: Located in a drainage swale. Photos of site: 881 - soil, 882 - southeast, 883 - northwest

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Juncus arcticus	40	Y	FACW
2. Carex praegracilis	35	Y	FACW
3. Poa sp.	15	N	-
4.			
5.			
6.			
7.			
8.			
	90	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
Total Cover:	0		

% Bare Ground in Herb Stratum 10 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:	75	x 2 =	150
FAC species:		x 3 =	0
FACU species:		x 4 =	0
UPL species:		x 5 =	0
Column Totals:	75 (A)		150 (B)

Prevalence Index = B/A = 2.00

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

X Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes: X** **No:**

Remarks: Wetland plant community

SOILS

Sampling Point: W06A

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 18	10YR 6/2	70	10YR 5/6	30	C	M	clay	crumbly structure

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- X Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: X No:

Remarks: Hydrogen sulfide smell is faint.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- X Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- X Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ___ No X Depth (Inches): ___

Water Table Present? Yes: ___ No X Depth (Inches): ___

Saturation Present? (incl. capillary fringe) Yes: ___ No X Depth (Inches): ___

Wetland Hydrology Present? Yes: X No:

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Alkali powder on surface. Soil column was moist, not saturated. It is assumed that early hydrology is responsible for wetland characteristics.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: May 22, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W06B
Investigator(s): Jeff Boice, Dennis Wenger, Collin Covington	Section, Township, Range: 31, 39S, 5W	
Landform (hillslope, terrace, etc.): terrace	Local relief (concave, convex, none): none	Slope (%): 0
Subregion (LRR): D	Easting: 371518	Northing: 4138370 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X	No: (If no, explain in Remarks.)	
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X	No:
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes: X	No:	**Is the Sampled Area within a Wetland?** Yes: No:
Hydric Soil Present?	Yes:	No: X	
Wetland Hydrology Present?	Yes:	No: X	

Remarks: Upland terrace within the wicking zone of the drainage swale. It is approximately 3 feet higher in elevation than the wetland sample point, W06B. Photos of site: 886 - soil, 887 - southwest, 888 - southeast

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:_____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:_____)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Juncus arcticus	20	Y	FACW
2. Carex praegracilis	5	N	FACW
3. Achillea millefolium	5	N	FACU
4. Pascopyrum smithii	5	N	FAC
5.			
6.			
7.			
8.			
	35	= Total Cover	
Woody Vine Stratum (Plot Size:_____)			
1.			
2.			
Total Cover: 0			

% Bare Ground in Herb Stratum 65 % Cover of Biotic Crust_____

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:	Multiply by:	
OBL species:	x 1=	0
FACW species: 25	x 2 =	50
FAC species: 5	x 3 =	15
FACU species: 5	x 4 =	20
UPL species:	x 5 =	0
Column Totals: 35 (A)		85 (B)

Prevalence Index = B/A = 2.43

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

X Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes: X No:

Remarks: Wetland plant community

SOILS

Sampling Point: W06B

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features					
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 3	7.5YR 5/4	100	-	-	-	-	silty clay	fine crumbly structure
3 - 18	7.5YR 5/6	100	-	-	-	-	silty clay	fine crumbly structure

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) **(LRR C)**
- ____ 1 cm Muck (A9) **(LRR D)**
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) **(LRR C)**
- ____ 2 cm Muck (A10) **(LRR B)**
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: No: X

Remarks: Soil is crumbly without any redox observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- _____ Water Marks (B1) **(Riverine)**
- _____ Sediment Deposits (B2) **(Riverine)**
- _____ Drift Deposits (B3) **(Riverine)**
- _____ Drainage patterns (B10)
- _____ Dry-Season Water Table (C2)
- _____ Crayfish Burrows (C8)
- _____ Saturation Visible on Aerial Imagery (C9)
- _____ Shallow Aquitard (D3)
- FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ____ No X Depth (inches): _____

Water Table Present? Yes: ____ No X Depth (inches): _____

Saturation Present? (incl. capillary fringe) Yes: No X Depth (inches):

Wetland Hydrology Present? Yes: No: X

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Edge of wicking zone on the break. The soil was dry and friable. Approximately 3 feet higher in elevation than the wetland sample point.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: May 22, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W07
Investigator(s): Jeff Bolce, Dennis Wenger, Collin Covington	Section, Township, Range: 31, 39S, 5W	
Landform (hillslope, terrace, etc.): drainage swale	Local relief (concave, convex, none): concave	Slope (%): 1
Subregion (LRR): D	Easting: 370110 Northing: 4138242	Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X No: (If no, explain in Remarks.)		
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X No:	
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes: X	No:	**Is the Sampled Area within a Wetland?** **Yes:** **No: X**
Hydric Soil Present?	Yes:	No: X	
Wetland Hydrology Present?	Yes:	No: X	

Remarks: Located in a drainage swale below the confluence of two upland drainage swales that do not have any channel characteristics. Photos of site: 897 - northeast, 898 - soil, 899 - southwest.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Juncus arcticus	60	Y	FACW
2. Pascopyrum smithii	40	Y	FAC
3. Iva axillaris	1	N	FAC
4. Aster sp.	1	N	-
5. Poa pratensis	1	N	FAC
6.			
7.			
8.			
	103	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
	Total Cover: 0		

% Bare Ground in Herb Stratum 0 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:	60	x 2 =	120
FAC species:	42	x 3 =	126
FACU species:		x 4 =	0
UPL species:		x 5 =	0
Column Totals:	102 (A)		246 (B)

Prevalence Index = B/A = 2.41

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

X Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes: X** **No:**

Remarks: Wetland plant community

SOILS

Sampling Point: W07

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 18	10YR 4/1	100	-	-	-	-	clay	fine granular

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) **(LRR C)**
- ____ 1 cm Muck (A9) **(LRR D)**
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) **(LRR C)**
- ____ 2 cm Muck (A10) **(LRR B)**
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: No: X

Remarks: No redox observed. Roots present throughout.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- _____ Water Marks (B1) **(Riverine)**
- _____ Sediment Deposits (B2) **(Riverine)**
- _____ Drift Deposits (B3) **(Riverine)**
- _____ Drainage patterns (B10)
- _____ Dry-Season Water Table (C2)
- _____ Crayfish Burrows (C8)
- _____ Saturation Visible on Aerial Imagery (C9)
- _____ Shallow Aquitard (D3)
- FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ____ No X Depth (inches): ____

Water Table Present? Yes: ____ No X Depth (inches): ____

Saturation Present? (incl. capillary fringe) Yes: ____ No X Depth (inches): ____

Wetland Hydrology Present? Yes: No: X

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Dry and friable. No evidence of wetland hydrology.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: May 22, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W08A
Investigator(s): Jeff Boice, Dennis Wenger, Collin Covington	Section, Township, Range: 25, 39S, 6W	
Landform (hillslope, terrace, etc.): drainage floor	Local relief (concave, convex, none): concave	Slope (%): 1
Subregion (LRR): D	Easting: 369390 Northing: 4138483	Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X No:	(If no, explain in Remarks.)	
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X No:	
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes: X	No:	**Is the Sampled Area within a Wetland?** Yes: X No:
Hydric Soil Present?	Yes: X	No:	
Wetland Hydrology Present?	Yes: X	No:	

Remarks: Wetland area adjacent to Ephemeral Stream Channel 14. Channel is a step-pool system. Photos of site: 900 - soil, 901 - east, 902 - north

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size: 6' x 6')			
1. Salix exigua	2	Y	FACW
2.			
3.			
4.			
	2	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Juncus arcticus	65	Y	FACW
2. Carex sp.	15	N	-
3. Medicago sativa	10	N	UPL
4. Taraxacum officinale	5	N	FACU
5. Poa pratensis	3	N	FAC
6. Achillea millefolium	2	N	FACU
7.			
8.			
	100	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
Total Cover: 0			
% Bare Ground in Herb Stratum 0	% Cover of Biotic Crust		

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:	67	x 2 =	134
FAC species:	3	x 3 =	9
FACU species:	7	x 4 =	28
UPL species:	10	x 5 =	50
Column Totals:	87 (A)		221 (B)

Prevalence Index = B/A = 2.54

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

X Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes: X No:

Remarks: Wetland plant community.

SOILS

Sampling Point: W08A

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0 - 0.25	10YR 2/1	100	-	-	-	-	clay	-
0.25 - 8	2.5Y 5/2	80	10YR 5/6	20	C	M	clay	alluvial material

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- X Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: Gravels

Depth (inches): 8

Hydric Soil Present? Yes: X No:

Remarks: -

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- X Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes: ___	No X	Depth (inches): ___		
Water Table Present?	Yes: X	No ___	Depth (inches): 6	**Wetland Hydrology Present?**	**Yes: X No:**
Saturation Present? (incl. capillary fringe)	Yes: X	No	Depth (inches): 0		

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Water present in the sample pit.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: May 22, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W08B
Investigator(s): Jeff Boice, Dennis Wenger, Collin Covington	Section, Township, Range: 25, 39S, 6W	
Landform (hillslope, terrace, etc.): hillslope	Local relief (concave, convex, none): none	Slope (%): 60
Subregion (LRR): D	Easting: 369393 Northing: 4138485	Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X No: (If no, explain in Remarks.)		
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X No:	
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes:	No: X	**Is the Sampled Area within a Wetland?**	**Yes: No: X**
Hydric Soil Present?	Yes:	No: X		
Wetland Hydrology Present?	Yes:	No: X		

Remarks: Located on the adjacent hillslope that is approximately 3 feet higher in elevation than the wetland sample point (W08A). Photos of site: 903 - soil, 904 - south

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size: 6' x 6')			
1. Artemisia tridentata	13	Y	UPL
2. Salix exigua	2	N	FACW
3.			
4.			
	15	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Juncus arcticus	4	Y	FACW
2. Medicago sativa	4	Y	UPL
3. Iva axillaris	2	Y	FAC
4.			
5.			
6.			
7.			
8.			
	10	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
Total Cover: 0			

% Bare Ground in Herb Stratum 90 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:	6	x 2 =	12
FAC species:	2	x 3 =	6
FACU species:		x 4 =	0
UPL species:	17	x 5 =	85
Column Totals:	25 (A)		103 (B)

Prevalence Index = B/A = 4.12

Hydrophytic Vegetation Indicators:

Dominance Test >50%

Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes: No: X

Remarks: Mixed, upland vegetation community.

SOILS

Sampling Point: W08B

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0 - 18	10YR 5/3	100	-	-	-	-	silty clay	fine granular

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) (**LRR C**)
- ____ 1 cm Muck (A9) (**LRR D**)
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) (**LRR C**)
- ____ 2 cm Muck (A10) (**LRR B**)
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: No: X

Remarks: No redox observed. Crumbling hillslope with rock and gravel mixed in.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- _____ Water Marks (B1) (**Riverine**)
- _____ Sediment Deposits (B2) (**Riverine**)
- _____ Drift Deposits (B3) (**Riverine**)
- _____ Drainage patterns (B10)
- _____ Dry-Season Water Table (C2)
- _____ Crayfish Burrows (C8)
- _____ Saturation Visible on Aerial Imagery (C9)
- _____ Shallow Aquitard (D3)
- FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ____ No X Depth (inches): _____

Water Table Present? Yes: ____ No X Depth (inches): _____

Saturation Present? (incl. capillary fringe) Yes: ____ No X Depth (inches): _____

Wetland Hydrology Present? Yes: No: X

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Dry.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: May 22, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W09
Investigator(s): Jeff Bolce, Dennis Wenger, Collin Covington	Section, Township, Range: 25, 39S, 6W	
Landform (hillslope, terrace, etc.): drainage floor	Local relief (concave, convex, none): none	Slope (%): 1
Subregion (LRR): D	Easting: 369571	Northing: 4139257 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X	No: (If no, explain in Remarks.)	
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X	No:
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes: X	No:	**Is the Sampled Area within a Wetland?** **Yes:** **No: X**
Hydric Soil Present?	Yes:	No: X	
Wetland Hydrology Present?	Yes:	No: X	

Remarks: Drainage swale. Photos of site: 908 - soil, 909 - west, 910 - east

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Juncus arcticus	50	Y	FACW
2. Poa pratensis	40	Y	FAC
3. Bromus inermis	10	N	FACU
4. Achillea millefolium	5	N	FACU
5. Taraxacum officinale	TR	N	UPL
6.			
7.			
8.			
	105	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
	Total Cover: 0		

% Bare Ground in Herb Stratum 0 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:	50	x 2 =	100
FAC species:	40	x 3 =	120
FACU species:	15	x 4 =	60
UPL species:		x 5 =	0
Column Totals:	105 (A)		280 (B)

Prevalence Index = B/A = 2.67

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

X Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes: X** **No:**

Remarks: Wetland plant community

SOILS

Sampling Point: W09

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features					
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 3	10YR 5/2	100	-	-	-	-	silty clay	densely rooted
3 - 9	10YR 5/2	100	-	-	-	-	silty clay	granular and gravels

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) **(LRR C)**
- ____ 1 cm Muck (A9) **(LRR D)**
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) **(LRR C)**
- ____ 2 cm Muck (A10) **(LRR B)**
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: Gravels

Depth (inches): 9

Hydric Soil Present? Yes: No: X

Remarks: No redox observed. Friable and fluvial material.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- _____ Water Marks (B1) **(Riverine)**
- _____ Sediment Deposits (B2) **(Riverine)**
- _____ Drift Deposits (B3) **(Riverine)**
- _____ Drainage patterns (B10)
- _____ Dry-Season Water Table (C2)
- _____ Crayfish Burrows (C8)
- _____ Saturation Visible on Aerial Imagery (C9)
- _____ Shallow Aquitard (D3)
- FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ____ No X Depth (inches): _____

Water Table Present? Yes: ____ No X Depth (inches): _____

Saturation Present? (incl. capillary fringe) Yes: ____ No X Depth (inches): _____

Wetland Hydrology Present? Yes: No: X

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: No hydrology observed. Site was dry and friable.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: May 22, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W10A
Investigator(s): Jeff Boice, Dennis Wenger, Collin Covington	Section, Township, Range: 19, 39S, 5W	
Landform (hillslope, terrace, etc.): drainage floor	Local relief (concave, convex, none): concave	Slope (%): 4
Subregion (LRR): D	Easting: 370575	Northing: 4140637 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X	No: (If no, explain in Remarks.)	
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X	No:
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes: X	No:	**Is the Sampled Area within a Wetland?**	**Yes: X** **No:**
Hydric Soil Present?	Yes: X	No:		
Wetland Hydrology Present?	Yes: X	No:		

Remarks: Seep in drainage at the top of Ephemeral Stream Channel 7. Pools of standing water present in drainage. Photos of site: 911 - soil, 912 - south, 913 - west.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Juncus arcticus	60	Y	FACW
2. Carex microptera	30	Y	FAC
3. Poa pratensis	10	N	FAC
4.			
5.			
6.			
7.			
8.			
	100	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
Total Cover:	0		

% Bare Ground in Herb Stratum 0 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:	60	x 2 =	120
FAC species:	40	x 3 =	120
FACU species:		x 4 =	0
UPL species:		x 5 =	0
Column Totals:	100 (A)		240 (B)

Prevalence Index = B/A = 2.40

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

X Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes: X** **No:**

Remarks: Wetland vegetation community.

SOILS

Sampling Point: W10A

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type[1]	Redox Features Loc[2]	Texture	Remarks
0 - 18	10YR 5/1	98	10YR 5/6	2	C	M	clay	dense and sticky

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- X Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: X No:

Remarks: Roots present throughout.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- X Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ **Drift Deposits (B3) (Riverine)**
- ___ Drainage patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ___ No X Depth (inches): ___

Water Table Present? Yes: ___ No X Depth (inches): ___

Saturation Present? (incl. capillary fringe) Yes: ___ No X Depth (inches): ___

Wetland Hydrology Present? Yes: X No:

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Soil column is moist, not saturated. It is assumed that early season water levels are sufficient to support wetland conditions.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: May 22, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W10B
Investigator(s): Jeff Boice, Dennis Wenger, Collin Covington	Section, Township, Range: 19, 39S, 5W	
Landform (hillslope, terrace, etc.): hillslope	Local relief (concave, convex, none): none	Slope (%): 75
Subregion (LRR): D	Easting: 370573 Northing: 4140637	Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X No: (If no, explain in Remarks.)		
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X No:	
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes:	No: X	**Is the Sampled Area within a Wetland?** **Yes:** **No: X**
Hydric Soil Present?	Yes:	No: X	
Wetland Hydrology Present?	Yes:	No: X	

Remarks: Hillslope to drainage bottom. Approximately 4 feet above the wetland sample point. Photos of site: 913 - west, 914 - soil, 915 - north.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size: 6' x 6')	Absolute % Cover	Dominant Species?	Indicator Status
1. Pinus edulis	5	Y	UPL
2.			
3.			
4.			
	5	= Total Cover	
Sapling/Shrub Stratum (Plot Size:)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Juncus arcticus	10	Y	FACW
2. Bromus inermis	3	Y	FACU
3. Fabaceae sp.	2	N	-
4.			
5.			
6.			
7.			
8.			
	15	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
Total Cover: 0			
% Bare Ground in Herb Stratum 85	% Cover of Biotic Crust		

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 33.3 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:	10	x 2 =	20
FAC species:		x 3 =	0
FACU species:	3	x 4 =	12
UPL species:	5	x 5 =	25
Column Totals:	18 (A)		57 (B)

Prevalence Index = B/A = 3.17

Hydrophytic Vegetation Indicators:

Dominance Test >50%

Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes:** **No: X**

Remarks: Upland vegetation community.

SOILS

Sampling Point: W10B

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type[1]	Redox Features Loc[2]	Texture	Remarks
0 - 18	2.5Y 5/2	100	-	-	-	-	clay	fine granular

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: No: X

Remarks: No redox observed

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ___ No X Depth (inches): ___

Water Table Present? Yes: ___ No X Depth (inches): ___

Saturation Present? (incl. capillary fringe) Yes: ___ No X Depth (inches): ___

Wetland Hydrology Present? Yes: No: X

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Dry

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: May 23, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W11A
Investigator(s): Jeff Boice, Dennis Wenger, Collin Covington	Section, Township, Range: 24, 39S, 6W	
Landform (hillslope, terrace, etc.): drainage floor	Local relief (concave, convex, none): concave	Slope (%): 1
Subregion (LRR): D	Easting: 368871	Northing: 4140989 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X	No: (If no, explain in Remarks.)	
Are Vegetation: X , Soil: X , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X	No:
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes: X	No:	**Is the Sampled Area within a Wetland?**	**Yes: X** **No:**
Hydric Soil Present?	Yes: X	No:		
Wetland Hydrology Present?	Yes: X	No:		

Remarks: The upland terrace of Pinyon / Juniper trees had been cleared and pushed into the drainage and wetland. The wetland is approximately 8 feet wide. Photos of site: 919 - soil and 920 - west

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Juncus arcticus	85	Y	FACW
2. Taraxacum officinale	10	N	FACU
3. Carex nebrascensis	3	N	OBL
4. Poa pratensis	2	N	FAC
5.			
6.			
7.			
8.			
	100	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
	Total Cover: 0		

% Bare Ground in Herb Stratum 0 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:	3	x 1=	3
FACW species:	85	x 2 =	170
FAC species:	2	x 3 =	6
FACU species:	10	x 4 =	40
UPL species:		x 5 =	0
Column Totals:	100 (A)		219 (B)

Prevalence Index = B/A = 2.19

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

X Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes: X** **No:**

Remarks: Wetland plant community.

SOILS

Sampling Point: W11A

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features					
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 18	10YR 4/1	99	10YR 5/6	1	C	M	clay	sticky

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- X Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) **(LRR C)**
- ____ 1 cm Muck (A9) **(LRR D)**
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) **(LRR C)**
- ____ 2 cm Muck (A10) **(LRR B)**
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: X No:

Remarks: -

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- X Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- _____ Water Marks (B1) **(Riverine)**
- _____ Sediment Deposits (B2) **(Riverine)**
- _____ Drift Deposits (B3) **(Riverine)**
- _____ Drainage patterns (B10)
- _____ Dry-Season Water Table (C2)
- _____ Crayfish Burrows (C8)
- _____ Saturation Visible on Aerial Imagery (C9)
- _____ Shallow Aquitard (D3)
- FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes:	____	No	X	Depth (inches):	____
Water Table Present?	Yes:	X	No	____	Depth (inches):	8
Saturation Present? (incl. capillary fringe)	Yes:	X	No		Depth (inches):	0

Wetland Hydrology Present? Yes: X No:

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Wetland hydrology

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: May 23, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W11B
Investigator(s): Jeff Boice, Dennis Wenger, Collin Covington	Section, Township, Range: 24, 39S, 6W	
Landform (hillslope, terrace, etc.): hillslope	Local relief (concave, convex, none): none	Slope (%): 35
Subregion (LRR): D	Easting: 368873	Northing: 4140989	Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X	No:	(If no, explain in Remarks.)	
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X	No:
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes:	No: X	**Is the Sampled Area within a Wetland?** **Yes:** **No: X**
Hydric Soil Present?	Yes:	No: X	
Wetland Hydrology Present?	Yes:	No: X	

Remarks: Fill material pushed downslope from upgradient road grading, native material. Approximately 2 feet above the wetland sample point. Photos of site: 921 - sample point

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:_____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size: 6' x 6')			
1. Artemisia tridentata	5	Y	UPL
2.			
3.			
4.			
	5	= Total Cover	
Herb Stratum (Plot Size:_____)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	0	= Total Cover	
Woody Vine Stratum (Plot Size:_____)			
1.			
2.			
	Total Cover: 0		
% Bare Ground in Herb Stratum 95	% Cover of Biotic Crust_____		

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0 (A/B)

Prevalence Index Worksheet:

Total % Cover of:	Multiply by:	
OBL species:	x 1=	0
FACW species:	x 2 =	0
FAC species:	x 3 =	0
FACU species:	x 4 =	0
UPL species: 5	x 5 =	25
Column Totals: 5 (A)		25 (B)

Prevalence Index = B/A = 5.00

Hydrophytic Vegetation Indicators:

Dominance Test >50%

Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes:** **No: X**

Remarks: Herbaceous plants had been buried.

SOILS

Sampling Point: W11B

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 18	10YR 4/2	100	-	-	-	-	clay	fine granular

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) **(LRR C)**
- ____ 1 cm Muck (A9) **(LRR D)**
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) **(LRR C)**
- ____ 2 cm Muck (A10) **(LRR B)**
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: No: X

Remarks: Native material

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- _____ Water Marks (B1) **(Riverine)**
- _____ Sediment Deposits (B2) **(Riverine)**
- _____ Drift Deposits (B3) **(Riverine)**
- _____ Drainage patterns (B10)
- _____ Dry-Season Water Table (C2)
- _____ Crayfish Burrows (C8)
- _____ Saturation Visible on Aerial Imagery (C9)
- _____ Shallow Aquitard (D3)
- FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ____ No X Depth (inches): _____

Water Table Present? Yes: ____ No X Depth (inches): _____

Saturation Present? (incl. capillary fringe) Yes: ____ No X Depth (inches): _____

Wetland Hydrology Present? Yes: No: X

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Friable and dry.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: May 23, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W12A
Investigator(s): Jeff Boice, Dennis Wenger, Collin Covington	Section, Township, Range: 13, 39S, 6W	
Landform (hillslope, terrace, etc.): drainage floor	Local relief (concave, convex, none): none	Slope (%): 1
Subregion (LRR): D	Easting: 369356 Northing: 4141669	Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X No: (If no, explain in Remarks.)		
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X No:	
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes: X No:	**Is the Sampled Area within a Wetland?**	**Yes: X** **No:**
Hydric Soil Present? Yes: X No:		
Wetland Hydrology Present? Yes: X No:		

Remarks: Adjacent to intermittent stream channel 2. Photos of site: 926 - soil, 927 - north, 928 - east

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:_____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:_____)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Juncus arcticus	60	Y	FACW
2. Eleocharis palustris	15	N	OBL
3. Hordeum jubatum	15	N	FAC
4. Kochia scoparia	5	N	UPL
5.			
6.			
7.			
8.			
	95	= Total Cover	
Woody Vine Stratum (Plot Size:_____)			
1.			
2.			
Total Cover: 0			
% Bare Ground in Herb Stratum 5	% Cover of Biotic Crust		

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:	15	x 1=	15
FACW species:	60	x 2 =	120
FAC species:	15	x 3 =	45
FACU species:		x 4 =	0
UPL species:	5	x 5 =	25
Column Totals:	95 (A)		205 (B)

Prevalence Index = B/A = 2.16

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

X Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes: X** **No:**

Remarks: Wetland plant community.

SOILS

Sampling Point: W12A

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0 - 12	10YR 5/2	50	7.5YR 4/6	50	C	M	sandy clay	-
12 - 18	7.5YR 2.5/1	60	7.5YR 4/6	40	C	PL	clay	-

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (Inches):

Hydric Soil Present? Yes: X No:

Remarks: -

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- X Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- Water-Stained Leaves (B9)
- X Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ___ No X Depth (Inches): ___

Water Table Present? Yes: ___ No X Depth (Inches): ___

Saturation Present? (incl. capillary fringe) Yes: ___ No X Depth (Inches): ___

Wetland Hydrology Present? Yes: X No:

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Soil column is moist. It is assumed that early season water levels are sufficient to support wetland conditions.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: May 23, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W12B
Investigator(s): Jeff Boice, Dennis Wenger, Collin Covington	Section, Township, Range: 13, 39S, 6W	
Landform (hillslope, terrace, etc.): terrace	Local relief (concave, convex, none): none	Slope (%): 1
Subregion (LRR): D	Easting: 369361	Northing: 4141670 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X	No: (If no, explain in Remarks.)	
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X	No:
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes:	No: X	**Is the Sampled Area within a Wetland?** Yes: No: X
Hydric Soil Present?	Yes:	No: X	
Wetland Hydrology Present?	Yes:	No: X	

Remarks: On terrace adjacent to wetland and hillslope into drainage. Photos of site: 929 - soil and 930 - west.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Kochia scoparia	30	Y	UPL
2. Pascopyrum smithii	30	Y	FAC
3. Achillea millefolium	10	N	FACU
4.			
5.			
6.			
7.			
8.			
	70	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
Total Cover:	0		

% Bare Ground in Herb Stratum 30 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:		x 2 =	0
FAC species:	30	x 3 =	90
FACU species:	10	x 4 =	40
UPL species:	30	x 5 =	150
Column Totals:	70 (A)		280 (B)

Prevalence Index = B/A = 4.00

Hydrophytic Vegetation Indicators:

Dominance Test >50%

Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes: No: X

Remarks: Upland plant community.

SOILS

Sampling Point: W12B

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features					
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 10	10YR 5/2	100	-	-	-	-	sandy loam	angular, granular
10 - 18	10YR 5/2	80	10YR 5/6	20	C	M	clay	fine granular

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) (**LRR C**)
- ____ 1 cm Muck (A9) (**LRR D**)
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) (**LRR C**)
- ____ 2 cm Muck (A10) (**LRR B**)
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: No: X

Remarks: No redox present in upper 10 inches of the profile. Redox is too deep to qualify for a depleted matrix.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- _____ Water Marks (B1) (**Riverine**)
- _____ Sediment Deposits (B2) (**Riverine**)
- _____ Drift Deposits (B3) (**Riverine**)
- _____ Drainage patterns (B10)
- _____ Dry-Season Water Table (C2)
- _____ Crayfish Burrows (C8)
- _____ Saturation Visible on Aerial Imagery (C9)
- _____ Shallow Aquitard (D3)
- FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ____ No X Depth (inches): _____

Water Table Present? Yes: ____ No X Depth (inches): _____

Saturation Present? (incl. capillary fringe) Yes: ____ No X Depth (inches): _____

Wetland Hydrology Present? Yes: No: X

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Dry and friable.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: May 23, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W13A
Investigator(s): Jeff Boice, Dennis Wenger, Collin Covington	Section, Township, Range: 13, 39S, 6W	
Landform (hillslope, terrace, etc.): drainage floor	Local relief (concave, convex, none): none	Slope (%): 1
Subregion (LRR): D	Easting: 369279	Northing: 4141903 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X No: (If no, explain in Remarks.)		
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X No:	
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes: X No:	Is the Sampled Area within a Wetland? Yes: X No:	
Hydric Soil Present? Yes: X No:		
Wetland Hydrology Present? Yes: X No:		

Remarks: Adjacent to Intermittent Stream Channel 2. Photos of site: 938 - soil, 939 - west, 940 - north

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:_____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:_____)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Juncus arcticus	75	Y	FACW
2. Hordeum jubatum	25	Y	FAC
3. Medicago sativa	TR	N	UPL
4.			
5.			
6.			
7.			
8.			
	100	= Total Cover	
Woody Vine Stratum (Plot Size:_____)			
1.			
2.			
Total Cover: 0			
% Bare Ground in Herb Stratum 0	% Cover of Biotic Crust_____		

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:	75	x 2 =	150
FAC species:	25	x 3 =	75
FACU species:		x 4 =	0
UPL species:		x 5 =	0
Column Totals:	100 (A)		225 (B)

Prevalence Index = B/A = 2.25

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

X Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes: X No:

Remarks: Wetland plant community

SOILS

Sampling Point: W13A

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 11	10YR 5/2	80	7.5YR 4/6	20	C	M	clay	granular
11 - 18	2.5YR 4/1	65	7.5YR 4/6	20	C	M	clay	granular
"	10YR 5/2	15						

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___ Histosol (A1)	___ Sandy Redox (S5)	___ 1 cm Muck (A9) **(LRR C)**
___ Histic Epipedon (A2)	___ Stripped Matrix (S6)	___ 2 cm Muck (A10) **(LRR B)**
___ Black Histic (A3)	___ Loamy Mucky Mineral **(F1)**	___ Reduced Vertic (F18)
___ Hydrogen Sulfide (A4)	___ Loamy Gleyed Matrix (F2)	___ Red Parent Material (TF2)
___ Stratified Layers (A5) **(LRR C)**	_X_ Depleted Matrix (F3)	___ Other (Explain in Remarks)
___ 1 cm Muck (A9) **(LRR D)**	___ Redox Dark Surface (F6)	
___ Depleted Below Dark Surface (A11)	___ Depleted Dark Surface (F7)	
___ Thick Dark Surface (A12)	___ Redox Depressions (F8)	
___ Sandy Mucky Mineral (S1)	___ Vernal Pools (F9)	
___ Sandy Gleyed Matrix (S4)		

Indicators for Problematic Hydric Soils[3]:

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: X No:

Remarks: Gravel and wood material found below 11 inches mixed into the clay.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)		Secondary Indicators (2 or more required)
___ Surface Water (A1)	___ Salt Crust (B11)	___ Water Marks (B1) **(Riverine)**
___ High Water Table (A2)	___ Biotic Crust (B12)	___ Sediment Deposits (B2) **(Riverine)**
___ Saturation (A3)	___ Aquatic Invertebrates (B13)	___ Drift Deposits (B3) **(Riverine)**
___ Water Marks (B1) **(Nonriverine)**	___ Hydrogen Sulfide Odor (C1)	___ Drainage patterns (B10)
___ Sediment Deposits (B2) **(Nonriverine)**	___ Oxidized Rhizospheres along Living Roots	___ Dry-Season Water Table (C2)
___ Drift Deposits (B3) **(Nonriverine)**	___ Presence of Reduced Iron (C4)	___ Crayfish Burrows (C8)
___ Surface Soil Cracks (B6)	___ Recent Iron Reduction in Plowed Soils (C6)	___ Saturation Visible on Aerial Imagery (C9)
___ Inundation Visible on Aerial Imagery (B7)	___ Thin Muck Surface (C7)	___ Shallow Aquitard (D3)
___ Water-Stained Leaves (B9)	___ Other (Explain in Remarks)	___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ___ No _X_ Depth (inches): ___

Water Table Present? Yes: ___ No _X_ Depth (inches): ___

Saturation Present? (incl. capillary fringe) Yes: ___ No X Depth (inches): ___

Wetland Hydrology Present? Yes: X No:

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Soil is moist. It is assumed that early season water levels are sufficient to support wetland conditions.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: May 23, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W13B
Investigator(s): Jeff Boice, Dennis Wenger, Collin Covington	Section, Township, Range: 13, 39S, 6W	
Landform (hillslope, terrace, etc.): hillslope	Local relief (concave, convex, none): none	Slope (%): 5
Subregion (LRR): D	Easting: 369264	Northing: 4141903 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X	No: (If no, explain in Remarks.)	
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X	No:
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes:	No: X	**Is the Sampled Area within a Wetland?** **Yes:** **No: X**
Hydric Soil Present?	Yes:	No: X	
Wetland Hydrology Present?	Yes:	No: X	

Remarks: On the side of the channel bottom near the base of the slope. Approximately 12 inches higher in elevation than the wetland sample point. Photos in site: 941 - slope and 942 - east.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size: 6' x 6')			
1. Artemisia tridentata	20	Y	UPL
2. Chrysothamnus nauseosus	20	Y	UPL
3.			
4.			
	40	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Juncus arcticus	15	Y	FACW
2. Medicago sativa	15	Y	UPL
3. Achillea millefolium	10	N	FACU
4. Pascopyrum smithii	10	N	FAC
5. Bromus inermis	2	N	FACU
6. Taraxacum officinale	2	N	FACU
7.			
8.			
	54	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
Total Cover: 0			

% Bare Ground in Herb Stratum 46 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 25 (A/B)

Prevalence Index Worksheet:

Total % Cover of:	Multiply by:	
OBL species:	x 1=	0
FACW species: 15	x 2 =	30
FAC species: 10	x 3 =	30
FACU species: 14	x 4 =	56
UPL species: 55	x 5 =	275
Column Totals: 94 (A)		391 (B)

Prevalence Index = B/A = 4.16

Hydrophytic Vegetation Indicators:

Dominance Test >50%

Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes:** **No: X**

Remarks: Upland plant community

SOILS

Sampling Point: W13B

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0 - 12	10YR 5/2	100	-	-	-	-	clay	fine granular
12 - 18	10YR 4/2	99	7.5 YR 4/6	1	C	M	clay	fine granular

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) **(LRR C)**
- ____ 1 cm Muck (A9) **(LRR D)**
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) **(LRR C)**
- ____ 2 cm Muck (A10) **(LRR B)**
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: No: X

Remarks: No redox within the top 10 inches. Does not meet the F3 requirements.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- _____ Water Marks (B1) **(Riverine)**
- _____ Sediment Deposits (B2) **(Riverine)**
- _____ Drift Deposits (B3) **(Riverine)**
- _____ Drainage patterns (B10)
- _____ Dry-Season Water Table (C2)
- _____ Crayfish Burrows (C8)
- _____ Saturation Visible on Aerial Imagery (C9)
- _____ Shallow Aquitard (D3)
- FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ____ No X Depth (inches): _____

Water Table Present? Yes: ____ No X Depth (inches): _____

Saturation Present? (incl. capillary fringe) Yes: ____ No X Depth (inches): _____

Wetland Hydrology Present? Yes: No: X

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Dry and friable

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: May 23, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W14A
Investigator(s): Jeff Boice, Dennis Wenger, Collin Covington	Section, Township, Range: 24, 39S, 6W	
Landform (hillslope, terrace, etc.): drainage floor	Local relief (concave, convex, none): none	Slope (%): 1
Subregion (LRR): D	Easting: 369484 Northing: 4141328	Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X No: (If no, explain in Remarks.)		
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X No:	
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes: X No:	**Is the Sampled Area within a Wetland? Yes: X No:**	
Hydric Soil Present? Yes: X No:		
Wetland Hydrology Present? Yes: X No:		

Remarks: Adjacent to Intermittent Stream Channel 2. Photos of site: 943 - soil, 944 - east, 945 - north

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:_____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:_____)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Juncus arcticus	55	Y	FACW
2. Carex microptera	35	Y	FAC
3. Hordeum jubatum	10	N	FAC
4.			
5.			
6.			
7.			
8.			
	100	= Total Cover	
Woody Vine Stratum (Plot Size:_____)			
1.			
2.			
Total Cover: 0			
% Bare Ground in Herb Stratum 0	% Cover of Biotic Crust_____		

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:	60	x 2 =	120
FAC species:	45	x 3 =	135
FACU species:		x 4 =	0
UPL species:		x 5 =	0
Column Totals:	105 (A)		255 (B)

Prevalence Index = B/A = 2.43

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

X Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes: X No:

Remarks: Wetland plant community

SOILS

Sampling Point: W14A

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 1	10YR 4/2	100	-	-	-	-	clay	-
1 - 17	10YR 4/2	75	7.5YR 4/4	25	C	M	clay	organics and roots present
17 - 18	Gley 1 4/10Y	75	7.5YR 4/4	25	C	M	clay	-

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___ Histosol (A1)	___ Sandy Redox (S5)	
___ Histic Epipedon (A2)	___ Stripped Matrix (S6)	
___ Black Histic (A3)	___ Loamy Mucky Mineral (F1)	
___ Hydrogen Sulfide (A4)	___ Loamy Gleyed Matrix (F2)	
___ Stratified Layers (A5) (**LRR C**)	_X_ Depleted Matrix (F3)	
___ 1 cm Muck (A9) (**LRR D**)	___ Redox Dark Surface (F6)	
___ Depleted Below Dark Surface (A11)	___ Depleted Dark Surface (F7)	
___ Thick Dark Surface (A12)	___ Redox Depressions (F8)	
___ Sandy Mucky Mineral (S1)	___ Vernal Pools (F9)	
___ Sandy Gleyed Matrix (S4)		

Indicators for Problematic Hydric Soils[3]:

___ 1 cm Muck (A9) (**LRR C**)
___ 2 cm Muck (A10) (**LRR B**)
___ Reduced Vertic (F18)
___ Red Parent Material (TF2)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: X No:

Remarks: Column is tightly packed together

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)		Secondary Indicators (2 or more required)
___ Surface Water (A1)	___ Salt Crust (B11)	___ Water Marks (B1) (**Riverine**)
___ High Water Table (A2)	___ Biotic Crust (B12)	___ Sediment Deposits (B2) (**Riverine**)
___ Saturation (A3)	___ Aquatic Invertebrates (B13)	___ Drift Deposits (B3) (**Riverine**)
___ Water Marks (B1) (**Nonriverine**)	___ Hydrogen Sulfide Odor (C1)	___ Drainage patterns (B10)
___ Sediment Deposits (B2) (**Nonriverine**)	___ Oxidized Rhizospheres along Living Roots	___ Dry-Season Water Table (C2)
___ Drift Deposits (B3) (**Nonriverine**)	___ Presence of Reduced Iron (C4)	___ Crayfish Burrows (C8)
___ Surface Soil Cracks (B6)	___ Recent Iron Reduction in Plowed Soils (C6)	___ Saturation Visible on Aerial Imagery (C9)
___ Inundation Visible on Aerial Imagery (B7)	___ Thin Muck Surface (C7)	___ Shallow Aquitard (D3)
___ Water-Stained Leaves (B9)	___ Other (Explain in Remarks)	___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ___ No _X_ Depth (inches): ___

Water Table Present? Yes: ___ No _X_ Depth (inches): ___

Saturation Present? (incl. capillary fringe) Yes: ___ No X Depth (inches): ___

Wetland Hydrology Present? Yes: X No:

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Soil column was dry. It is assumed that early season water levels are sufficient to support wetland conditions.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: May 23, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W14B
Investigator(s): Jeff Boice, Dennis Wenger, Collin Covington	Section, Township, Range: 24, 39S, 6W	
Landform (hillslope, terrace, etc.): terrace	Local relief (concave, convex, none): none	Slope (%): 1
Subregion (LRR): D	Easting: 369493	Northing: 4141326 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X	No: (If no, explain in Remarks.)	
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X	No:
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes:	No: X	**Is the Sampled Area within a Wetland?** Yes: No: X
Hydric Soil Present?	Yes:	No: X	
Wetland Hydrology Present?	Yes:	No: X	

Remarks: Toe of high terrace slop in the uplands adjacent to drainage floor. 948 - soil, 949 - south, 950 - west

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size: 6' x 6')			
1. Artemisia tridentata	5	Y	UPL
2.			
3.			
4.			
	5	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Achillea millefolium	20	Y	FACU
2. Poa pratensis	20	Y	FAC
3. Pascopyrum smithii	15	Y	FAC
4. Taraxacum officinale	15	Y	FACU
5. Grindelia squarrosa	5	N	FACU
6. Chenopodium sp.	TR	N	-
7.			
8.			
	75	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
Total Cover:	0		

% Bare Ground in Herb Stratum 25 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 40 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:		x 2 =	0
FAC species:	35	x 3 =	105
FACU species:	40	x 4 =	160
UPL species:	5	x 5 =	25
Column Totals:	80 (A)		290 (B)

Prevalence Index = B/A = 3.63

Hydrophytic Vegetation Indicators:

- Dominance Test >50%
- Prevalence Index is ≤3.0[1]
- Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes: No: X

Remarks: Upland plant community

SOILS

Sampling Point: W14B

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]		
0 - 13	10YR 4/2	100	-	-	-	-	clay	fine granular
13 - 18	10YR 5/2	99	10YR 5/6	>1	C	M	clay	fine granular

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) (**LRR C**)
- ____ 1 cm Muck (A9) (**LRR D**)
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) (**LRR C**)
- ____ 2 cm Muck (A10) (**LRR B**)
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: No: X

Remarks: No redox in upper 10 inches of the soil column and the redox in the column is less than 1%.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- _____ Water Marks (B1) (**Riverine**)
- _____ Sediment Deposits (B2) (**Riverine**)
- _____ Drift Deposits (B3) (**Riverine**)
- _____ Drainage patterns (B10)
- _____ Dry-Season Water Table (C2)
- _____ Crayfish Burrows (C8)
- _____ Saturation Visible on Aerial Imagery (C9)
- _____ Shallow Aquitard (D3)
- FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ____ No _X_ Depth (inches): _____

Water Table Present? Yes: ____ No _X_ Depth (inches): _____

Saturation Present? (incl. capillary fringe) Yes: ____ No X Depth (inches):

Wetland Hydrology Present? Yes: No: X

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Dry in upper portion of column and the lower portion is moist.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: May 23, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W15A
Investigator(s): Jeff Boice, Dennis Wenger, Collin Covington	Section, Township, Range: 24, 39S, 6W	
Landform (hillslope, terrace, etc.): drainage floor	Local relief (concave, convex, none): none	Slope (%): 1
Subregion (LRR): D	Easting: 369494 Northing: 4141210	Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X No: (If no, explain in Remarks.)		
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X No:	
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes: X No:	Is the Sampled Area within a Wetland? Yes: X No:	
Hydric Soil Present? Yes: X No:		
Wetland Hydrology Present? Yes: X No:		

Remarks: Adjacent to intermittent stream channel 2. Photos of site: 951 - soil and 952 - south.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:_____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:_____)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Carex praegracilis	45	Y	FACW
2. Juncus arcticus	25	Y	FACW
3. Hordeum jubatum	10	N	FAC
4. Grindelia squarrosa	5	N	FACU
5. Taraxacum officinale	TR	N	FACU
6.			
7.			
8.			
	85	= Total Cover	
Woody Vine Stratum (Plot Size:_____)			
1.			
2.			
	Total Cover: 0		
% Bare Ground in Herb Stratum 15	% Cover of Biotic Crust_____		

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:	70	x 2 =	140
FAC species:	10	x 3 =	30
FACU species:	5	x 4 =	20
UPL species:		x 5 =	0
Column Totals:	85 (A)		190 (B)

Prevalence Index = B/A = 2.24

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

X Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes: X No:

Remarks: Wetland plant community.

SOILS

Sampling Point: W15A

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features					
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 11	10YR 5/1	80	10YR 5/4	20	C	M	clay	-
11 - 18	10YR 5/1	50	10YR 5/4	50	C	M	clay	-

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: X No:

Remarks: More redox in the deeper parts of the column that vary between 20% and 50% in density. Roots present throughout the column. Between 10" and 11" there is soil stratification.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ___ No X Depth (inches): ___

Water Table Present? Yes: ___ No X Depth (inches): ___

Saturation Present? (incl. capillary fringe) Yes: No X Depth (inches):

Wetland Hydrology Present? Yes: X No:

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Dry. It is assumed that early season water levels are sufficient to support wetland conditions. Sample point is located approximately 12' from a transient channel off of Intermittent Stream Channel 2.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: May 23, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W15B
Investigator(s): Jeff Boice, Dennis Wenger, Collin Covington	Section, Township, Range: 24, 39S, 6W	
Landform (hillslope, terrace, etc.): drainage floor	Local relief (concave, convex, none): none	Slope (%): 1
Subregion (LRR): D	Easting: 369491 Northing: 4141212	Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X No: (If no, explain in Remarks.)		
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X No:	
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes: X No:	Is the Sampled Area within a Wetland?	Yes: X No:
Hydric Soil Present? Yes: X No:		
Wetland Hydrology Present? Yes: X No:		

Remarks: Adjacent to Intermittent Stream Channel 2. Photos of site: 953 - soil and 954 - south.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:_____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:_____)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Grindelia squarrosa	30	Y	FACU
2. Juncus arcticus	20	Y	FACW
3. Poa pratensis	20	Y	FAC
4. Hordeum jubatum	5	N	FAC
5. Taraxacum officinale	5	N	FACU
6.			
7.			
8.			
	80	= Total Cover	
Woody Vine Stratum (Plot Size:_____)			
1.			
2.			
Total Cover: 0			
% Bare Ground in Herb Stratum 20	% Cover of Biotic Crust_____		

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 66.7 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:	20	x 2 =	40
FAC species:	25	x 3 =	75
FACU species:	35	x 4 =	140
UPL species:		x 5 =	0
Column Totals:	80 (A)		255 (B)

Prevalence Index = B/A = 3.19

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes: X No:

Remarks: Marginal wetland plant community.

SOILS

Sampling Point: W15B

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 18	10YR 4/1	85	10YR 5/6	15	C	M	clay	-

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___ Histosol (A1)	___ Sandy Redox (S5)	___ 1 cm Muck (A9) (**LRR C**)
___ Histic Epipedon (A2)	___ Stripped Matrix (S6)	___ 2 cm Muck (A10) (**LRR B**)
___ Black Histic (A3)	___ Loamy Mucky Mineral (F1)	___ Reduced Vertic (F18)
___ Hydrogen Sulfide (A4)	___ Loamy Gleyed Matrix (F2)	___ Red Parent Material (TF2)
___ Stratified Layers (A5) (**LRR C**)	_X_ Depleted Matrix (F3)	___ Other (Explain in Remarks)
___ 1 cm Muck (A9) (**LRR D**)	___ Redox Dark Surface (F6)	
___ Depleted Below Dark Surface (A11)	___ Depleted Dark Surface (F7)	
___ Thick Dark Surface (A12)	___ Redox Depressions (F8)	
___ Sandy Mucky Mineral (S1)	___ Vernal Pools (F9)	
___ Sandy Gleyed Matrix (S4)		

Indicators for Problematic Hydric Soils[3]:

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: X No:

Remarks: -

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)		Secondary Indicators (2 or more required)
___ Surface Water (A1)	___ Salt Crust (B11)	___ Water Marks (B1) (**Riverine**)
___ High Water Table (A2)	___ Biotic Crust (B12)	___ Sediment Deposits (B2) (**Riverine**)
___ Saturation (A3)	___ Aquatic Invertebrates (B13)	___ Drift Deposits (B3) (**Riverine**)
___ Water Marks (B1) (**Nonriverine**)	___ Hydrogen Sulfide Odor (C1)	___ Drainage patterns (B10)
___ Sediment Deposits (B2) (**Nonriverine**)	___ Oxidized Rhizospheres along Living Roots	___ Dry-Season Water Table (C2)
___ Drift Deposits (B3) (**Nonriverine**)	___ Presence of Reduced Iron (C4)	___ Crayfish Burrows (C8)
___ Surface Soil Cracks (B6)	___ Recent Iron Reduction in Plowed Soils (C6)	___ Saturation Visible on Aerial Imagery (C9)
___ Inundation Visible on Aerial Imagery (B7)	___ Thin Muck Surface (C7)	___ Shallow Aquitard (D3)
___ Water-Stained Leaves (B9)	___ Other (Explain in Remarks)	___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ___ No _X_ Depth (inches): ___

Water Table Present? Yes: ___ No _X_ Depth (inches): ___

Saturation Present? (Incl. capillary fringe) Yes: ___ No X Depth (inches): ___

Wetland Hydrology Present? Yes: X No:

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Dry. It is assumed that early season water levels are sufficient to support wetland conditions.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: May 23, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W15C
Investigator(s): Jeff Boice, Dennis Wenger, Collin Covington	Section, Township, Range: 24, 39S, 6W	
Landform (hillslope, terrace, etc.): terrace	Local relief (concave, convex, none): none	Slope (%): 1
Subregion (LRR): D	Easting: 369480 Northing: 4141208	Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X No: (If no, explain in Remarks.)		
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X No:	
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes:	No: X	**Is the Sampled Area within a Wetland?** **Yes:** **No: X**
Hydric Soil Present?	Yes:	No: X	
Wetland Hydrology Present?	Yes:	No: X	

Remarks: Slightly higher in elevation than the adjacent wetland sample points. Photos of site: 955 - soil and 956 - east.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Convolvulus arvensis	35	Y	UPL
2. Poa pratensis	20	Y	FAC
3. Grindelia squarrosa	20	Y	FACU
4. Bromus tectorum	15	N	UPL
5. Achillea millefolium	2	N	FACU
6. Thinopyrum intermedium	TR	N	UPL
7.			
8.			
	92	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
Total Cover: 0			
% Bare Ground in Herb Stratum 8	% Cover of Biotic Crust		

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 33.3 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:		x 2 =	0
FAC species:	20	x 3 =	60
FACU species:	22	x 4 =	88
UPL species:	50	x 5 =	250
Column Totals:	92 (A)		398 (B)

Prevalence Index = B/A = 4.33

Hydrophytic Vegetation Indicators:

- Dominance Test >50%
- Prevalence Index is ≤3.0[1]
- Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes:** **No: X**

Remarks: -

SOILS

Sampling Point: W15C

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]		
0 - 16	10YR 4/1	100	-	-	-	-	clay	fine granular
16 - 18	10YR 4/1	99	7.5YR 5/6	>1	C	M	clay	faint redox

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) **(LRR C)**
- ____ 1 cm Muck (A9) **(LRR D)**
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) **(LRR C)**
- ____ 2 cm Muck (A10) **(LRR B)**
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: No: X

Remarks: Not enough redox and it is found too deep in the soil profile to qualify for hydric condtions.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- _____ Water Marks (B1) **(Riverine)**
- _____ Sediment Deposits (B2) **(Riverine)**
- _____ Drift Deposits (B3) **(Riverine)**
- _____ Drainage patterns (B10)
- _____ Dry-Season Water Table (C2)
- _____ Crayfish Burrows (C8)
- _____ Saturation Visible on Aerial Imagery (C9)
- _____ Shallow Aquitard (D3)
- FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ____ No _X_ Depth (inches): _____

Water Table Present? Yes: ____ No _X_ Depth (inches): _____

Saturation Present? (incl. capillary fringe) Yes: ____ No X Depth (inches): _____

Wetland Hydrology Present? Yes: No: X

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Dry

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: May 23, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W16A
Investigator(s): Jeff Boice, Dennis Wenger, Collin Covington	Section, Township, Range: 24, 39S, 6W	
Landform (hillslope, terrace, etc.): drainage floor	Local relief (concave, convex, none): none	Slope (%): 2
Subregion (LRR): D	Easting: 369201 Northing: 4140108	Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X No:	(If no, explain in Remarks.)	
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X No:	
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes: X	No:	**Is the Sampled Area within a Wetland?**	**Yes: X** **No:**
Hydric Soil Present?	Yes: X	No:		
Wetland Hydrology Present?	Yes: X	No:		

Remarks: Sample point is approximately 12 inches above and 3 feet east of the flowing water in Kanab Creek. Photos of site: 961 - soil, 962 - north, 963 - east.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size: 6' x 6')			
1. Salix exigua	5	Y	FACW
2.			
3.			
4.			
	5	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Juncus arcticus	40	Y	FACW
2. Triglochin maritima	5	N	OBL
3.			
4.			
5.			
6.			
7.			
8.			
	45	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
Total Cover: 0			

% Bare Ground in Herb Stratum 55 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:	5	x 1=	5
FACW species:	45	x 2 =	90
FAC species:		x 3 =	0
FACU species:		x 4 =	0
UPL species:		x 5 =	0
Column Totals:	50 (A)		95 (B)

Prevalence Index = B/A = 1.90

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

X Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes: X** **No:**

Remarks: Wetland plant community

SOILS

Sampling Point: W16A

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type[1]	Redox Features Loc[2]	Texture	Remarks
0 - 2	Gley 1 3/5GY	100	-	-	-	-	sandy clay	-
2 - 5	10YR 4/3	100	-	-	-	-	clay	-

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___ Histosol (A1)	___ Sandy Redox (S5)	___ 1 cm Muck (A9) (**LRR C**)
___ Histic Epipedon (A2)	___ Stripped Matrix (S6)	___ 2 cm Muck (A10) (**LRR B**)
___ Black Histic (A3)	___ Loamy Mucky Mineral (F1)	___ Reduced Vertic (F18)
X Hydrogen Sulfide (A4)	___ Loamy Gleyed Matrix (F2)	___ Red Parent Material (TF2)
___ Stratified Layers (A5) (**LRR C**)	___ Depleted Matrix (F3)	___ Other (Explain in Remarks)
___ 1 cm Muck (A9) (**LRR D**)	___ Redox Dark Surface (F6)	
___ Depleted Below Dark Surface (A11)	___ Depleted Dark Surface (F7)	
___ Thick Dark Surface (A12)	___ Redox Depressions (F8)	
___ Sandy Mucky Mineral (S1)	___ Vernal Pools (F9)	
___ Sandy Gleyed Matrix (S4)		

Indicators for Problematic Hydric Soils[3]:

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: Gravels

Depth (inches): 5

Hydric Soil Present? Yes: X No:

Remarks: No redox present, alluvial materials.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)		Secondary Indicators (2 or more required)
___ Surface Water (A1)	___ Salt Crust (B11)	___ Water Marks (B1) (**Riverine**)
___ High Water Table (A2)	___ Biotic Crust (B12)	___ Sediment Deposits (B2) (**Riverine**)
___ Saturation (A3)	___ Aquatic Invertebrates (B13)	___ Drift Deposits (B3) (**Riverine**)
___ Water Marks (B1) (**Nonriverine**)	X Hydrogen Sulfide Odor (C1)	___ Drainage patterns (B10)
___ Sediment Deposits (B2) (**Nonriverine**)	___ Oxidized Rhizospheres along Living Roots	___ Dry-Season Water Table (C2)
___ Drift Deposits (B3) (**Nonriverine**)	___ Presence of Reduced Iron (C4)	___ Crayfish Burrows (C8)
___ Surface Soil Cracks (B6)	___ Recent Iron Reduction in Plowed Soils (C6)	___ Saturation Visible on Aerial Imagery (C9)
___ Inundation Visible on Aerial Imagery (B7)	___ Thin Muck Surface (C7)	___ Shallow Aquitard (D3)
___ Water-Stained Leaves (B9)	___ Other (Explain in Remarks)	___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes: ___	No X	Depth (inches): ___		
Water Table Present?	Yes: X	No ___	Depth (inches): 11	**Wetland Hydrology Present?**	**Yes: X No:**
Saturation Present? (incl. capillary fringe)	Yes: X	No	Depth (inches): 0		

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: -

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: May 23, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W16B
Investigator(s): Jeff Boice, Dennis Wenger, Collin Covington	Section, Township, Range: 24, 39S, 6W	
Landform (hillslope, terrace, etc.): terrace	Local relief (concave, convex, none): none	Slope (%): >1
Subregion (LRR): D	Easting: 369213	Northing: 414097 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X	No: (If no, explain in Remarks.)	
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X	No:
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes:	No: X	**Is the Sampled Area within a Wetland?** **Yes:** **No: X**
Hydric Soil Present?	Yes:	No: X	
Wetland Hydrology Present?	Yes:	No: X	

Remarks: Terrace adjacent to wetland along Kanab Creek. Approximately 3 feet higher in elevation than wetland sample point. Photos of site: 958 - soil, 959 - west, 960 - southwest

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:_____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:_____)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Bromus inermis	50	Y	FACU
2. Juncus arcticus	20	Y	FACW
3. Medicago sativa	20	Y	UPL
4. Poa pratensis	5	N	FAC
5. Equisetum hyemale	TR	N	FACW
6.			
7.			
8.			
	95	= Total Cover	
Woody Vine Stratum (Plot Size:_____)			
1.			
2.			
Total Cover: 0			

% Bare Ground in Herb Stratum 5 % Cover of Biotic Crust_____

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 33.3 (A/B)

Prevalence Index Worksheet:

Total % Cover of:	Multiply by:	
OBL species:	x 1=	0
FACW species: 20	x 2 =	40
FAC species: 5	x 3 =	15
FACU species: 50	x 4 =	200
UPL species: 20	x 5 =	100
Column Totals: 95 (A)		355 (B)

Prevalence Index = B/A = 3.74

Hydrophytic Vegetation Indicators:

- Dominance Test >50%
- Prevalence Index is ≤3.0[1]
- Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes:** **No: X**

Remarks: Upland plant community

SOILS

Sampling Point: W16B

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 18	10YR 6/3	100	-	-	-	-	sand	very fine granular

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) (**LRR C**)
- ____ 1 cm Muck (A9) (**LRR D**)
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) (**LRR C**)
- ____ 2 cm Muck (A10) (**LRR B**)
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: No: X

Remarks: No redox present

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- _____ Water Marks (B1) (**Riverine**)
- _____ Sediment Deposits (B2) (**Riverine**)
- _____ Drift Deposits (B3) (**Riverine**)
- _____ Drainage patterns (B10)
- _____ Dry-Season Water Table (C2)
- _____ Crayfish Burrows (C8)
- _____ Saturation Visible on Aerial Imagery (C9)
- _____ Shallow Aquitard (D3)
- FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ____ No X Depth (inches): _____

Water Table Present? Yes: ____ No X Depth (inches): _____

Saturation Present? (incl. capillary fringe) Yes: ____ No X Depth (inches): _____

Wetland Hydrology Present? Yes: No: X

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks; Dry. No wetland hydrology indicators.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: May 23, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W17A
Investigator(s): Jeff Boice, Dennis Wenger, Collin Covington	Section, Township, Range: 24, 39S, 6W	
Landform (hillslope, terrace, etc.): drainage floor	Local relief (concave, convex, none): none	Slope (%): 1
Subregion (LRR): D	Easting: 369532 Northing: 4140540	Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X No: (If no, explain in Remarks.)		
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X No:	
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes: X	No:	**Is the Sampled Area within a Wetland? Yes: X No:**
Hydric Soil Present?	Yes: X	No:	
Wetland Hydrology Present?	Yes: X	No:	

Remarks: Kanab Creek bottoms. Photos of site: 968 - soil, 969 - west, 970 - south

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size: 6' x 6')			
1. Salix exigua	15	Y	FACW
2.			
3.			
4.			
	15	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Juncus mexicanus	40	Y	FACW
2. Juncus arcticus	35	Y	FACW
3. Carex praegracilis	10	N	FACW
4.			
5.			
6.			
7.			
8.			
	85	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
Total Cover: 0			

% Bare Ground in Herb Stratum 15 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:	100	x 2 =	200
FAC species:		x 3 =	0
FACU species:		x 4 =	0
UPL species:		x 5 =	0
Column Totals:	100 (A)		200 (B)

Prevalence Index = B/A = 2.00

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

X Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes: X No:

Remarks: Wetland plant community

SOILS

Sampling Point: W17A

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features					
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 2	10YR 5/2	100	-	-	-	-	sandy clay	pour linings present
2 - 18	10YR 5/1	30	10YR 5/6	20	C	M	sandy clay	sandy portion of matrix
"	Gley 1 2.5/N	50						

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___	Histosol (A1)	___	Sandy Redox (S5)	___	1 cm Muck (A9) (**LRR C**)
___	Histic Epipedon (A2)	___	Stripped Matrix (S6)	___	2 cm Muck (A10) (**LRR B**)
___	Black Histic (A3)	___	Loamy Mucky Mineral (F1)	___	Reduced Vertic (F18)
X	Hydrogen Sulfide (A4)	___	Loamy Gleyed Matrix (F2)	___	Red Parent Material (TF2)
___	Stratified Layers (A5) (**LRR C**)	X	Depleted Matrix (F3)	___	Other (Explain in Remarks)
___	1 cm Muck (A9) (**LRR D**)	___	Redox Dark Surface (F6)		
___	Depleted Below Dark Surface (A11)	___	Depleted Dark Surface (F7)		
___	Thick Dark Surface (A12)	___	Redox Depressions (F8)		
___	Sandy Mucky Mineral (S1)	___	Vernal Pools (F9)		
	Sandy Gleyed Matrix (S4)				

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: X No:

Remarks: -

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)				Secondary Indicators (2 or more required)	
___	Surface Water (A1)	___	Salt Crust (B11)	___	Water Marks (B1) (**Riverine**)
X	High Water Table (A2)	___	Biotic Crust (B12)	___	Sediment Deposits (B2) (**Riverine**)
X	Saturation (A3)	___	Aquatic Invertebrates (B13)	___	Drift Deposits (B3) (**Riverine**)
___	Water Marks (B1) (**Nonriverine**)	X	Hydrogen Sulfide Odor (C1)	___	Drainage patterns (B10)
___	Sediment Deposits (B2) (**Nonriverine**)	___	Oxidized Rhizospheres along Living Roots	___	Dry-Season Water Table (C2)
___	Drift Deposits (B3) (**Nonriverine**)	___	Presence of Reduced Iron (C4)	___	Crayfish Burrows (C8)
___	Surface Soil Cracks (B6)	___	Recent Iron Reduction in Plowed Soils (C6)	___	Saturation Visible on Aerial Imagery (C9)
___	Inundation Visible on Aerial Imagery (B7)	___	Thin Muck Surface (C7)	___	Shallow Aquitard (D3)
	Water-Stained Leaves (B9)		Other (Explain in Remarks)		FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes: ___	No X	Depth (inches): ___			
Water Table Present?	Yes: X	No ___	Depth (inches): 8	**Wetland Hydrology Present?**	**Yes: X**	**No:**
Saturation Present? (incl. capillary fringe)	Yes: X	No	Depth (inches): 0			

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Appears to be the active floodplain of Kanab Creek.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: May 23, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W17B
Investigator(s): Jeff Boice, Dennis Wenger, Collin Covington	Section, Township, Range: 24, 39S, 6W	
Landform (hillslope, terrace, etc.): hillslope	Local relief (concave, convex, none): none	Slope (%): 5
Subregion (LRR): D	Easting: 369526	Northing: 4140541 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X	No: (If no, explain in Remarks.)	
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X	No:
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes:	No: X	**Is the Sampled Area within a Wetland? Yes: No: X**
Hydric Soil Present?	Yes:	No: X	
Wetland Hydrology Present?	Yes:	No: X	

Remarks: Sample point is approximately 3 feet above the inactive low terrace. Photos of site: 971 - soil, 972 - west, 973 - cactus, 974 - east

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size: 6' x 6')			
1. Artemisia tridentata	25	Y	UPL
2. Salix exigua	15	Y	FACW
3.			
4.			
	40	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Bromus inermis	20	Y	FACU
2. Opuntia sp.	3	N	-
3. Aster sp.	2	N	-
4. Bromus sp.	2	N	-
5. Fabaceae sp.	TR	N	-
6.			
7.			
8.			
	27	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
	Total Cover: 0		

% Bare Ground in Herb Stratum 73 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 33.3 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:	15	x 2 =	30
FAC species:		x 3 =	0
FACU species:	20	x 4 =	80
UPL species:	25	x 5 =	125
Column Totals:	60 (A)		235 (B)

Prevalence Index = B/A = 3.92

Hydrophytic Vegetation Indicators:

- Dominance Test >50%
- Prevalence Index is ≤3.0[1]
- Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes: No: X

Remarks: Upland plant community

SOILS

Sampling Point: W17B

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 18	-	-	-	-	-	-	sand/gravel	-

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) (**LRR C**)
- ____ 1 cm Muck (A9) (**LRR D**)
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) (**LRR C**)
- ____ 2 cm Muck (A10) (**LRR B**)
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: No: X

Remarks: Sandy cobble and gravel on inactive low terrace, poor soil development.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- _____ Water Marks (B1) (**Riverine**)
- _____ Sediment Deposits (B2) (**Riverine**)
- _____ Drift Deposits (B3) (**Riverine**)
- _____ Drainage patterns (B10)
- _____ Dry-Season Water Table (C2)
- _____ Crayfish Burrows (C8)
- _____ Saturation Visible on Aerial Imagery (C9)
- _____ Shallow Aquitard (D3)
- _____ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ____ No X Depth (inches): _____

Water Table Present? Yes: ____ No X Depth (inches): _____

Saturation Present? (incl. capillary fringe) Yes: ____ No X Depth (inches): _____

Wetland Hydrology Present? Yes: No: X

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Dry and friable

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: May 23, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W18A
Investigator(s): Jeff Boice, Dennis Wenger, Collin Covington	Section, Township, Range: 24, 39S, 6W	
Landform (hillslope, terrace, etc.): drainage bottom	Local relief (concave, convex, none): concave	Slope (%): >1
Subregion (LRR): D	Easting: 369633	Northing: 4140582 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X	No: (If no, explain in Remarks.)	
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X	No:
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes: X	No:	**Is the Sampled Area within a Wetland?** **Yes: X** **No:**
Hydric Soil Present?	Yes: X	No:	
Wetland Hydrology Present?	Yes: X	No:	

Remarks: Abandoned oxbow channel that is connected to Kanab Creek. Photos of site: 975 - soil and 976 - south.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Eleocharis palustris	90	Y	OBL
2. Juncus arcticus	5	N	FACW
3.			
4.			
5.			
6.			
7.			
8.			
	95	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
Total Cover:	0		

% Bare Ground in Herb Stratum 5 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:	90	x 1=	90
FACW species:	5	x 2 =	10
FAC species:		x 3 =	0
FACU species:		x 4 =	0
UPL species:		x 5 =	0
Column Totals:	95 (A)		100 (B)

Prevalence Index = B/A = 1.05

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

X Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes: X** **No:**

Remarks: Wetland plant community.

SOILS

Sampling Point: W18A

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features					
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 6	Gley 1 4/N	100	-	-	-	-	clay	-
6 - 18	Gley 1 4/N	20	-	-	-	-	clay	80% gravel/cobble

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- X Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) (**LRR C**)
- ____ 1 cm Muck (A9) (**LRR D**)
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) (**LRR C**)
- ____ 2 cm Muck (A10) (**LRR B**)
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: X No:

Remarks; -

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- X Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- X Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- _____ Water Marks (B1) (**Riverine**)
- _____ Sediment Deposits (B2) (**Riverine**)
- _____ Drift Deposits (B3) (**Riverine**)
- _____ Drainage patterns (B10)
- _____ Dry-Season Water Table (C2)
- _____ Crayfish Burrows (C8)
- _____ Saturation Visible on Aerial Imagery (C9)
- _____ Shallow Aquitard (D3)
- _____ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: X No ___ Depth (inches): 1

Water Table Present? Yes: X No ___ Depth (inches): -

Saturation Present? (incl. capillary fringe) Yes: X No Depth (inches): -

Wetland Hydrology Present? Yes: X No:

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: -

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: May 23, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W18B
Investigator(s): Jeff Boice, Dennis Wenger, Collin Covington	Section, Township, Range: 24, 39S, 6W	
Landform (hillslope, terrace, etc.): hillslope	Local relief (concave, convex, none): none	Slope (%): 10
Subregion (LRR): D	Easting: 369635 Northing: 4140575	Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X No: (If no, explain in Remarks.)		
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X No:	
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes:	No: X	**Is the Sampled Area within a Wetland?** **Yes:** **No: X**
Hydric Soil Present?	Yes:	No: X	
Wetland Hydrology Present?	Yes:	No: X	

Remarks: At the base of the hillslope near the oxbow. Approximately 12 inches higher in elevation than wetland sample point. Photos of site: 977 - soil and 978 - north.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size: 6' x 6')	Absolute % Cover	Dominant Species?	Indicator Status
1. Quercus gambelii	25	Y	UPL
2.			
3.			
4.			
	25	= Total Cover	
Sapling/Shrub Stratum (Plot Size: 6' x 6')			
1. Artemisia tridentata	30	Y	UPL
2. Chrysothamnus nauseosus	15	N	UPL
3. Rosa woodsii	5	N	FACU
4.			
	50	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Bromus inermis	20	Y	FACU
2. Poa pratensis	20	Y	FAC
3. Achillea millefolium	5	N	FACU
4.			
5.			
6.			
7.			
8.			
	45	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
	Total Cover: 0		

% Bare Ground in Herb Stratum 55 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 25 (A/B)

Prevalence Index Worksheet:

Total % Cover of:	Multiply by:	
OBL species:	x 1=	0
FACW species:	x 2 =	0
FAC species: 20	x 3 =	60
FACU species: 30	x 4 =	120
UPL species: 70	x 5 =	350
Column Totals: 120 (A)		530 (B)

Prevalence Index = B/A = 4.42

Hydrophytic Vegetation Indicators:

- Dominance Test >50%
- Prevalence Index is ≤3.0[1]
- Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes:** **No: X**

Remarks: Upland plant community.

SOILS

Sampling Point: W18B

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 20	10YR 3/2	100	-	-	-	-	clay	fine granular
20 - 22	10YR 5/2	100	10YR 5/6	1	C	M	sand	fine granular

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) (**LRR C**)
- ____ 1 cm Muck (A9) (**LRR D**)
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) (**LRR C**)
- ____ 2 cm Muck (A10) (**LRR B**)
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: No: X

Remarks: Redox is too deep to qualify for hydric conditions.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- _____ Water Marks (B1) (**Riverine**)
- _____ Sediment Deposits (B2) (**Riverine**)
- _____ Drift Deposits (B3) (**Riverine**)
- _____ Drainage patterns (B10)
- _____ Dry-Season Water Table (C2)
- _____ Crayfish Burrows (C8)
- _____ Saturation Visible on Aerial Imagery (C9)
- _____ Shallow Aquitard (D3)
- FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes: ___	No X	Depth (inches): ___		
Water Table Present?	Yes: X	No ___	Depth (inches): 20	**Wetland Hydrology Present?**	**Yes: No: X**
Saturation Present? (incl. capillary fringe)	Yes: X	No	Depth (inches): 18		

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: The sample point is higher in elevation and likely does not receive adequate hydrology to support wetland conditions.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: May 24, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W19A
Investigator(s): Jeff Bolce, Dennis Wenger, Collin Covington	Section, Township, Range: 24, 39S, 6W	
Landform (hillslope, terrace, etc.): channel floor	Local relief (concave, convex, none): concave	Slope (%):1
Subregion (LRR): D	Easting: 369581	Northing: 4140679 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X	No: (If no, explain in Remarks.)	
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X	No:
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes: X	No:	**Is the Sampled Area within a Wetland? Yes: X No:**
Hydric Soil Present?	Yes: X	No:	
Wetland Hydrology Present?	Yes: X	No:	

Remarks: Side channel in the Kanab Creek floodplain. Photos of site: 997 - soil, 998 - south, 999 - east.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size: 6' x 6')			
1. Salix exigua	10	Y	FACW
2.			
3.			
4.			
	10	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Eleocharis palustris	25	Y	OBL
2. Juncus arcticus	10	N	FACW
3. Poa secunda	5	N	FACU
4.			
5.			
6.			
7.			
8.			
	40	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
Total Cover: 0			

% Bare Ground in Herb Stratum 60 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:	25	x 1=	25
FACW species:	20	x 2 =	40
FAC species:		x 3 =	0
FACU species:	5	x 4 =	20
UPL species:		x 5 =	0
Column Totals:	50 (A)		85 (B)

Prevalence Index = B/A = 1.70

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

X Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes: X No:

Remarks: Wetland plant community.

SOILS

Sampling Point: W19A

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0 - 3	10YR 5/2	100	7.5YR 5/6	5	C	M	clay	-
3 - 4	-	100	-	-	-	-	sand/gravel	deposition
4 - 10	10YR 5/1	90	5YR 4/6	10	C	M	sandy clay	decaying organic material
10	Restrictive Layer							

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___ Histosol (A1)	___ Sandy Redox (S5)	
___ Histic Epipedon (A2)	___ Stripped Matrix (S6)	
___ Black Histic (A3)	___ Loamy Mucky Mineral (F1)	
___ Hydrogen Sulfide (A4)	___ Loamy Gleyed Matrix (F2)	
___ Stratified Layers (A5) (**LRR C**)	X Depleted Matrix (F3)	
___ 1 cm Muck (A9) (**LRR D**)	___ Redox Dark Surface (F6)	
___ Depleted Below Dark Surface (A11)	___ Depleted Dark Surface (F7)	
___ Thick Dark Surface (A12)	___ Redox Depressions (F8)	
___ Sandy Mucky Mineral (S1)	___ Vernal Pools (F9)	
___ Sandy Gleyed Matrix (S4)		

Indicators for Problematic Hydric Soils[3]:

___ 1 cm Muck (A9) (**LRR C**)
___ 2 cm Muck (A10) (**LRR B**)
___ Reduced Vertic (F18)
___ Red Parent Material (TF2)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: Gravel/Cobble

Depth (inches): 10

Hydric Soil Present? Yes: X No:

Remarks: Hydric soil

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)		Secondary Indicators (2 or more required)
___ Surface Water (A1)	___ Salt Crust (B11)	___ Water Marks (B1) (**Riverine**)
___ High Water Table (A2)	___ Biotic Crust (B12)	___ Sediment Deposits (B2) (**Riverine**)
X Saturation (A3)	___ Aquatic Invertebrates (B13)	___ Drift Deposits (B3) (**Riverine**)
___ Water Marks (B1) (**Nonriverine**)	___ Hydrogen Sulfide Odor (C1)	___ Drainage patterns (B10)
___ Sediment Deposits (B2) (**Nonriverine**)	___ Oxidized Rhizospheres along Living Roots	___ Dry-Season Water Table (C2)
___ Drift Deposits (B3) (**Nonriverine**)	___ Presence of Reduced Iron (C4)	___ Crayfish Burrows (C8)
___ Surface Soil Cracks (B6)	___ Recent Iron Reduction in Plowed Soils (C6)	___ Saturation Visible on Aerial Imagery (C9)
___ Inundation Visible on Aerial Imagery (B7)	___ Thin Muck Surface (C7)	___ Shallow Aquitard (D3)
___ Water-Stained Leaves (B9)	___ Other (Explain in Remarks)	___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ___ No X Depth (inches): ___

Water Table Present? Yes: ___ No X Depth (inches): ___

Saturation Present? (incl. capillary fringe) Yes: X No ___ Depth (inches): 0

Wetland Hydrology Present? Yes: X No:

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: -

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: May 24, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W19B
Investigator(s): Jeff Boice, Dennis Wenger, Collin Covington	Section, Township, Range: 24, 39S, 6W	
Landform (hillslope, terrace, etc.): terrace	Local relief (concave, convex, none): concave	Slope (%): 1
Subregion (LRR): D	Easting:369572 Northing: 4140676	Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X	No: (If no, explain in Remarks.)	
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X	No:
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes: X	No:	**Is the Sampled Area within a Wetland?** **Yes:** **No: X**
Hydric Soil Present?	Yes:	No: X	
Wetland Hydrology Present?	Yes:	No: X	

Remarks: Low terrace that is approximately 2 feet above the wetland sample point. Photos of site: 994 - soil, 995 - north, 996 - west

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size: 6' x 6')			
1. Salix exigua	10	Y	FACW
2.			
3.			
4.			
	10	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Equisetum arvense	10	Y	FAC
2. Medicago sativa	10	Y	UPL
3. Poa secunda	1	N	FACU
4.			
5.			
6.			
7.			
8.			
	21	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
Total Cover: 0			
% Bare Ground in Herb Stratum 79	% Cover of Biotic Crust		

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 66.7 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:	10	x 2 =	20
FAC species:	10	x 3 =	30
FACU species:	1	x 4 =	4
UPL species:	10	x 5 =	50
Column Totals:	31 (A)		104 (B)

Prevalence Index = B/A = 3.35

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes: X** **No:**

Remarks: Mostly unvegetated with the Salix exigua driving the dominance test in this area. The herb stratum does not meet the wetland plant community requirements.

SOILS

Sampling Point: W19B

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features					
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 18	-	-	-	-	-	-	sand/gravel	No soil development

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) (**LRR C**)
- ____ 1 cm Muck (A9) (**LRR D**)
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) (**LRR C**)
- ____ 2 cm Muck (A10) (**LRR B**)
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: No: X

Remarks: No soil development, the terrace is composed of sand and gravel.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- _____ Water Marks (B1) (**Riverine**)
- _____ Sediment Deposits (B2) (**Riverine**)
- _____ Drift Deposits (B3) (**Riverine**)
- _____ Drainage patterns (B10)
- _____ Dry-Season Water Table (C2)
- _____ Crayfish Burrows (C8)
- _____ Saturation Visible on Aerial Imagery (C9)
- _____ Shallow Aquitard (D3)
- _____ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ____ No X Depth (inches): _____

Water Table Present? Yes: ____ No X Depth (inches): _____

Saturation Present? (incl. capillary fringe) Yes: ____ No X Depth (inches): _____

Wetland Hydrology Present? Yes: No: X

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Well drained and dry. Approximately 2 feet above the wetland and likely only receives adequate hydrology during high flow events.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: May 24, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W20A
Investigator(s): Jeff Bolce, Dennis Wenger, Collin Covington	Section, Township, Range: 24, 39S, 6W	
Landform (hillslope, terrace, etc.): drainage floor	Local relief (concave, convex, none): none	Slope (%): 1
Subregion (LRR): D	Easting: 369579 Northing: 4140817	Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X No: (If no, explain in Remarks.)		
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X No:	
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes: X	No:	**Is the Sampled Area within a Wetland?** **Yes: X** **No:**
Hydric Soil Present?	Yes: X	No:	
Wetland Hydrology Present?	Yes: X	No:	

Remarks: Wetland near Kanab Creek on the drainage floor. Photos of site: 1010 - soil, 1011 - east, and 1012 - north.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Juncus arcticus	35	Y	FACW
2. Carex microptera	15	Y	FAC
3. Equisetum arvense	10	N	FAC
4. Iris missouriensis	5	N	FACW
5.			
6.			
7.			
8.			
	65	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
Total Cover:	0		

% Bare Ground in Herb Stratum 35 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:	40	x 2 =	80
FAC species:	25	x 3 =	75
FACU species:		x 4 =	0
UPL species:		x 5 =	0
Column Totals:	65 (A)		155 (B)

Prevalence Index = B/A = 2.38

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

X Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes: X** **No:**

Remarks: Wetland plant community.

SOILS

Sampling Point: W20A

Profile Description: (Describe to the depth needed to document the Indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0 - 5	10YR 4/1	100	-	-	-	-	silt	-
5 - 13	10YR 6/2	90	10YR 5/6	10	C	M	silt	black organic streaking
13 - 18	10YR 4/1	100	-	-	-	-	silt	-

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___ Histosol (A1)	___ Sandy Redox (S5)	___ 1 cm Muck (A9) (**LRR C**)
___ Histic Epipedon (A2)	___ Stripped Matrix (S6)	___ 2 cm Muck (A10) (**LRR B**)
___ Black Histic (A3)	___ Loamy Mucky Mineral (F1)	___ Reduced Vertic (F18)
___ Hydrogen Sulfide (A4)	___ Loamy Gleyed Matrix (F2)	___ Red Parent Material (TF2)
___ Stratified Layers (A5) (**LRR C**)	X Depleted Matrix (F3)	___ Other (Explain in Remarks)
___ 1 cm Muck (A9) (**LRR D**)	___ Redox Dark Surface (F6)	
___ Depleted Below Dark Surface (A11)	___ Depleted Dark Surface (F7)	
___ Thick Dark Surface (A12)	___ Redox Depressions (F8)	
___ Sandy Mucky Mineral (S1)	___ Vernal Pools (F9)	
___ Sandy Gleyed Matrix (S4)		

Indicators for Problematic Hydric Soils[3]:

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: X No:

Remarks: Soil was saturated and did not easily hold together.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)		Secondary Indicators (2 or more required)
___ Surface Water (A1)	___ Salt Crust (B11)	___ Water Marks (B1) (**Riverine**)
X High Water Table (A2)	___ Biotic Crust (B12)	___ Sediment Deposits (B2) (**Riverine**)
X Saturation (A3)	___ Aquatic Invertebrates (B13)	___ Drift Deposits (B3) (**Riverine**)
___ Water Marks (B1) (**Nonriverine**)	___ Hydrogen Sulfide Odor (C1)	___ Drainage patterns (B10)
___ Sediment Deposits (B2) (**Nonriverine**)	___ Oxidized Rhizospheres along Living Roots	___ Dry-Season Water Table (C2)
___ Drift Deposits (B3) (**Nonriverine**)	___ Presence of Reduced Iron (C4)	___ Crayfish Burrows (C8)
___ Surface Soil Cracks (B6)	___ Recent Iron Reduction in Plowed Soils (C6)	___ Saturation Visible on Aerial Imagery (C9)
___ Inundation Visible on Aerial Imagery (B7)	___ Thin Muck Surface (C7)	___ Shallow Aquitard (D3)
___ Water-Stained Leaves (B9)	___ Other (Explain in Remarks)	___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes: ___	No X	Depth (inches): 0		
Water Table Present?	Yes: X	No ___	Depth (inches): 10	**Wetland Hydrology Present?**	**Yes: X No:**
Saturation Present? (incl. capillary fringe)	Yes: X	No	Depth (inches): 0		

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: -

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: May 24, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W20B
Investigator(s): Jeff Boice, Dennis Wenger, Collin Covington	Section, Township, Range: 24, 39S, 6W	
Landform (hillslope, terrace, etc.): terrace	Local relief (concave, convex, none): none	Slope (%): 1
Subregion (LRR): D	Easting: 369575	Northing: 4140821 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X No: (If no, explain in Remarks.)		
Are Vegetation: , Soil: , or Hydrology: significantly disturbed? Are "Normal Circumstances" present? Yes: X No:		
Are Vegetation: , Soil: , or Hydrology: naturally disturbed? (If needed, explain any answers in Remarks.)		

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes:	No: X	**Is the Sampled Area within a Wetland? Yes: No: X**
Hydric Soil Present?	Yes:	No: X	
Wetland Hydrology Present?	Yes:	No: X	

Remarks: Terrace at the mouth of abandoned oxbow approximately 2 feet above the wetland sample point. Photos of site: 1013 - soil, 1014 - east, 1015 - west.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size: 6' x 6')			
1. Salix exigua	1	Y	FACW
2.			
3.			
4.			
	1	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Bromus inermis	60	Y	FACU
2. Medicago sativa	10	N	UPL
3. Equisetum arvense	5	N	FAC
4. Poa pratensis	5	N	FAC
5. Achillea millefolium	3	N	FACU
6. Taraxacum officinale	3	N	FACU
7. Juncus arcticus	2	N	FACW
8. Mentha piperita	2	N	FACW
	90	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
Total Cover: 0			

% Bare Ground in Herb Stratum 10 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50 (A/B)

Prevalence Index Worksheet:

Total % Cover of:	Multiply by:	
OBL species:	x 1=	0
FACW species: 5	x 2 =	10
FAC species: 10	x 3 =	30
FACU species: 66	x 4 =	264
UPL species: 10	x 5 =	50
Column Totals: 91 (A)		354 (B)

Prevalence Index = B/A = 3.89

Hydrophytic Vegetation Indicators:

- Dominance Test >50%
- Prevalence Index is ≤3.0[1]
- Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes: No: X

Remarks: Upland plant community.

SOILS

Sampling Point: W20B

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features					
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 7	-	-	-	-	-	-	sand/gravel	-
7 - 13	10YR 6/3	100	-	-	-	-	clay	-
13 - 18	10YR 6/2	80	10YR 5/6	20	C	M	clay	-

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: No: X

Remarks: Redox is not shallow enough to qualify for a Depleted Matrix (F3).

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ___ No X Depth (inches): ___

Water Table Present? Yes: ___ No X Depth (inches): ___

Saturation Present? (incl. capillary fringe) Yes: ___ No X Depth (inches): ___

Wetland Hydrology Present? Yes: No: X

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Dry and friable.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: May 24, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W21
Investigator(s): Jeff Boice, Dennis Wenger, Collin Covington	Section, Township, Range: 24, 39S, 6W	
Landform (hillslope, terrace, etc.): abandoned oxbow	Local relief (concave, convex, none): concave	Slope (%): 1
Subregion (LRR): D	Easting: 369516 Northing: 4140821	Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X No:	(If no, explain in Remarks.)	
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X No:	
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes: X	No:	**Is the Sampled Area within a Wetland?** **Yes:** **No: X**
Hydric Soil Present?	Yes:	No: X	
Wetland Hydrology Present?	Yes:	No: X	

Remarks: Abandoned oxbow feature off Kanab Creek. Channel is shown on the National Hydrography Dataset. Photos of site: 1016 - soil, 1017 - north, 1018 - west.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size: 6' x 6')			
1. Salix exigua	40	Y	FACW
2. Artemisia tridentata	5	N	UPL
3.			
4.			
	45	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Juncus arcticus	20	Y	FACW
2. Bromus inermis	15	Y	FACU
3. Grindelia squarrosa	10	N	FACU
4. Pascopyrum smithii	10	N	FAC
5. Poa pratensis	10	N	FAC
6. Medicago sativa	5	N	UPL
7. Distichlis spicata	TR	N	FAC
8. Taraxacum officinale	TR	N	FACU
	70	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
	Total Cover: 0		

% Bare Ground in Herb Stratum 30 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 66.7 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:	60	x 2 =	120
FAC species:	20	x 3 =	60
FACU species:	25	x 4 =	100
UPL species:	10	x 5 =	50
Column Totals:	115 (A)		330 (B)

Prevalence Index = B/A = 2.87

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

X Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes: X** **No:**

Remarks: Remnant wetland vegetation in an abandoned oxbow channel. Kanab Creek does not flow through area anymore.

SOILS

Sampling Point: W21

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features					
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 4	10YR 4/2	100	-	-	-	-	sandy loam	-
4 - 8	10YR 5/2	70	10YR 5/6	30	C	M	clay	-
8	Restrictive Layer	100	-	-	-	-	gravel	-

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: Gravel

Depth (inches): 8

Hydric Soil Present? **Yes:** **No: X**

Remarks: The site does not meet hydric characteristics, the redox layer in the soil is not thick enough to qualify as a Depleted Matrix.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ___ No X Depth (inches): ___

Water Table Present? Yes: ___ No X Depth (inches): ___

Saturation Present? (incl. capillary fringe) Yes: ___ No X Depth (inches): ___

Wetland Hydrology Present? **Yes:** **No: X**

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Dry and friable, site is an abandoned feature that is higher in elevation than Kanab Creek. No evidence of recent flow.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: May 24, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W22A
Investigator(s): Jeff Boice, Dennis Wenger, Collin Covington	Section, Township, Range: 24, 39S, 6W	
Landform (hillslope, terrace, etc.): drainage floor	Local relief (concave, convex, none): concave	Slope (%): 2
Subregion (LRR): D	Easting: 369578	Northing: 4140949 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X	No: (If no, explain in Remarks.)	
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X	No:
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes: X	No:	**Is the Sampled Area within a Wetland?** **Yes: X** **No:**
Hydric Soil Present?	Yes: X	No:	
Wetland Hydrology Present?	Yes: X	No:	

Remarks: Backwater wetland off of Kanab Creek. Photos of site: 1019 - soil, 1020 - south, 1021 - west.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Juncus arcticus	50	Y	FACW
2. Eleocharis palustris	30	Y	OBL
3. Epilobium sp.	5	N	-
4. Medicago sativa	3	N	UPL
5. Iris missouriensis	1	N	FACW
6. Typha latifolia	1	N	OBL
7.			
8.			
	90	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
Total Cover:	0		

% Bare Ground in Herb Stratum 10 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:	31	x 1=	31
FACW species:	51	x 2 =	102
FAC species:		x 3 =	0
FACU species:		x 4 =	0
UPL species:	3	x 5 =	15
Column Totals:	85 (A)		148 (B)

Prevalence Index = B/A = 1.74

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

X Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes: X** **No:**

Remarks: Wetland plant community.

SOILS

Sampling Point: W22A

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features					
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 18	10YR 5/2	100	-	-	-	-	sand	gravel pieces and organic materials

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___ Histosol (A1)	___ Sandy Redox (S5)	___ 1 cm Muck (A9) (**LRR C**)
___ Histic Epipedon (A2)	___ Stripped Matrix (S6)	___ 2 cm Muck (A10) (**LRR B**)
___ Black Histic (A3)	___ Loamy Mucky Mineral (F1)	___ Reduced Vertic (F18)
___ Hydrogen Sulfide (A4)	___ Loamy Gleyed Matrix (F2)	___ Red Parent Material (TF2)
___ Stratified Layers (A5) (**LRR C**)	___ Depleted Matrix (F3)	___ Other (Explain in Remarks)
___ 1 cm Muck (A9) (**LRR D**)	___ Redox Dark Surface (F6)	
___ Depleted Below Dark Surface (A11)	___ Depleted Dark Surface (F7)	
___ Thick Dark Surface (A12)	___ Redox Depressions (F8)	
X Sandy Mucky Mineral (S1)	___ Vernal Pools (F9)	
___ Sandy Gleyed Matrix (S4)		

Indicators for Problematic Hydric Soils[3]:

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: X No:

Remarks: No redox present, sandy deposition. At 8 inches there is a fine gravel layer.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)		Secondary Indicators (2 or more required)
___ Surface Water (A1)	___ Salt Crust (B11)	___ Water Marks (B1) (**Riverine**)
X High Water Table (A2)	___ Biotic Crust (B12)	___ Sediment Deposits (B2) (**Riverine**)
X Saturation (A3)	___ Aquatic Invertebrates (B13)	___ Drift Deposits (B3) (**Riverine**)
___ Water Marks (B1) (**Nonriverine**)	___ Hydrogen Sulfide Odor (C1)	___ Drainage patterns (B10)
___ Sediment Deposits (B2) (**Nonriverine**)	___ Oxidized Rhizospheres along Living Roots	___ Dry-Season Water Table (C2)
___ Drift Deposits (B3) (**Nonriverine**)	___ Presence of Reduced Iron (C4)	___ Crayfish Burrows (C8)
___ Surface Soil Cracks (B6)	___ Recent Iron Reduction in Plowed Soils (C6)	___ Saturation Visible on Aerial Imagery (C9)
___ Inundation Visible on Aerial Imagery (B7)	___ Thin Muck Surface (C7)	___ Shallow Aquitard (D3)
___ Water-Stained Leaves (B9)	___ Other (Explain in Remarks)	___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes: ___	No X	Depth (inches):		
Water Table Present?	Yes: X	No ___	Depth (inches):	6	**Wetland Hydrology Present? Yes: X No:**
Saturation Present? (incl. capillary fringe)	Yes: X	No	Depth (inches):	0	

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Adequate wetland hydrology.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: May 24, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W22B
Investigator(s): Jeff Boice, Dennis Wenger, Collin Covington	Section, Township, Range: 24, 39S, 6W	
Landform (hillslope, terrace, etc.): bench	Local relief (concave, convex, none): convex	Slope (%): 1
Subregion (LRR): D	Easting: 369575 Northing: 4140949	Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	

Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X No: (If no, explain in Remarks.)

Are Vegetation: , Soil: , or Hydrology: significantly disturbed? Are "Normal Circumstances" present? Yes: X No:

Are Vegetation: , Soil: , or Hydrology: naturally disturbed? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes:	No: X	**Is the Sampled Area within a Wetland?** **Yes:** **No: X**
Hydric Soil Present?	Yes:	No: X	
Wetland Hydrology Present?	Yes:	No: X	

Remarks: Upland gravel bar in the Kanab Creek drainage. Approximately 18 inches higher in elevation than the adjacent wetland sample point. Photos of site: 1022 - soil and 1023 - east.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:_____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:_____)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Medicago sativa	2	Y	UPL
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	2	= Total Cover	
Woody Vine Stratum (Plot Size:_____)			
1.			
2.			
Total Cover:	0		

% Bare Ground in Herb Stratum 98 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:		x 2 =	0
FAC species:		x 3 =	0
FACU species:		x 4 =	0
UPL species:	2	x 5 =	10
Column Totals:	2 (A)		10 (B)

Prevalence Index = B/A = 5.00

Hydrophytic Vegetation Indicators:

Dominance Test >50%

Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes:** **No: X**

Remarks: Mostly unvegetated area. The vegetation is upland.

SOILS

Sampling Point: W22B

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type[1]	Redox Features Loc[2]	Texture	Remarks
0 - 18	-	100		-	-	-	gravel/sand	cobble

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) **(LRR C)**
- ____ 1 cm Muck (A9) **(LRR D)**
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) **(LRR C)**
- ____ 2 cm Muck (A10) **(LRR B)**
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: No: X

Remarks: Gravel/sand/cobble no soil development

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- _____ Water Marks (B1) **(Riverine)**
- _____ Sediment Deposits (B2) **(Riverine)**
- _____ Drift Deposits (B3) **(Riverine)**
- _____ Drainage patterns (B10)
- _____ Dry-Season Water Table (C2)
- _____ Crayfish Burrows (C8)
- _____ Saturation Visible on Aerial Imagery (C9)
- _____ Shallow Aquitard (D3)
- FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ____ No X Depth (inches): ____

Water Table Present? Yes: ____ No X Depth (inches): ____

Saturation Present? (incl. capillary fringe) Yes: ____ No X Depth (inches): ____

Wetland Hydrology Present? Yes: No: X

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Dry and friable. Sample point is higher than the adjacent wetland sample point and likely only receives hydrology during high flow events.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: May 24, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W23A
Investigator(s): Dennis Wenger, Collin Covington	Section, Township, Range: 24, 39S, 6W	
Landform (hillslope, terrace, etc.): drainage floor	Local relief (concave, convex, none): none	Slope (%): 1
Subregion (LRR): D	Easting: 369761 Northing: 4141506	Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X No: (If no, explain in Remarks.)		
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X No:	
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes: X	No:	**Is the Sampled Area within a Wetland?**	**Yes: X** **No:**
Hydric Soil Present?	Yes: X	No:		
Wetland Hydrology Present?	Yes: X	No:		

Remarks: Kanab Creek floodplain. Photos of site: 1027 - soil, 1028 - west, 1029 - southwest

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Juncus arcticus	73	Y	FACW
2. Eleocharis sp.	15	N	-
3. Bromus inermis	10	N	FACU
4. Iris missouriensis	2	N	FACW
5.			
6.			
7.			
8.			
	100	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
Total Cover: 0			

% Bare Ground in Herb Stratum 0 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:	Multiply by:	
OBL species:	x 1=	0
FACW species: 75	x 2 =	150
FAC species:	x 3 =	0
FACU species: 10	x 4 =	40
UPL species:	x 5 =	0
Column Totals: 85 (A)		190 (B)

Prevalence Index = B/A = 2.24

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

X Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes: X** **No:**

Remarks: Wetland vegetation community.

SOILS

Sampling Point: W23A

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0 - 18	10YR 5/2	85	10YR 5/6	15	C	M	clay	black organic streaking present

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___ Histosol (A1)	___ Sandy Redox (S5)	___ 1 cm Muck (A9) (**LRR C**)
___ Histic Epipedon (A2)	___ Stripped Matrix (S6)	___ 2 cm Muck (A10) (**LRR B**)
___ Black Histic (A3)	___ Loamy Mucky Mineral (F1)	___ Reduced Vertic (F18)
___ Hydrogen Sulfide (A4)	___ Loamy Gleyed Matrix (F2)	___ Red Parent Material (TF2)
___ Stratified Layers (A5) (**LRR C**)	X Depleted Matrix (F3)	___ Other (Explain in Remarks)
___ 1 cm Muck (A9) (**LRR D**)	___ Redox Dark Surface (F6)	
___ Depleted Below Dark Surface (A11)	___ Depleted Dark Surface (F7)	
___ Thick Dark Surface (A12)	___ Redox Depressions (F8)	
___ Sandy Mucky Mineral (S1)	___ Vernal Pools (F9)	
___ Sandy Gleyed Matrix (S4)		

Indicators for Problematic Hydric Soils[3]:

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: X No:

Remarks: -

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)		Secondary Indicators (2 or more required)
___ Surface Water (A1)	___ Salt Crust (B11)	___ Water Marks (B1) (**Riverine**)
___ High Water Table (A2)	___ Biotic Crust (B12)	___ Sediment Deposits (B2) (**Riverine**)
X Saturation (A3)	___ Aquatic Invertebrates (B13)	___ Drift Deposits (B3) (**Riverine**)
___ Water Marks (B1) (**Nonriverine**)	___ Hydrogen Sulfide Odor (C1)	___ Drainage patterns (B10)
___ Sediment Deposits (B2) (**Nonriverine**)	___ Oxidized Rhizospheres along Living Roots	___ Dry-Season Water Table (C2)
___ Drift Deposits (B3) (**Nonriverine**)	___ Presence of Reduced Iron (C4)	___ Crayfish Burrows (C8)
___ Surface Soil Cracks (B6)	___ Recent Iron Reduction in Plowed Soils (C6)	___ Saturation Visible on Aerial Imagery (C9)
___ Inundation Visible on Aerial Imagery (B7)	___ Thin Muck Surface (C7)	___ Shallow Aquitard (D3)
___ Water-Stained Leaves (B9)	___ Other (Explain in Remarks)	___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes: ___	No X	Depth (inches): ___		
Water Table Present?	Yes: ___	No X	Depth (inches): ___	**Wetland Hydrology Present?**	**Yes: X No:**
Saturation Present? (incl. capillary fringe)	Yes: X	No ___	Depth (inches): 0		

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Saturated to the surface.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: May 24, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W23B
Investigator(s): Dennis Wenger, Collin Covington	Section, Township, Range: 24, 39S, 6W	
Landform (hillslope, terrace, etc.): hillslope	Local relief (concave, convex, none): none	Slope (%): 5
Subregion (LRR): D	Easting: 369756	Northing: 4141505 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X	No: (If no, explain in Remarks.)	
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X	No:
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes:	No: X	**Is the Sampled Area within a Wetland?** **Yes:** **No: X**
Hydric Soil Present?	Yes:	No: X	
Wetland Hydrology Present?	Yes:	No: X	

Remarks: Hillslope out of the wetlands adjacent to Kanab Creek. Sample point is approximately 18 inches above the wetland sample point. Photos of site: 1030 - soil and 1031 - east.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size: 6' x 6')			
1. Artemisia tridentata	10	Y	UPL
2. Symphoricarpos albus	5	Y	FACU
3. Rosa woodsii	5	Y	FACU
4.			
	20	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Pascopyrum smithii	40	Y	FAC
2. Poa pratensis	20	Y	FAC
3. Medicago sativa	10	N	UPL
4. Achillea millefolium	5	N	FACU
5. Equisetum hyemale	2	N	FACW
6. Cirsium sp.	TR	N	-
7. Vicia villosa	TR	N	UPL
8.			
	77	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
Total Cover:	0		

% Bare Ground in Herb Stratum 23 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 40 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:	2	x 2 =	4
FAC species:	60	x 3 =	180
FACU species:	15	x 4 =	60
UPL species:	20	x 5 =	100
Column Totals:	97 (A)		344 (B)

Prevalence Index = B/A = 3.55

Hydrophytic Vegetation Indicators:

- Dominance Test >50%
- Prevalence Index is ≤3.0[1]
- Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes:** **No: X**

Remarks: Uplant plant community.

SOILS

Sampling Point: W23B

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]		
0 - 18	10YR 5/3	100	-	-	-	-	clay loam	very fine granular

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) **(LRR C)**
- ____ 1 cm Muck (A9) **(LRR D)**
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) **(LRR C)**
- ____ 2 cm Muck (A10) **(LRR B)**
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: No: X

Remarks: No redox present

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- _____ Water Marks (B1) **(Riverine)**
- _____ Sediment Deposits (B2) **(Riverine)**
- _____ Drift Deposits (B3) **(Riverine)**
- _____ Drainage patterns (B10)
- _____ Dry-Season Water Table (C2)
- _____ Crayfish Burrows (C8)
- _____ Saturation Visible on Aerial Imagery (C9)
- _____ Shallow Aquitard (D3)
- FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ____ No X Depth (inches): _____

Water Table Present? Yes: ____ No X Depth (inches): _____

Saturation Present? (Incl. capillary fringe) Yes: ____ No X Depth (inches):

Wetland Hydrology Present? Yes: No: X

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Dry and friable. Higher in elevation than the adjacent wetland.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: May 24, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W24A
Investigator(s): Dennis Wenger, Collin Covington	Section, Township, Range: 24, 39S, 6W	
Landform (hillslope, terrace, etc.): drainage floor	Local relief (concave, convex, none): none	Slope (%): 2
Subregion (LRR): D	Easting: 369614	Northing: 4141279 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X No: (If no, explain in Remarks.)		
Are Vegetation: , Soil: , or Hydrology: significantly disturbed? Are "Normal Circumstances" present? Yes: X No:		
Are Vegetation: , Soil: , or Hydrology: naturally disturbed? (If needed, explain any answers in Remarks.)		

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes: X	No:	**Is the Sampled Area within a Wetland? Yes: X No:**
Hydric Soil Present?	Yes: X	No:	
Wetland Hydrology Present?	Yes: X	No:	

Remarks: Kanab Creek floodplain. Sample point is approximately 1.5 feet away from flowing water of Kanab Creek. Photos of site: 1038 - soil, 1039 - southwest, 1040 - north.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Juncus arcticus	55	Y	FACW
2. Bromus inermis	15	N	FACU
3. Poa pratensis	15	N	FAC
4. Equisetum arvense	TR	N	FAC
5. Equisetum hyemale	TR	N	FACW
6. Achillea millefolium	TR	N	FACU
7. Taraxacum officinale	TR	N	FACU
8.			
	85	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
	Total Cover: 0		

% Bare Ground in Herb Stratum 15 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:	55	x 2 =	110
FAC species:	15	x 3 =	45
FACU species:	15	x 4 =	60
UPL species:		x 5 =	0
Column Totals:	85 (A)		215 (B)

Prevalence Index = B/A = 2.53

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

X Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes: X No:

Remarks: Wetland plant community.

SOILS

Sampling Point: W24A

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features					
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 15	10YR 5/2	80	10YR 5/6	20	C	M	sandy clay	black sulfide streaks
15 - 18	-	-	-	-	-	-	Gravel	-

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___	Histosol (A1)	___	Sandy Redox (S5)
___	Histic Epipedon (A2)	___	Stripped Matrix (S6)
___	Black Histic (A3)	___	Loamy Mucky Mineral (F1)
X	Hydrogen Sulfide (A4)	___	Loamy Gleyed Matrix (F2)
___	Stratified Layers (A5) (**LRR C**)	X	Depleted Matrix (F3)
___	1 cm Muck (A9) (**LRR D**)	___	Redox Dark Surface (F6)
___	Depleted Below Dark Surface (A11)	___	Depleted Dark Surface (F7)
___	Thick Dark Surface (A12)	___	Redox Depressions (F8)
___	Sandy Mucky Mineral (S1)	___	Vernal Pools (F9)
___	Sandy Gleyed Matrix (S4)		

Indicators for Problematic Hydric Soils[3]:

___	1 cm Muck (A9) (**LRR C**)
___	2 cm Muck (A10) (**LRR B**)
___	Reduced Vertic (F18)
___	Red Parent Material (TF2)
___	Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: X No:

Remarks: -

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)				Secondary Indicators (2 or more required)	
___	Surface Water (A1)	___	Salt Crust (B11)	_____	Water Marks (B1) (**Riverine**)
___	High Water Table (A2)	___	Biotic Crust (B12)	_____	Sediment Deposits (B2) (**Riverine**)
___	Saturation (A3)	___	Aquatic Invertebrates (B13)	_____	Drift Deposits (B3) (**Riverine**)
___	Water Marks (B1) (**Nonriverine**)	X	Hydrogen Sulfide Odor (C1)	_____	Drainage patterns (B10)
___	Sediment Deposits (B2) (**Nonriverine**)	X	Oxidized Rhizospheres along Living Roots	_____	Dry-Season Water Table (C2)
___	Drift Deposits (B3) (**Nonriverine**)	___	Presence of Reduced Iron (C4)	_____	Crayfish Burrows (C8)
___	Surface Soil Cracks (B6)	___	Recent Iron Reduction in Plowed Soils (C6)	_____	Saturation Visible on Aerial Imagery (C9)
___	Inundation Visible on Aerial Imagery (B7)	___	Thin Muck Surface (C7)	_____	Shallow Aquitard (D3)
	Water-Stained Leaves (B9)		Other (Explain in Remarks)		FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes:	___	No	X	Depth (inches):	_____
Water Table Present?	Yes:	___	No	X	Depth (inches):	_____
Saturation Present? (incl. capillary fringe)	Yes:	X	No		Depth (inches):	15

Wetland Hydrology Present? Yes: X No:

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Soil column was moist throughout but not saturated.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: May 24, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W24B
Investigator(s): Dennis Wenger, Collin Covington	Section, Township, Range: 24, 39S, 6W	
Landform (hillslope, terrace, etc.): terrace	Local relief (concave, convex, none): none	Slope (%): 2
Subregion (LRR): D	Easting: 369612	Northing: 4141282 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X	No: (If no, explain in Remarks.)	
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X	No:
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes:	No: X	**Is the Sampled Area within a Wetland?** **Yes:** **No: X**
Hydric Soil Present?	Yes:	No: X	
Wetland Hydrology Present?	Yes:	No: X	

Remarks: Low terrace of Kanab Creek. The sample point is approximately 12 inches above the wetland sample point. Photos of site: 1036 - soil and 1037 - south.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size: 6' x 6')			
1. Artemisia nova	15	Y	UPL
2. Artemisia tridentata	10	Y	UPL
3.			
4.			
	25	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Bromus inermis	25	Y	FACU
2. Medicago sativa	5	N	UPL
3. Equisetum hyemale	3	N	FACW
4.			
5.			
6.			
7.			
8.			
	33	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
Total Cover: 0			

% Bare Ground in Herb Stratum 67 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0 (A/B)

Prevalence Index Worksheet:

Total % Cover of:	Multiply by:	
OBL species:	x 1=	0
FACW species: 3	x 2 =	6
FAC species:	x 3 =	0
FACU species: 25	x 4 =	100
UPL species: 30	x 5 =	150
Column Totals: 58 (A)		256 (B)

Prevalence Index = B/A = 4.41

Hydrophytic Vegetation Indicators:

Dominance Test >50%

Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes:** **No: X**

Remarks: Upland vegetation community.

SOILS

Sampling Point: W24B

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 10	-	100	-	-	-	-	sand/gravel/	cobble

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) **(LRR C)**
- ____ 1 cm Muck (A9) **(LRR D)**
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) **(LRR C)**
- ____ 2 cm Muck (A10) **(LRR B)**
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: Gravel/cobble

Depth (inches): 10

Hydric Soil Present? Yes: No: X

Remarks: No evidence of hydric conditions.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- _____ Water Marks (B1) **(Riverine)**
- _____ Sediment Deposits (B2) **(Riverine)**
- _____ Drift Deposits (B3) **(Riverine)**
- _____ Drainage patterns (B10)
- _____ Dry-Season Water Table (C2)
- _____ Crayfish Burrows (C8)
- _____ Saturation Visible on Aerial Imagery (C9)
- _____ Shallow Aquitard (D3)
- FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ____ No X Depth (inches): _____

Water Table Present? Yes: ____ No X Depth (inches): _____

Saturation Present? (incl. capillary fringe) Yes: ____ No X Depth (inches):

Wetland Hydrology Present? Yes: No: X

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Dry and friable.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: May 24, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W25A
Investigator(s): Dennis Wenger, Collin Covington	Section, Township, Range: 24, 39S, 6W	
Landform (hillslope, terrace, etc.): drainage floor	Local relief (concave, convex, none): none	Slope (%): 1
Subregion (LRR): D	Easting: 369718	Northing: 4141356 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X	No: (If no, explain in Remarks.)	
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X	No:
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes: X	No:	**Is the Sampled Area within a Wetland?** **Yes: X** **No:**
Hydric Soil Present?	Yes: X	No:	
Wetland Hydrology Present?	Yes: X	No:	

Remarks: Kanab Creek floodplain. Sample point is approximately 8 inches away from flowing water of Kanab Creek. Photos of site: 1042 - soil, 1043 - southwest, 1044 - northeast.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:_____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:_____)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Eleocharis palustris	20	Y	OBL
2. Poa pratensis	20	Y	FAC
3. Juncus arcticus	10	N	FACW
4. Juncus mexicanus	10	N	FACW
5.			
6.			
7.			
8.			
	60	= Total Cover	
Woody Vine Stratum (Plot Size:_____)			
1.			
2.			
	Total Cover: 0		

% Bare Ground in Herb Stratum 40 % Cover of Biotic Crust_____

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:	20	x 1=	20
FACW species:	20	x 2 =	40
FAC species:	20	x 3 =	60
FACU species:		x 4 =	0
UPL species:		x 5 =	0
Column Totals:	60 (A)		120 (B)

Prevalence Index = B/A = 2.00

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

X Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes: X** **No:**

Remarks: Wetland plant community.

SOILS

Sampling Point: W25A

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features					
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 5	10YR 5/2	100	10YR 5/6	20	C	M	clay	black organic streaking
5 - 12	10YR 5/1	100	10YR 5/6	20	C	M	clay	gravel present
12	Restrictive Layer	-	-	-	-	-	gravel	-

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___ Histosol (A1)	___ Sandy Redox (S5)	___ 1 cm Muck (A9) (**LRR C**)
___ Histic Epipedon (A2)	___ Stripped Matrix (S6)	___ 2 cm Muck (A10) (**LRR B**)
___ Black Histic (A3)	___ Loamy Mucky Mineral (F1)	___ Reduced Vertic (F18)
___ Hydrogen Sulfide (A4)	___ Loamy Gleyed Matrix (F2)	___ Red Parent Material (TF2)
___ Stratified Layers (A5) (**LRR C**)	_X_ Depleted Matrix (F3)	___ Other (Explain in Remarks)
___ 1 cm Muck (A9) (**LRR D**)	___ Redox Dark Surface (F6)	
___ Depleted Below Dark Surface (A11)	___ Depleted Dark Surface (F7)	
___ Thick Dark Surface (A12)	___ Redox Depressions (F8)	
___ Sandy Mucky Mineral (S1)	___ Vernal Pools (F9)	
___ Sandy Gleyed Matrix (S4)		

Indicators for Problematic Hydric Soils[3]:

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: Gravel

Depth (inches): 12

Hydric Soil Present? Yes: X No:

Remarks: At 5 inches there is gravel mixed into the clay.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)		Secondary Indicators (2 or more required)
___ Surface Water (A1)	___ Salt Crust (B11)	___ Water Marks (B1) (**Riverine**)
___ High Water Table (A2)	___ Biotic Crust (B12)	___ Sediment Deposits (B2) (**Riverine**)
___ Saturation (A3)	___ Aquatic Invertebrates (B13)	___ Drift Deposits (B3) (**Riverine**)
___ Water Marks (B1) (**Nonriverine**)	___ Hydrogen Sulfide Odor (C1)	___ Drainage patterns (B10)
___ Sediment Deposits (B2) (**Nonriverine**)	___ Oxidized Rhizospheres along Living Roots	___ Dry-Season Water Table (C2)
___ Drift Deposits (B3) (**Nonriverine**)	___ Presence of Reduced Iron (C4)	___ Crayfish Burrows (C8)
___ Surface Soil Cracks (B6)	___ Recent Iron Reduction in Plowed Soils (C6)	___ Saturation Visible on Aerial Imagery (C9)
___ Inundation Visible on Aerial Imagery (B7)	___ Thin Muck Surface (C7)	___ Shallow Aquitard (D3)
___ Water-Stained Leaves (B9)	___ Other (Explain in Remarks)	___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes: ___	No _X_	Depth (inches): ___		
Water Table Present?	Yes: ___	No _X_	Depth (inches): ___	**Wetland Hydrology Present?**	**Yes: X No:**
Saturation Present? (incl. capillary fringe)	Yes: X	No ___	Depth (inches): 0		

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: -

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: May 24, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W25B
Investigator(s): Dennis Wenger, Collin Covington	Section, Township, Range: 24, 39S, 6W	
Landform (hillslope, terrace, etc.): terrace	Local relief (concave, convex, none): none	Slope (%): 1
Subregion (LRR): D	Easting: 369721	Northing: 4141353 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X No: (If no, explain in Remarks.)		
Are Vegetation: , Soil: , or Hydrology: significantly disturbed? Are "Normal Circumstances" present? Yes: X No:		
Are Vegetation: , Soil: , or Hydrology: naturally disturbed? (If needed, explain any answers in Remarks.)		

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes:	No: X	**Is the Sampled Area within a Wetland?** **Yes:** **No: X**
Hydric Soil Present?	Yes:	No: X	
Wetland Hydrology Present?	Yes:	No: X	

Remarks: High point on an upland peninsula approximately 12 inches above the wetland adjacent to Kanab Creek. Photos of site: 1045 - soil and 1046 - northwest.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size: 6' x 6')	Absolute % Cover	Dominant Species?	Indicator Status
1. Juniperus osteosperma	30	Y	UPL
2. Pinus edulis	30	Y	UPL
3.			
4.			
	60	= Total Cover	
Sapling/Shrub Stratum (Plot Size: 6' x 6')			
1. Symphoricarpos albus	15	Y	FACU
2. Artemisia tridentata	10	Y	UPL
3. Quercus gambelii	10	Y	UPL
4.			
	35	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Poa pratensis	8	Y	FAC
2. Pascopyrum smithii	4	Y	FAC
3. Achillea millefolium	1	N	FACU
4. Equisetum hyemale	TR	N	FACW
5.			
6.			
7.			
8.			
	13	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
Total Cover: 0			

% Bare Ground in Herb Stratum 87 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 7 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 28.6 (A/B)

Prevalence Index Worksheet:

Total % Cover of:	Multiply by:	
OBL species:	x 1=	0
FACW species:	x 2 =	0
FAC species: 12	x 3 =	36
FACU species: 16	x 4 =	64
UPL species: 80	x 5 =	400
Column Totals: 108 (A)		500 (B)

Prevalence Index = B/A = 4.63

Hydrophytic Vegetation Indicators:

Dominance Test >50%

Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes:** **No: X**

Remarks: Upland plant community.

SOILS

Sampling Point: W25B

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0 - 18	-	100	-	-	-	-	Sand/Gravel	Cobble

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) (**LRR C**)
- ____ 1 cm Muck (A9) (**LRR D**)
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) (**LRR C**)
- ____ 2 cm Muck (A10) (**LRR B**)
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: No: X

Remarks: No soil development. Sand/Gravel/Cobble.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- _____ Water Marks (B1) (**Riverine**)
- _____ Sediment Deposits (B2) (**Riverine**)
- _____ Drift Deposits (B3) (**Riverine**)
- _____ Drainage patterns (B10)
- _____ Dry-Season Water Table (C2)
- _____ Crayfish Burrows (C8)
- _____ Saturation Visible on Aerial Imagery (C9)
- _____ Shallow Aquitard (D3)
- FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ____ No _X_ Depth (inches): _____

Water Table Present? Yes: ____ No _X_ Depth (inches): _____

Saturation Present? (incl. capillary fringe) Yes: ____ No X Depth (inches):

Wetland Hydrology Present? Yes: No: X

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Sample pit is moist. No evidence of wetland hydrology.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: May 24, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W26A
Investigator(s): Dennis Wenger, Collin Covington	Section, Township, Range: 13, 39S, 6W	
Landform (hillslope, terrace, etc.): drainage floor	Local relief (concave, convex, none): none	Slope (%): 1
Subregion (LRR): D	Easting: 369873	Northing: 4141765 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X	No: (If no, explain in Remarks.)	
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X	No:
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes: X	No:	**Is the Sampled Area within a Wetland?** **Yes: X** **No:**
Hydric Soil Present?	Yes: X	No:	
Wetland Hydrology Present?	Yes: X	No:	

Remarks: Kanab Creek floodplain. Sample point is approximately 25 feet away from low flow channel of Kanab Creek. Photos of site: 1049 - soil, 1050 - south, 1051 - west.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Eleocharis palustris	50	Y	OBL
2. Juncus arcticus	45	Y	FACW
3. Equisetum hyemale	2	N	FACW
4. Triglochin maritima	TR	N	OBL
5.			
6.			
7.			
8.			
	97	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
	Total Cover: 0		

% Bare Ground in Herb Stratum 3 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:	50	x 1=	50
FACW species:	47	x 2 =	94
FAC species:		x 3 =	0
FACU species:		x 4 =	0
UPL species:		x 5 =	0
Column Totals:	97 (A)		144 (B)

Prevalence Index = B/A = 1.48

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

X Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes: X** **No:**

Remarks: Wetland plant community.

SOILS

Sampling Point: W26A

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 7	10YR 5/2	85	10YR 5/6	15	C	M	clay	-
7 - 15	10YR 5/2	50	-	-	-	-	clay	-
"	Gley 1 2.5/N	50	-	-	-	-	clay	-
15	Restrictive Layer	-	-	-	-	-	gravel	-

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- X Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: Gravel

Depth (inches): 15

Hydric Soil Present? Yes: X No:

Remarks: Strong hydrogen sulfide smell

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- X Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes: ___	No X	Depth (inches):	___	
Water Table Present?	Yes: X	No ___	Depth (inches):	15	**Wetland Hydrology Present? Yes: X No:**
Saturation Present? (incl. capillary fringe)	Yes: X	No	Depth (inches):	0	

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Wetland conditions present.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: May 24, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W26B
Investigator(s): Dennis Wenger, Collin Covington	Section, Township, Range: 13, 39S, 6W	
Landform (hillslope, terrace, etc.): terrace	Local relief (concave, convex, none): none	Slope (%): 0
Subregion (LRR): D	Easting: 369866	Northing: 4141764 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X	No: (If no, explain in Remarks.)	
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X	No:
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes:	No: X	**Is the Sampled Area within a Wetland?** Yes: No: X
Hydric Soil Present?	Yes:	No: X	
Wetland Hydrology Present?	Yes:	No: X	

Remarks: Terrace approximately 12 inches above wetland sample point. Photos of site: 1052 - soil, 1054 - east, 1053 - Iris with Sagebrush.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size: 6' x 6')	Absolute % Cover	Dominant Species?	Indicator Status
1. Juniperus osteosperma	10	Y	UPL
2.			
3.			
4.			
	10	= Total Cover	
Sapling/Shrub Stratum (Plot Size: 6' x 6')			
1. Artemisia nova	35	Y	UPL
2. Artemisia tridentata	5	N	UPL
3. Rosa woodsii	1	N	FACU
4.			
	41	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Medicago sativa	15	Y	UPL
2. Poa pratensis	15	Y	FAC
3. Pascopyrum smithii	5	N	FAC
4. Distichlis spicata	5	N	FAC
5. Achillea millefolium	2	N	FACU
6. Plantago eriopoda	TR	N	FACW
7.			
8.			
	42	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
	Total Cover: 0		

% Bare Ground in Herb Stratum 58 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 25 (A/B)

Prevalence Index Worksheet:

Total % Cover of:	Multiply by:	
OBL species:	x 1=	0
FACW species:	x 2 =	0
FAC species: 25	x 3 =	75
FACU species: 3	x 4 =	12
UPL species: 65	x 5 =	325
Column Totals: 93 (A)		412 (B)

Prevalence Index = B/A = 4.43

Hydrophytic Vegetation Indicators:

- Dominance Test >50%
- Prevalence Index is ≤3.0[1]
- Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes: No: X

Remarks: Upland plant community.

SOILS

Sampling Point: W26B

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0 - 14	10YR 4/3	100	-	-	-	-	sand	gravels present
14	Restrictive Layer	100	-	-	-	-	sand/gravel	-

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) **(LRR C)**
- ____ 1 cm Muck (A9) **(LRR D)**
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) **(LRR C)**
- ____ 2 cm Muck (A10) **(LRR B)**
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: Gravel

Depth (inches): 14

Hydric Soil Present? Yes: No: X

Remarks: Crumbly. No redox observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ____ Water Marks (B1) **(Riverine)**
- ____ Sediment Deposits (B2) **(Riverine)**
- ____ Drift Deposits (B3) **(Riverine)**
- ____ Drainage patterns (B10)
- ____ Dry-Season Water Table (C2)
- ____ Crayfish Burrows (C8)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Shallow Aquitard (D3)
- FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ___ No X Depth (inches): ____

Water Table Present? Yes: ___ No X Depth (inches): ____

Saturation Present? (incl. capillary fringe) Yes: No X Depth (inches):

Wetland Hydrology Present? Yes: No: X

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Soil is moist, not saturated.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: May 24, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W27A
Investigator(s): Jeff Boice, Dennis Wenger, Collin Covington	Section, Township, Range: 13, 39S, 6W	
Landform (hillslope, terrace, etc.): drainage floor	Local relief (concave, convex, none): none	Slope (%): 1
Subregion (LRR): D	Easting: 369957 Northing: 4141883	Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	

Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X No: (If no, explain in Remarks.)

Are Vegetation: , Soil: , or Hydrology: significantly disturbed? Are "Normal Circumstances" present? Yes: X No:

Are Vegetation: , Soil: , or Hydrology: naturally disturbed? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes: X	No:	**Is the Sampled Area within a Wetland?** Yes: X No:
Hydric Soil Present?	Yes: X	No:	
Wetland Hydrology Present?	Yes: X	No:	

Remarks: Kanab Creek floodplain. Sample point is approximately 6 feet away and 10 inches above the low flow channel of Kanab Creek. Photos of site: 1057 - soil, 1058 - northeast, 1059 - east.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Juncus arcticus	65	Y	FACW
2. Eleocharis palustris	30	Y	OBL
3. Carex praegracilis	5	N	FACW
4. Iris missouriensis	TR	N	FACW
5.			
6.			
7.			
8.			
	100	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
	Total Cover: 0		

% Bare Ground in Herb Stratum 0 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:	30	x 1=	30
FACW species:	70	x 2 =	140
FAC species:		x 3 =	0
FACU species:		x 4 =	0
UPL species:		x 5 =	0
Column Totals:	100 (A)		170 (B)

Prevalence Index = B/A = 1.70

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

X Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes: X No:

Remarks: Wetland plant community.

SOILS

Sampling Point: W27A

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features					
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 9	Gley 1 2.5/N	50	10YR 5/6	10	C	M	clay	-
"	10YR 5/2	30	-	-	-	-	"	-
"	10YR 6/3	10	-	-	-	-	"	-
9 - 18	-	100	-	-	-	-	sand/gravel	-

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- X Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: X No:

Remarks: Hydric soil.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- X Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ___ No X Depth (inches): ___

Water Table Present? Yes: X No ___ Depth (inches): 10

Saturation Present? (incl. capillary fringe) Yes: X No Depth (inches): 0

Wetland Hydrology Present? Yes: X No:

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: -

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: May 24, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W27B
Investigator(s): Jeff Boice, Dennis Wenger, Collin Covington	Section, Township, Range: 13, 39S, 6W	
Landform (hillslope, terrace, etc.): hillslope	Local relief (concave, convex, none): none	Slope (%): 5
Subregion (LRR): D	Easting: 369960 Northing: 4141880	Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X No: (If no, explain in Remarks.)		
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X No:	
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes:	No: X	**Is the Sampled Area within a Wetland?** Yes: No: X
Hydric Soil Present?	Yes:	No: X	
Wetland Hydrology Present?	Yes:	No: X	

Remarks: Hillslope adjacent to wetlands around Kanab Creek. Photos of site: 1060 - soil and 1061 - west.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size: 6' x 6')			
1. Chrysothamnus nauseosus	20	Y	UPL
2.			
3.			
4.			
	20	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Juncus arcticus	30	Y	FACW
2. Medicago sativa	30	Y	UPL
3. Poa pratensis	15	N	FAC
4. Achillea millefolium	5	N	FACU
5. Taraxacum officinale	2	N	FACU
6.			
7.			
8.			
	82	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
Total Cover:	0		
% Bare Ground in Herb Stratum 18	% Cover of Biotic Crust		

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 33.3 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:	30	x 2 =	60
FAC species:	15	x 3 =	45
FACU species:	7	x 4 =	28
UPL species:	50	x 5 =	250
Column Totals:	102 (A)		383 (B)

Prevalence Index = B/A = 3.75

Hydrophytic Vegetation Indicators:

Dominance Test >50%

Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes: No: X

Remarks: Upland plant community.

SOILS

Sampling Point: W27B

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features					
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 18	10YR 5/4	100	-	-	-	-	clay	-

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) (**LRR C**)
- ____ 1 cm Muck (A9) (**LRR D**)
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) (**LRR C**)
- ____ 2 cm Muck (A10) (**LRR B**)
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: No: X

Remarks: No redox present.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ____ Water Marks (B1) (**Riverine**)
- ____ Sediment Deposits (B2) (**Riverine**)
- ____ Drift Deposits (B3) (**Riverine**)
- ____ Drainage patterns (B10)
- ____ Dry-Season Water Table (C2)
- ____ Crayfish Burrows (C8)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Shallow Aquitard (D3)
- ____ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ___ No X Depth (inches): ____

Water Table Present? Yes: ___ No X Depth (inches): ____

Saturation Present? (incl. capillary fringe) Yes: ___ No X Depth (inches): ____

Wetland Hydrology Present? Yes: No: X

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Dry and friable.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: May 24, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W28A
Investigator(s): Dennis Wenger, Collin Covington	Section, Township, Range: 13, 39S, 6W	
Landform (hillslope, terrace, etc.): drainage floor	Local relief (concave, convex, none): none	Slope (%): 1
Subregion (LRR): D	Easting: 370042	Northing: 4142110 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	

Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X No: (If no, explain in Remarks.)

Are Vegetation: , Soil: , or Hydrology: significantly disturbed? Are "Normal Circumstances" present? Yes: X No:

Are Vegetation: , Soil: , or Hydrology: naturally disturbed? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes: X	No:	**Is the Sampled Area within a Wetland?** **Yes: X** **No:**
Hydric Soil Present?	Yes: X	No:	
Wetland Hydrology Present?	Yes: X	No:	

Remarks: Approximately 12 inches above the elevation of the flowing water in Kanab Creek and 3 feet to the west. Photos of site: 1066 - soil, 1067 - east, 1068 - north.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size: 6' x 6')	Absolute % Cover	Dominant Species?	Indicator Status
1. Elaeagnus angustifolia	5	Y	FAC
2.			
3.			
4.			
	5	= Total Cover	
Sapling/Shrub Stratum (Plot Size: 6' x 6')			
1. Rosa woodsii	5	Y	FACU
2.			
3.			
4.			
	5	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Juncus arcticus	35	Y	FACW
2. Juncus mexicanus	10	N	FACW
3. Phleum pratense	10	N	FACU
4. Iris missouriensis	3	N	FACW
5. Carex sp.	2	N	-
6. Plantago eriopoda	TR	N	FACW
7.			
8.			
	60	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
Total Cover:	0		

% Bare Ground in Herb Stratum 40 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 66.7 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:	48	x 2 =	96
FAC species:	5	x 3 =	15
FACU species:	15	x 4 =	60
UPL species:		x 5 =	0
Column Totals:	68 (A)		171 (B)

Prevalence Index = B/A = 2.51

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

X Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes: X** **No:**

Remarks: Wetland plant community.

SOILS

Sampling Point: W28A

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features					
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 18	10YR 5/2	70	10YR 4/6	30	C	M	clay	black organic streaking present

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___	Histosol (A1)	___	Sandy Redox (S5)
___	Histic Epipedon (A2)	___	Stripped Matrix (S6)
___	Black Histic (A3)	___	Loamy Mucky Mineral (F1)
X	Hydrogen Sulfide (A4)	___	Loamy Gleyed Matrix (F2)
___	Stratified Layers (A5) (**LRR C**)	X	Depleted Matrix (F3)
___	1 cm Muck (A9) (**LRR D**)	___	Redox Dark Surface (F6)
___	Depleted Below Dark Surface (A11)	___	Depleted Dark Surface (F7)
___	Thick Dark Surface (A12)	___	Redox Depressions (F8)
___	Sandy Mucky Mineral (S1)	___	Vernal Pools (F9)
___	Sandy Gleyed Matrix (S4)		

Indicators for Problematic Hydric Soils[3]:

___	1 cm Muck (A9) (**LRR C**)
___	2 cm Muck (A10) (**LRR B**)
___	Reduced Vertic (F18)
___	Red Parent Material (TF2)
___	Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: X No:

Remarks: Black, organic decaying material present along with course gravel and sand mixed throughout the column.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)				Secondary Indicators (2 or more required)	
___	Surface Water (A1)	___	Salt Crust (B11)	___	Water Marks (B1) (**Riverine**)
X	High Water Table (A2)	___	Biotic Crust (B12)	___	Sediment Deposits (B2) (**Riverine**)
X	Saturation (A3)	___	Aquatic Invertebrates (B13)	___	Drift Deposits (B3) (**Riverine**)
___	Water Marks (B1) (**Nonriverine**)	X	Hydrogen Sulfide Odor (C1)	___	Drainage patterns (B10)
___	Sediment Deposits (B2) (**Nonriverine**)	___	Oxidized Rhizospheres along Living Roots	___	Dry-Season Water Table (C2)
___	Drift Deposits (B3) (**Nonriverine**)	___	Presence of Reduced Iron (C4)	___	Crayfish Burrows (C8)
___	Surface Soil Cracks (B6)	___	Recent Iron Reduction in Plowed Soils (C6)	___	Saturation Visible on Aerial Imagery (C9)
___	Inundation Visible on Aerial Imagery (B7)	___	Thin Muck Surface (C7)	___	Shallow Aquitard (D3)
	Water-Stained Leaves (B9)		Other (Explain in Remarks)		FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes:	___	No	X	Depth (inches):	___
Water Table Present?	Yes:	X	No	___	Depth (inches):	7
Saturation Present? (Incl. capillary fringe)	Yes:	X	No		Depth (inches):	0

Wetland Hydrology Present? Yes: X No:

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: -

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: May 24, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W28B
Investigator(s): Dennis Wenger, Collin Covington	Section, Township, Range: 13, 39S, 6W	
Landform (hillslope, terrace, etc.): terrace	Local relief (concave, convex, none): none	Slope (%): 1
Subregion (LRR): D	Easting: 370037	Northing: 4142105 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X	No: (If no, explain in Remarks.)	
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X	No:
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes:	No: X	**Is the Sampled Area within a Wetland?** **Yes:** **No: X**
Hydric Soil Present?	Yes:	No: X	
Wetland Hydrology Present?	Yes:	No: X	

Remarks: Approximately 2 feet higher in elevation than the adjacent wetland sample point. Photos of site: 1069 - soil and 1070 - east.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size: 6' x 6')			
1. Artemisia nova	15	Y	UPL
2. Artemisia tridentata	15	Y	UPL
3.			
4.			
	30	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Medicago sativa	25	Y	UPL
2. Poa pratensis	10	Y	FAC
3. Achillea millefolium	5	N	FACU
4. Juncus arcticus	5	N	FACW
5.			
6.			
7.			
8.			
	45	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
Total Cover: 0			

% Bare Ground in Herb Stratum 55 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 25 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:	5	x 2 =	10
FAC species:	10	x 3 =	30
FACU species:	5	x 4 =	20
UPL species:	55	x 5 =	275
Column Totals:	75 (A)		335 (B)

Prevalence Index = B/A = 4.47

Hydrophytic Vegetation Indicators:

Dominance Test >50%

Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes:** **No: X**

Remarks: Upland plant community.

SOILS

Sampling Point: W28B

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0 - 18	-	100	-	-	-	-	sand/gravel	no soil development

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) (**LRR C**)
- ____ 1 cm Muck (A9) (**LRR D**)
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) (**LRR C**)
- ____ 2 cm Muck (A10) (**LRR B**)
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: No: X

Remarks: -

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- _____ Water Marks (B1) (**Riverine**)
- _____ Sediment Deposits (B2) (**Riverine**)
- _____ Drift Deposits (B3) (**Riverine**)
- _____ Drainage patterns (B10)
- _____ Dry-Season Water Table (C2)
- _____ Crayfish Burrows (C8)
- _____ Saturation Visible on Aerial Imagery (C9)
- _____ Shallow Aquitard (D3)
- FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ____ No X Depth (inches): _____

Water Table Present? Yes: ____ No X Depth (inches): _____

Saturation Present? (incl. capillary fringe) Yes: ____ No X Depth (inches):

Wetland Hydrology Present? Yes: No: X

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Dry and friable.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: May 24, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W29A
Investigator(s): Jeff Boice, Dennis Wenger, Collin Covington	Section, Township, Range: 13, 39S, 6W	
Landform (hillslope, terrace, etc.): hillslope	Local relief (concave, convex, none): none	Slope (%): 15
Subregion (LRR): D	Easting: 369968 Northing: 4142148	Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X No: (If no, explain in Remarks.)		
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X No:	
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes: X No:	**Is the Sampled Area within a Wetland?**	**Yes: X** **No:**
Hydric Soil Present? Yes: X No:		
Wetland Hydrology Present? Yes: X No:		

Remarks: Hillslope seep area. Photos of site: 1072 - soil, 1073 - north, 1074 - west.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Juncus arcticus	55	Y	FACW
2. Distichlis spicata	10	N	FAC
3. Plantago eriopoda	10	N	FACW
4. Triglochin maritima	10	N	OBL
5. Carex sp.	5	N	-
6. Carex praegracilis	5	N	FACW
7. Juncus mexicanus	5	N	FACW
8.			
	100	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
Total Cover: 0			

% Bare Ground in Herb Stratum 0 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:	10	x 1=	10
FACW species:	75	x 2 =	150
FAC species:	10	x 3 =	30
FACU species:		x 4 =	0
UPL species:		x 5 =	0
Column Totals:	95 (A)		190 (B)

Prevalence Index = B/A = 2.00

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

X Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes: X No:

Remarks: Wetland plant community.

SOILS

Sampling Point: W29A

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 18	Gley 1 5/10Y	60	-	-	-	-	clay	-
"	10YR 5/6	40	-	-	-	-	clay	-

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- X Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: X No:

Remarks: Organic material and gravel found throughout column.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- X Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes: ___	No X	Depth (inches): ___		
Water Table Present?	Yes: ___	No X	Depth (inches): ___		
Saturation Present? (incl. capillary fringe)	Yes: X	No	Depth (inches): 0	**Wetland Hydrology Present?**	**Yes: X No:**

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: -

\WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: May 24, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W29B
Investigator(s): Jeff Boice, Dennis Wenger, Collin Covington	Section, Township, Range: 13, 39S, 6W	
Landform (hillslope, terrace, etc.): hillslope	Local relief (concave, convex, none): none	Slope (%): 15
Subregion (LRR): D	Easting: 369963 Northing: 4142143	Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X No:	(If no, explain in Remarks.)	
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X No:	
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes:	No: X	**Is the Sampled Area within a Wetland?** **Yes:** **No: X**
Hydric Soil Present?	Yes:	No: X	
Wetland Hydrology Present?	Yes:	No: X	

Remarks: Hillslope above the wetland seep area. Approximately 4 feet above the wetland sample point. Photos of site: 1075 - soil and 1076 - east.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:_____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size: 6' x 6')			
1. Artemisia tridentata	40	Y	UPL
2.			
3.			
4.			
	40	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Juncus arcticus	45	Y	FACW
2. Achillea millefolium	10	N	FACU
3. Medicago sativa	TR	N	UPL
4.			
5.			
6.			
7.			
8.			
	55	= Total Cover	
Woody Vine Stratum (Plot Size:_____)			
1.			
2.			
Total Cover: 0			
% Bare Ground in Herb Stratum 45	% Cover of Biotic Crust_____		

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50 (A/B)

Prevalence Index Worksheet:

Total % Cover of:	Multiply by:	
OBL species:	x 1=	0
FACW species: 45	x 2 =	90
FAC species:	x 3 =	0
FACU species: 10	x 4 =	40
UPL species: 40	x 5 =	200
Column Totals: 95 (A)		330 (B)

Prevalence Index = B/A = 3.47

Hydrophytic Vegetation Indicators:

Dominance Test >50%

Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes:** **No: X**

Remarks: Upland plant community.

SOILS

Sampling Point: W29B

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features					
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 18	10YR 4/2	100	-	-	-	-	clay	-

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) **(LRR C)**
- ____ 1 cm Muck (A9) **(LRR D)**
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) **(LRR C)**
- ____ 2 cm Muck (A10) **(LRR B)**
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: No: X

Remarks: No redox present. White calcium carbonate nodules present below 10 inches.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ____ Water Marks (B1) **(Riverine)**
- ____ Sediment Deposits (B2) **(Riverine)**
- ____ Drift Deposits (B3) **(Riverine)**
- ____ Drainage patterns (B10)
- ____ Dry-Season Water Table (C2)
- ____ Crayfish Burrows (C8)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Shallow Aquitard (D3)
- FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ____ No X Depth (inches): ____

Water Table Present? Yes: ____ No X Depth (inches): ____

Saturation Present? (incl. capillary fringe) Yes: ____ No X Depth (inches): ____

Wetland Hydrology Present? Yes: No: X

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Dry and friable.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: May 24, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W30
Investigator(s): Jeff Boice, Dennis Wenger, Collin Covington	Section, Township, Range: 18, 39S, 5W	
Landform (hillslope, terrace, etc.): drainage floor	Local relief (concave, convex, none): none	Slope (%): 1
Subregion (LRR): D	Easting: 370127	Northing: 4142333 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X No: (If no, explain in Remarks.)		
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X No:	
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes: X	No:	**Is the Sampled Area within a Wetland? Yes: X No:**
Hydric Soil Present?	Yes: X	No:	
Wetland Hydrology Present?	Yes: X	No:	

Remarks: Within Ordinary High Water Mark of Kanab Creek. Approximately 3 feet west of the low-flow channel and 3 inches higher in elevation. Photos of site: 1084 - soil and 1085 - north.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Medicago sativa	7	Y	UPL
2. Carex praegracilis	3	Y	FACW
3. Juncus arcticus	3	Y	FACW
4. Bromus inermis	1	N	FACU
5.			
6.			
7.			
8.			
	14	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
	Total Cover: 0		

% Bare Ground in Herb Stratum 86 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 66.7 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:	6	x 2 =	12
FAC species:		x 3 =	0
FACU species:	1	x 4 =	4
UPL species:	7	x 5 =	35
Column Totals:	14 (A)		51 (B)

Prevalence Index = B/A = 3.64

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes: X No:

Remarks:

SOILS

Sampling Point: W30

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type[1]	Redox Features Loc[2]	Texture	Remarks
0 - 18	-	100	-	-	-	-	sand/gravel	-

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: X No:

Remarks: No soil development. Within active floodplain of Kanab Creek.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ___ No _X_ Depth (inches): ___

Water Table Present? Yes: ___ No _X_ Depth (inches): ___

Saturation Present? (incl. capillary fringe) Yes: No X Depth (inches):

Wetland Hydrology Present? Yes: X No:

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Dry and friable. It is assumed that early season water levels are sufficient to support wetland conditions.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: June 4, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W31A
Investigator(s): Jeff Boice, Collin Covington	Section, Township, Range: 12, 39S, 6W	
Landform (hillslope, terrace, etc.): blocked drainage	Local relief (concave, convex, none): concave	Slope (%): >1
Subregion (LRR): D	Easting: 369671	Northing: 4143268 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X No: (If no, explain in Remarks.)		
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X No:	
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes: X	No:	**Is the Sampled Area within a Wetland?** **Yes: X** **No:**
Hydric Soil Present?	Yes: X	No:	
Wetland Hydrology Present?	Yes: X	No:	

Remarks: Man-made livestock pond that blocks an upland drainage swale and captures upland runoff from hillslope to west. Has historically held water and appears to be transitioning to drier conditions. Photos of site: 1119 - soil, 1120 - south, 1121 - west.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:_____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:_____)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Hordeum jubatum	20	Y	FAC
2. Xanthium strumarium	13	Y	FAC
3. Medicago sativa	5	N	UPL
4. Lactuca serriola	5	N	FACU
5. Convolvulus arvensis	5	N	UPL
6. Chenopodium sp.	2	N	-
7. Bromus inermis	2	N	FACU
8. Agropyron cristatum	TR	N	UPL
	52	= Total Cover	
Woody Vine Stratum (Plot Size:_____)			
1.			
2.			
	Total Cover: 0		

% Bare Ground in Herb Stratum 48 % Cover of Biotic Crust_____

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:		x 2 =	0
FAC species:	33	x 3 =	99
FACU species:	7	x 4 =	28
UPL species:	10	x 5 =	50
Column Totals:	50 (A)		177 (B)

Prevalence Index = B/A = 3.54

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes: X** **No:**

Remarks: Wetland plant community.

SOILS

Sampling Point: W31A

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features					
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 5	2.5Y 6/2	90	2.5Y 5/2	10	C	M	clay	crumbly, angular
5 - 18	2.5Y 5/6	80	10YR 5/2	20	C	M	clay	crumbly, angular

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___ Histosol (A1)	___ Sandy Redox (S5)	___ 1 cm Muck (A9) **(LRR C)**
___ Histic Epipedon (A2)	___ Stripped Matrix (S6)	___ 2 cm Muck (A10) **(LRR B)**
___ Black Histic (A3)	___ Loamy Mucky Mineral (F1)	___ Reduced Vertic (F18)
___ Hydrogen Sulfide (A4)	___ Loamy Gleyed Matrix (F2)	___ Red Parent Material (TF2)
___ Stratified Layers (A5) **(LRR C)**	X Depleted Matrix (F3)	___ Other (Explain in Remarks)
___ 1 cm Muck (A9) **(LRR D)**	___ Redox Dark Surface (F6)	
___ Depleted Below Dark Surface (A11)	___ Depleted Dark Surface (F7)	
___ Thick Dark Surface (A12)	___ Redox Depressions (F8)	
___ Sandy Mucky Mineral (S1)	___ Vernal Pools (F9)	
___ Sandy Gleyed Matrix (S4)		

Indicators for Problematic Hydric Soils[3]:

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: X No:

Remarks: -

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)		Secondary Indicators (2 or more required)
___ Surface Water (A1)	___ Salt Crust (B11)	___ Water Marks (B1) **(Riverine)**
___ High Water Table (A2)	___ Biotic Crust (B12)	___ Sediment Deposits (B2) **(Riverine)**
___ Saturation (A3)	___ Aquatic Invertebrates (B13)	___ Drift Deposits (B3) **(Riverine)**
___ Water Marks (B1) **(Nonriverine)**	___ Hydrogen Sulfide Odor (C1)	___ Drainage patterns (B10)
___ Sediment Deposits (B2) **(Nonriverine)**	___ Oxidized Rhizospheres along Living Roots	___ Dry-Season Water Table (C2)
___ Drift Deposits (B3) **(Nonriverine)**	___ Presence of Reduced Iron (C4)	___ Crayfish Burrows (C8)
X Surface Soil Cracks (B6)	___ Recent Iron Reduction in Plowed Soils (C6)	___ Saturation Visible on Aerial Imagery (C9)
___ Inundation Visible on Aerial Imagery (B7)	___ Thin Muck Surface (C7)	___ Shallow Aquitard (D3)
___ Water-Stained Leaves (B9)	___ Other (Explain in Remarks)	___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes: ___	No X	Depth (inches): ___		
Water Table Present?	Yes: ___	No X	Depth (inches): ___	**Wetland Hydrology Present?**	**Yes: X No:**
Saturation Present? (incl. capillary fringe)	Yes:	No X	Depth (inches):		

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Dry and friable. It is assumed that early season water levels are sufficient to support wetland conditions.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: June 4, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W31B
Investigator(s): Jeff Boice, Collin Covington	Section, Township, Range: 12, 39S, 6W	
Landform (hillslope, terrace, etc.): terrace	Local relief (concave, convex, none): none	Slope (%): >1
Subregion (LRR): D	Easting: 369673	Northing: 4143276	Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X	No:	(If no, explain in Remarks.)
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X	No:
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes:	No: X	**Is the Sampled Area within a Wetland?** Yes: No: X
Hydric Soil Present?	Yes:	No: X	
Wetland Hydrology Present?	Yes:	No: X	

Remarks: On the terrace above the man-made pond. Approximately 2 feet higher in elevation than the wetland sample point. Photos of site: 1122 - soil, 1123 - south, 1124 - east.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Melilotus officinalis	35	Y	FACU
2. Agropyron cristatum	15	Y	UPL
3. Poa pratensis	5	N	FAC
4.			
5.			
6.			
7.			
8.			
	55	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
	Total Cover: 0		

% Bare Ground in Herb Stratum 45 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:		x 2 =	0
FAC species:	5	x 3 =	15
FACU species:	35	x 4 =	140
UPL species:	15	x 5 =	75
Column Totals:	55 (A)		230 (B)

Prevalence Index = B/A = 4.18

Hydrophytic Vegetation Indicators:

- Dominance Test >50%
- Prevalence Index is ≤3.0[1]
- Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes: No: X

Remarks: Upland plant community.

SOILS

Sampling Point: W31B

Profile Description: (Describe to the depth needed to document the Indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type[1]	Redox Features Loc[2]	Texture	Remarks
0 - 18	10YR 5/2	100	-	-	-	-	clay	fine granular

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) **(LRR C)**
- ____ 1 cm Muck (A9) **(LRR D)**
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) **(LRR C)**
- ____ 2 cm Muck (A10) **(LRR B)**
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: No: X

Remarks: No redox observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- _____ Water Marks (B1) **(Riverine)**
- _____ Sediment Deposits (B2) **(Riverine)**
- _____ Drift Deposits (B3) **(Riverine)**
- _____ Drainage patterns (B10)
- _____ Dry-Season Water Table (C2)
- _____ Crayfish Burrows (C8)
- _____ Saturation Visible on Aerial Imagery (C9)
- _____ Shallow Aquitard (D3)
- _____ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ____ No X Depth (inches): _____

Water Table Present? Yes: ____ No X Depth (inches): _____

Saturation Present? (incl. capillary fringe) Yes: ____ No X Depth (inches): _____

Wetland Hydrology Present? Yes: No: X

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Dry and friable.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: June 5, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W32A
Investigator(s): Jeff Boice, Collin Covington	Section, Township, Range: 13, 39S, 6W	
Landform (hillslope, terrace, etc.): drainage bottom	Local relief (concave, convex, none): concave	Slope (%): 1
Subregion (LRR): D	Easting: 369106 Northing: 4142479	Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X No: (If no, explain in Remarks.)		
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X No:	
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes: X	No:	**Is the Sampled Area within a Wetland?** **Yes: X** **No:**
Hydric Soil Present?	Yes: X	No:	
Wetland Hydrology Present?	Yes: X	No:	

Remarks: Adjacent to drainage bottom, no defined channel. Photos of site: 1130 - soil, 1131 - north, 1132 - west.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Triglochin maritima	35	Y	OBL
2. Eleocharis palustris	15	Y	OBL
3. Juncus arcticus	15	Y	FACW
4. Carex praegracilis	5	N	FACW
5.			
6.			
7.			
8.			
	70	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
Total Cover: 0			
% Bare Ground in Herb Stratum 30	% Cover of Biotic Crust		

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:	50	x 1=	50
FACW species:	20	x 2 =	40
FAC species:		x 3 =	0
FACU species:		x 4 =	0
UPL species:		x 5 =	0
Column Totals:	70 (A)		90 (B)

Prevalence Index = B/A = 1.29

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

X Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes: X** **No:**

Remarks: Wetland plant community.

SOILS

Sampling Point: W32A

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features					
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 6	Gley 1 2.5/N	100	-	-	-	-	clay	-
6 - 18	10YR 5/1	80	10YR 5/6	20	C	M	clay	-

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- X Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: X No:

Remarks: Alkali powder on surface

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- X Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes: ___	No X	Depth (inches):		
Water Table Present?	Yes: X	No ___	Depth (inches):	14	**Wetland Hydrology Present? Yes: X No:**
Saturation Present? (incl. capillary fringe)	Yes: X	No	Depth (inches):	10	

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Flowing water on the surface approximately 12 inches to the west, no channel indicators present.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: June 5, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W32B
Investigator(s): Jeff Boice, Collin Covington	Section, Township, Range: 13, 39S, 6W	
Landform (hillslope, terrace, etc.): hillslope	Local relief (concave, convex, none): none	Slope (%): 10
Subregion (LRR): D	Easting: 369113	Northing: 4142480 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X	No: (If no, explain in Remarks.)	
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X	No:
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes:	No: X	**Is the Sampled Area within a Wetland?** **Yes:** **No: X**
Hydric Soil Present?	Yes:	No: X	
Wetland Hydrology Present?	Yes:	No: X	

Remarks: Hillslope adjacent to drainage bottom. Approximately 3 feet above the wetland sample point. Photos of site: 1133 - soil, 1134 - west, 1135 - south.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size: 6' x 6')			
1. Artemisia tridentata	10	Y	UPL
2.			
3.			
4.			
	10	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Melilotus officinalis	45	Y	FACU
2. Bromus inermis	15	Y	FACU
3. Thinopyrum intermedium	10	N	UPL
4. Achillea millefolium	5	N	FACU
5.			
6.			
7.			
8.			
	75	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
Total Cover:	0		

% Bare Ground in Herb Stratum 25 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0 (A/B)

Prevalence Index Worksheet:

Total % Cover of:	Multiply by:	
OBL species:	x 1=	0
FACW species:	x 2 =	0
FAC species:	x 3 =	0
FACU species: 65	x 4 =	260
UPL species: 20	x 5 =	100
Column Totals: 85 (A)		360 (B)

Prevalence Index = B/A = 4.24

Hydrophytic Vegetation Indicators:

- Dominance Test >50%
- Prevalence Index is ≤3.0[1]
- Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes:** **No: X**

Remarks: Upland plant community.

SOILS

Sampling Point: W32B

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]		
0 - 18	10YR 5/2	100	-	-	-	-	clay	granular

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: No: X

Remarks: No redox observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ___ No X Depth (inches): ___

Water Table Present? Yes: ___ No X Depth (inches): ___

Saturation Present? (incl. capillary fringe) Yes: ___ No X Depth (inches): ___

Wetland Hydrology Present? Yes: No: X

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Dry and friable.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: June 5, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W33A
Investigator(s): Jeff Boice, Collin Covington	Section, Township, Range: 13, 39S, 6W	
Landform (hillslope, terrace, etc.): drainage floor	Local relief (concave, convex, none): none	Slope (%): 2
Subregion (LRR): D	Easting: 369012	Northing: 4142559 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X	No: (If no, explain in Remarks.)	
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X	No:
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes: X	No:	**Is the Sampled Area within a Wetland?** **Yes: X** **No:**
Hydric Soil Present?	Yes: X	No:	
Wetland Hydrology Present?	Yes: X	No:	

Remarks: Adjacent to intermittent stream channel above the ordinary high water mark on the terrace. Photos of site: 1136 - soil, 1137 - southeast, 1138 - southwest.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size: 6' x 6')			
1. Salix exigua	5	Y	FACW
2. Chrysothamnus nauseosus	2	Y	UPL
3. Artemisia tridentata	TR	N	UPL
4.			
	7	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Juncus arcticus	80	Y	FACW
2. Hordeum jubatum	13	N	FAC
3. Poa palustris	5	N	FAC
4. Eleocharis palustris	2	N	OBL
5.			
6.			
7.			
8.			
	100	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
Total Cover: 0			

% Bare Ground in Herb Stratum 0 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 66.7 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:	2	x 1=	2
FACW species:	85	x 2 =	170
FAC species:	18	x 3 =	54
FACU species:		x 4 =	0
UPL species:	2	x 5 =	10
Column Totals:	107 (A)		236 (B)

Prevalence Index = B/A = 2.21

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

X Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes: X** **No:**

Remarks: Wetland plant community.

SOILS

Sampling Point: W33A

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 6	10YR 5/2	90	10YR 5/6	10	C	M	clay	-
6 - 18	10YR 4/1	80	10YR 5/6	20	C	M, PL	clay	-

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___ Histosol (A1)	___ Sandy Redox (S5)	___ 1 cm Muck (A9) (**LRR C**)
___ Histic Epipedon (A2)	___ Stripped Matrix (S6)	___ 2 cm Muck (A10) (**LRR B**)
___ Black Histic (A3)	___ Loamy Mucky Mineral (F1)	___ Reduced Vertic (F18)
X Hydrogen Sulfide (A4)	___ Loamy Gleyed Matrix (F2)	___ Red Parent Material (TF2)
___ Stratified Layers (A5) (**LRR C**)	X Depleted Matrix (F3)	___ Other (Explain in Remarks)
___ 1 cm Muck (A9) (**LRR D**)	___ Redox Dark Surface (F6)	
___ Depleted Below Dark Surface (A11)	___ Depleted Dark Surface (F7)	
___ Thick Dark Surface (A12)	___ Redox Depressions (F8)	
___ Sandy Mucky Mineral (S1)	___ Vernal Pools (F9)	
___ Sandy Gleyed Matrix (S4)		

Indicators for Problematic Hydric Soils[3]:

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: X No:

Remarks: Black streaking present below 6 inches.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)		Secondary Indicators (2 or more required)
___ Surface Water (A1)	___ Salt Crust (B11)	___ Water Marks (B1) (**Riverine**)
___ High Water Table (A2)	___ Biotic Crust (B12)	___ Sediment Deposits (B2) (**Riverine**)
___ Saturation (A3)	___ Aquatic Invertebrates (B13)	___ Drift Deposits (B3) (**Riverine**)
___ Water Marks (B1) (**Nonriverine**)	X Hydrogen Sulfide Odor (C1)	___ Drainage patterns (B10)
___ Sediment Deposits (B2) (**Nonriverine**)	___ Oxidized Rhizospheres along Living Roots	___ Dry-Season Water Table (C2)
___ Drift Deposits (B3) (**Nonriverine**)	___ Presence of Reduced Iron (C4)	___ Crayfish Burrows (C8)
___ Surface Soil Cracks (B6)	___ Recent Iron Reduction in Plowed Soils (C6)	___ Saturation Visible on Aerial Imagery (C9)
___ Inundation Visible on Aerial Imagery (B7)	___ Thin Muck Surface (C7)	___ Shallow Aquitard (D3)
___ Water-Stained Leaves (B9)	___ Other (Explain in Remarks)	___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ___ No X Depth (inches): ___

Water Table Present? Yes: ___ No X Depth (inches): ___

Saturation Present? (incl. capillary fringe) Yes: ___ No X Depth (inches): ___

Wetland Hydrology Present? Yes: X No:

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Moist, not saturated. It is assumed that early season water levels are sufficient to support wetland conditions.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: June 5, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W33B
Investigator(s): Jeff Boice, Collin Covington	Section, Township, Range: 13, 39S, 6W	
Landform (hillslope, terrace, etc.): hillslope	Local relief (concave, convex, none): none	Slope (%): 30
Subregion (LRR): D	Easting: 369007	Northing: 4142556 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X	No: (If no, explain in Remarks.)	
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X	No:
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes: ____	No: X	**Is the Sampled Area within a Wetland?** **Yes:** **No: X**
Hydric Soil Present?	Yes: ____	No: X	
Wetland Hydrology Present?	Yes:	No: X	

Remarks: Located on the hillslope approximately 2 feet above the wetland sample point. Opposite bank has evidence of slumping and seepage. Photos of site: 1139 - soil and 1140 - east.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size: 6' x 6')			
1. Artemisia tridentata	35	Y	UPL
2. Chrysothamnus nauseosus	5	N	UPL
3. Salix exigua	5	N	FACW
4. Rosa woodsii	2	N	FACU
	47	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Bromus inermis	60	Y	FACU
2. Achillea millefolium	5	N	FACU
3. Juncus arcticus	5	N	FACW
4. Melilotus officinalis	2	N	FACU
5.			
6.			
7.			
8.			
	72	= Total Cover	
Woody Vine Stratum (Plot Size: ____)			
1.			
2.			
Total Cover: 0			

% Bare Ground in Herb Stratum 28 % Cover of Biotic Crust ____

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:	10	x 2 =	20
FAC species:		x 3 =	0
FACU species:	69	x 4 =	276
UPL species:	40	x 5 =	200
Column Totals:	119 (A)		496 (B)

Prevalence Index = B/A = 4.17

Hydrophytic Vegetation Indicators:

Dominance Test >50%

Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes:** **No: X**

Remarks: Upland plant community.

SOILS

Sampling Point: W33B

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features					
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 18	10YR 5/2	100	-	-	-	-	clay	granular

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) **(LRR C)**
- ____ 1 cm Muck (A9) **(LRR D)**
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) **(LRR C)**
- ____ 2 cm Muck (A10) **(LRR B)**
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: No: X

Remarks: No redox observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- _____ Water Marks (B1) **(Riverine)**
- _____ Sediment Deposits (B2) **(Riverine)**
- _____ Drift Deposits (B3) **(Riverine)**
- _____ Drainage patterns (B10)
- _____ Dry-Season Water Table (C2)
- _____ Crayfish Burrows (C8)
- _____ Saturation Visible on Aerial Imagery (C9)
- _____ Shallow Aquitard (D3)
- FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ____ No X Depth (inches): _____

Water Table Present? Yes: ____ No X Depth (inches): _____

Saturation Present? (incl. capillary fringe) Yes: ____ No X Depth (inches):

Wetland Hydrology Present? Yes: No: X

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Dry and friable.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: June 5, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W34A
Investigator(s): Jeff Boice, Collin Covington	Section, Township, Range: 13, 39S, 6W	
Landform (hillslope, terrace, etc.): drainage floor	Local relief (concave, convex, none): none	Slope (%): 2
Subregion (LRR): D	Easting: 369217	Northing: 4142612 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X	No: (If no, explain in Remarks.)	
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X	No:
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes: X No:	**Is the Sampled Area within a Wetland? Yes: X No:**	
Hydric Soil Present? Yes: X No:		
Wetland Hydrology Present? Yes: X No:		

Remarks: Wetland area adjacent to intermittent stream channel. Photos of site: 1141 - soil, 1142 - south, 1143 - west.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Hordeum jubatum	40	Y	FAC
2. Juncus arcticus	30	Y	FACW
3. Carex praegracilis	20	Y	FACW
4. Carex sp.	5	N	-
5. Poa pratensis	5	N	FAC
6. Eleocharis palustris	2	N	OBL
7.			
8.			
	102	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
	Total Cover: 0		
% Bare Ground in Herb Stratum 0	% Cover of Biotic Crust		

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	3	(A)
Total Number of Dominant Species Across All Strata:	3	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	100	(A/B)

Prevalence Index Worksheet:

	Total % Cover of:	Multiply by:	
OBL species:	2	x 1=	2
FACW species:	50	x 2 =	100
FAC species:	45	x 3 =	135
FACU species:		x 4 =	0
UPL species:		x 5 =	0
Column Totals:	97 (A)		237 (B)

Prevalence Index = B/A = 2.44

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

X Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes: X No:

Remarks: Wetland plant community.

SOILS

Sampling Point: W34A

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features					
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 9	10YR 4/2	98	10YR 5/6	2	C	M	clay	densely rooted
9 - 18	10YR 4/1	90	10YR 5/6	10	C	M	clay	calcium carbonate nodules

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

____ Histosol (A1)	____ Sandy Redox (S5)	____ 1 cm Muck (A9) (**LRR C**)
____ Histic Epipedon (A2)	____ Stripped Matrix (S6)	____ 2 cm Muck (A10) (**LRR B**)
____ Black Histic (A3)	____ Loamy Mucky Mineral (F1)	____ Reduced Vertic (F18)
____ Hydrogen Sulfide (A4)	____ Loamy Gleyed Matrix (F2)	____ Red Parent Material (TF2)
____ Stratified Layers (A5) (**LRR C**)	__X__ Depleted Matrix (F3)	____ Other (Explain in Remarks)
____ 1 cm Muck (A9) (**LRR D**)	____ Redox Dark Surface (F6)	
____ Depleted Below Dark Surface (A11)	____ Depleted Dark Surface (F7)	
____ Thick Dark Surface (A12)	____ Redox Depressions (F8)	
____ Sandy Mucky Mineral (S1)	____ Vernal Pools (F9)	
____ Sandy Gleyed Matrix (S4)		

Indicators for Problematic Hydric Soils[3]:

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: X No:

Remarks: -

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)		Secondary Indicators (2 or more required)
___ Surface Water (A1)	___ Salt Crust (B11)	_____ Water Marks (B1) (**Riverine**)
___ High Water Table (A2)	___ Biotic Crust (B12)	_____ Sediment Deposits (B2) (**Riverine**)
___ Saturation (A3)	___ Aquatic Invertebrates (B13)	_____ Drift Deposits (B3) (**Riverine**)
___ Water Marks (B1) (**Nonriverine**)	___ Hydrogen Sulfide Odor (C1)	_____ Drainage patterns (B10)
___ Sediment Deposits (B2) (**Nonriverine**)	___ Oxidized Rhizospheres along Living Roots	_____ Dry-Season Water Table (C2)
___ Drift Deposits (B3) (**Nonriverine**)	___ Presence of Reduced Iron (C4)	_____ Crayfish Burrows (C8)
___ Surface Soil Cracks (B6)	___ Recent Iron Reduction in Plowed Soils (C6)	_____ Saturation Visible on Aerial Imagery (C9)
___ Inundation Visible on Aerial Imagery (B7)	___ Thin Muck Surface (C7)	_____ Shallow Aquitard (D3)
___ Water-Stained Leaves (B9)	___ Other (Explain in Remarks)	_____ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes: ____	No __X__	Depth (inches): ____		
Water Table Present?	Yes: ____	No __X__	Depth (inches): ____	**Wetland Hydrology Present?**	**Yes: X No:**
Saturation Present? (incl. capillary fringe)	Yes: ____	No X	Depth (inches): ____		

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Dry. It is assumed that early season water levels are sufficient to support wetland conditions.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: June 5, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W34B
Investigator(s): Jeff Boice, Collin Covington	Section, Township, Range: 13, 39S, 6W	
Landform (hillslope, terrace, etc.): hillslope	Local relief (concave, convex, none): none	Slope (%): 15
Subregion (LRR): D	Easting: 369222	Northing: 4142607 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X No: (If no, explain in Remarks.)		
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X No:	
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes:	No: X	**Is the Sampled Area within a Wetland?** Yes: No: X
Hydric Soil Present?	Yes:	No: X	
Wetland Hydrology Present?	Yes:	No: X	

Remarks: Located on a hillslope adjacent to wetland, approximately 18 inches higher than the wetland sample point. Photos of site: 1144 - soil, 1145 - north, 1146 - east.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size: 6' x 6')			
1. Rosa woodsii	7	Y	FACU
2. Artemisia tridentata	3	Y	UPL
3.			
4.			
	10	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Bromus inermis	35	Y	FACU
2. Melilotus officinalis	15	Y	FACU
3. Achillea millefolium	10	N	FACU
4. Juncus arcticus	5	N	FACW
5. Thinopyrum intermedium	5	N	UPL
6. Poa pratensis	2	N	FAC
7.			
8.			
	72	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
Total Cover: 0			

% Bare Ground in Herb Stratum 28 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:	5	x 2 =	10
FAC species:	2	x 3 =	6
FACU species:	67	x 4 =	268
UPL species:	8	x 5 =	40
Column Totals:	82 (A)		324 (B)

Prevalence Index = B/A = 3.95

Hydrophytic Vegetation Indicators:

- Dominance Test >50%
- Prevalence Index is ≤3.0[1]
- Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes: No: X

Remarks: Upland plant community.

SOILS

Sampling Point: W34B

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 18	10YR 5/2	100	-	-	-	-	clay	granular

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) **(LRR C)**
- ____ 1 cm Muck (A9) **(LRR D)**
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) **(LRR C)**
- ____ 2 cm Muck (A10) **(LRR B)**
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: No: X

Remarks: No redox observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- _____ Water Marks (B1) **(Riverine)**
- _____ Sediment Deposits (B2) **(Riverine)**
- _____ Drift Deposits (B3) **(Riverine)**
- _____ Drainage patterns (B10)
- _____ Dry-Season Water Table (C2)
- _____ Crayfish Burrows (C8)
- _____ Saturation Visible on Aerial Imagery (C9)
- _____ Shallow Aquitard (D3)
- FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ____ No X Depth (inches): _____

Water Table Present? Yes: ____ No X Depth (inches): _____

Saturation Present? (incl. capillary fringe) Yes: ____ No X Depth (inches): _____

Wetland Hydrology Present? Yes: No: X

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Powdery dry and friable. Approximately 18 inches above the wetland.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: June 5, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W35A
Investigator(s): Jeff Boice, Collin Covington	Section, Township, Range: 13, 39S, 6W	
Landform (hillslope, terrace, etc.): drainage floor	Local relief (concave, convex, none): none	Slope (%): 1
Subregion (LRR): D	Easting: 369201	Northing: 4143123 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X	No: (If no, explain in Remarks.)	
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X	No:
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes: X No:	**Is the Sampled Area within a Wetland? Yes: X No:**
Hydric Soil Present?	Yes: X No:	
Wetland Hydrology Present?	Yes: X No:	

Remarks: Wetland area adjacent to intermittent stream channel. Photos of site: 1147 - soil, 1148 - south, 1149 - west.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:_____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:_____)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Juncus arcticus	65	Y	FACW
2. Triglochin maritima	20	Y	OBL
3. Juncus sp.	10	N	-
4.			
5.			
6.			
7.			
8.			
	95	= Total Cover	
Woody Vine Stratum (Plot Size:_____)			
1.			
2.			
Total Cover: 0			

% Bare Ground in Herb Stratum 5 % Cover of Biotic Crust_____

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:	20	x 1=	20
FACW species:	65	x 2 =	130
FAC species:		x 3 =	0
FACU species:		x 4 =	0
UPL species:		x 5 =	0
Column Totals:	85 (A)		150 (B)

Prevalence Index = B/A = 1.76

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

X Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes: X No:

Remarks: Wetland plant community.

SOILS

Sampling Point: W35A

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features					
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 5	2.5Y 5/2	80	10YR 5/6	20	C	M	clay	black streaking
5 - 15	Gley 1 2.5/N	90	10YR 5/6	10	C	M	clay	-
15 - 18	10YR 5/1	60	10YR 5/6	40	C	M	clay	-

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___	Histosol (A1)	___	Sandy Redox (S5)
___	Histic Epipedon (A2)	___	Stripped Matrix (S6)
___	Black Histic (A3)	___	Loamy Mucky Mineral (F1)
X	Hydrogen Sulfide (A4)	___	Loamy Gleyed Matrix (F2)
___	Stratified Layers (A5) **(LRR C)**	X	Depleted Matrix (F3)
___	1 cm Muck (A9) **(LRR D)**	___	Redox Dark Surface (F6)
___	Depleted Below Dark Surface (A11)	___	Depleted Dark Surface (F7)
___	Thick Dark Surface (A12)	___	Redox Depressions (F8)
___	Sandy Mucky Mineral (S1)	___	Vernal Pools (F9)
	Sandy Gleyed Matrix (S4)		

Indicators for Problematic Hydric Soils[3]:

___ 1 cm Muck (A9) **(LRR C)**
___ 2 cm Muck (A10) **(LRR B)**
___ Reduced Vertic (F18)
___ Red Parent Material (TF2)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: X No:

Remarks: -

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)				Secondary Indicators (2 or more required)	
___	Surface Water (A1)	___	Salt Crust (B11)	_____	Water Marks (B1) **(Riverine)**
___	High Water Table (A2)	___	Biotic Crust (B12)	_____	Sediment Deposits (B2) **(Riverine)**
X	Saturation (A3)	___	Aquatic Invertebrates (B13)	_____	Drift Deposits (B3) **(Riverine)**
___	Water Marks (B1) **(Nonriverine)**	X	Hydrogen Sulfide Odor (C1)	_____	Drainage patterns (B10)
___	Sediment Deposits (B2) **(Nonriverine)**	___	Oxidized Rhizospheres along Living Roots	_____	Dry-Season Water Table (C2)
___	Drift Deposits (B3) **(Nonriverine)**	___	Presence of Reduced Iron (C4)	_____	Crayfish Burrows (C8)
___	Surface Soil Cracks (B6)	___	Recent Iron Reduction in Plowed Soils (C6)	_____	Saturation Visible on Aerial Imagery (C9)
___	Inundation Visible on Aerial Imagery (B7)	___	Thin Muck Surface (C7)	_____	Shallow Aquitard (D3)
	Water-Stained Leaves (B9)		Other (Explain in Remarks)		FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes:	___	No	X	Depth (inches):	
Water Table Present?	Yes:	X	No	___	Depth (inches):	15
Saturation Present? (Incl. capillary fringe)	Yes:	X	No		Depth (inches):	0

Wetland Hydrology Present? Yes: X No:

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Alkali powder on the suface.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: June 5, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W35B
Investigator(s): Jeff Boice, Collin Covington	Section, Township, Range: 13, 39S, 6W	
Landform (hillslope, terrace, etc.): hillslope	Local relief (concave, convex, none): none	Slope (%): 65
Subregion (LRR): D	Easting: 369196	Northing: 4143122 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X	No: (If no, explain in Remarks.)	
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X	No:
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes:	No: X	**Is the Sampled Area within a Wetland?** **Yes:** **No: X**
Hydric Soil Present?	Yes:	No: X	
Wetland Hydrology Present?	Yes:	No: X	

Remarks: Sample point is approximately 3 feet above the wetland sample point. Photos of site: 1150 - soil, 1151 - north, 1152 - east.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size: 6' x 6')			
1. Artemisia tridentata	20	Y	UPL
2. Rosa woodsii	5	Y	FACU
3. Chrysothamnus nauseosus	TR	N	UPL
4.			
	25	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Bromus inermis	60	Y	FACU
2. Juncus arcticus	15	Y	FACW
3. Cirsium sp.	TR	N	-
4.			
5.			
6.			
7.			
8.			
	75	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
	Total Cover: 0		

% Bare Ground in Herb Stratum 25 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 25 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:	15	x 2 =	30
FAC species:		x 3 =	0
FACU species:	65	x 4 =	260
UPL species:	20	x 5 =	100
Column Totals:	100 (A)		390 (B)

Prevalence Index = B/A = 3.90

Hydrophytic Vegetation Indicators:

Dominance Test >50%

Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes:** **No: X**

Remarks: Upland plant community.

SOILS

Sampling Point: W35B

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features					
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 18	10YR 5/2	100	-	-	-	-	clay	granular

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) (**LRR C**)
- ____ 1 cm Muck (A9) (**LRR D**)
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) (**LRR C**)
- ____ 2 cm Muck (A10) (**LRR B**)
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: No: X

Remarks: No redox observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- _____ Water Marks (B1) (**Riverine**)
- _____ Sediment Deposits (B2) (**Riverine**)
- _____ Drift Deposits (B3) (**Riverine**)
- _____ Drainage patterns (B10)
- _____ Dry-Season Water Table (C2)
- _____ Crayfish Burrows (C8)
- _____ Saturation Visible on Aerial Imagery (C9)
- _____ Shallow Aquitard (D3)
- FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ____ No _X_ Depth (inches): _____

Water Table Present? Yes: ____ No _X_ Depth (inches): _____

Saturation Present? (incl. capillary fringe) Yes: ____ No X Depth (inches): _____

Wetland Hydrology Present? Yes: No: X

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Dry and friable. Approximately 3 feet above the wetland.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: June 5, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W36A
Investigator(s): Jeff Boice, Collin Covington	Section, Township, Range: 13, 39S, 6W	
Landform (hillslope, terrace, etc.): drainage floor	Local relief (concave, convex, none): none	Slope (%): 1
Subregion (LRR): D	Easting: 368884	Northing: 4142823 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X	No: (If no, explain in Remarks.)	
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X	No:
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes: X	No:	**Is the Sampled Area within a Wetland?** Yes: X No:
Hydric Soil Present?	Yes: X	No:	
Wetland Hydrology Present?	Yes: X	No:	

Remarks: Intermittent stream channel above the ordinary high water mark, approximately 2 feet above and 5 feet east of the channel bottom. Photos of site: 1153 - soil, 1154 - northwest, 1155 - northeast.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:_____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:_____)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Juncus arcticus	90	Y	FACW
2. Hordeum jubatum	5	N	FAC
3. Poa pratensis	2	N	FAC
4. Achillea millefolium	1	N	FACU
5. Melilotus officinalis	1	N	FACU
6. Chenopodium sp.	1	N	-
7.			
8.			
	100	= Total Cover	
Woody Vine Stratum (Plot Size:_____)			
1.			
2.			
Total Cover: 0			

% Bare Ground in Herb Stratum 0 % Cover of Biotic Crust _____

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:	90	x 2 =	180
FAC species:	7	x 3 =	21
FACU species:	2	x 4 =	8
UPL species:		x 5 =	0
Column Totals:	99 (A)		209 (B)

Prevalence Index = B/A = 2.11

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

X Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes: X No:

Remarks: Wetland plant community.

SOILS

Sampling Point: W36A

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0 - 5	10YR 5/2	100	-	-	-	-	clay	-
5 - 18	10YR 4/1	98	10YR 5/6	2	C	M	clay	-

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

____ Histosol (A1)	____ Sandy Redox (S5)	____ 1 cm Muck (A9) (**LRR C**)
____ Histic Epipedon (A2)	____ Stripped Matrix (S6)	____ 2 cm Muck (A10) (**LRR B**)
____ Black Histic (A3)	____ Loamy Mucky Mineral (F1)	____ Reduced Vertic (F18)
____ Hydrogen Sulfide (A4)	____ Loamy Gleyed Matrix (F2)	____ Red Parent Material (TF2)
____ Stratified Layers (A5) (**LRR C**)	__X__ Depleted Matrix (F3)	____ Other (Explain in Remarks)
____ 1 cm Muck (A9) (**LRR D**)	____ Redox Dark Surface (F6)	
____ Depleted Below Dark Surface (A11)	____ Depleted Dark Surface (F7)	
____ Thick Dark Surface (A12)	____ Redox Depressions (F8)	
____ Sandy Mucky Mineral (S1)	____ Vernal Pools (F9)	
____ Sandy Gleyed Matrix (S4)		

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Indicators for Problematic Hydric Soils[3]:

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: X No:

Remarks: -

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)		Secondary Indicators (2 or more required)
___ Surface Water (A1)	___ Salt Crust (B11)	_____ Water Marks (B1) (**Riverine**)
___ High Water Table (A2)	___ Biotic Crust (B12)	_____ Sediment Deposits (B2) (**Riverine**)
___ Saturation (A3)	___ Aquatic Invertebrates (B13)	_____ Drift Deposits (B3) (**Riverine**)
___ Water Marks (B1) (**Nonriverine**)	___ Hydrogen Sulfide Odor (C1)	_____ Drainage patterns (B10)
___ Sediment Deposits (B2) (**Nonriverine**)	___ Oxidized Rhizospheres along Living Roots	_____ Dry-Season Water Table (C2)
___ Drift Deposits (B3) (**Nonriverine**)	___ Presence of Reduced Iron (C4)	_____ Crayfish Burrows (C8)
___ Surface Soil Cracks (B6)	___ Recent Iron Reduction in Plowed Soils (C6)	_____ Saturation Visible on Aerial Imagery (C9)
___ Inundation Visible on Aerial Imagery (B7)	___ Thin Muck Surface (C7)	_____ Shallow Aquitard (D3)
___ Water-Stained Leaves (B9)	___ Other (Explain in Remarks)	_____ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes: ____	No __X__	Depth (inches): ____		
Water Table Present?	Yes: ____	No __X__	Depth (inches): ____	**Wetland Hydrology Present?**	**Yes: X No:**
Saturation Present? (incl. capillary fringe)	Yes: ____	No X	Depth (inches):		

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Soil was moist. It is assumed that early season water levels are sufficient to support wetland conditions.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: June 5, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W36B
Investigator(s): Jeff Boice, Collin Covington	Section, Township, Range: 13, 39S, 6W	
Landform (hillslope, terrace, etc.): base of hillslope	Local relief (concave, convex, none): none	Slope (%): 10
Subregion (LRR): D	Easting: 368884	Northing: 4142831 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X No: (If no, explain in Remarks.)		
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X No:	
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes:	No: X	**Is the Sampled Area within a Wetland?** **Yes:** **No: X**
Hydric Soil Present?	Yes:	No: X	
Wetland Hydrology Present?	Yes:	No: X	

Remarks: Base of hillslope at the edge of channel bottom, approximately 12 inches higher than the adjacent wetland sample point. Photos of site: 1156 - soil, 1157 - southeast, 1158 - southwest.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size: 6' x 6')			
1. Artemisia tridentata	10	Y	UPL
2.			
3.			
4.			
	10	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Achillea millefolium	35	Y	FACU
2. Juncus arcticus	15	Y	FACW
3. Bromus inermis	10	N	FACU
4. Melilotus officinalis	10	N	FACU
5. Poa pratensis	5	N	FAC
6.			
7.			
8.			
	75	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
	Total Cover: 0		

% Bare Ground in Herb Stratum 25 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 33.3 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:	15	x 2 =	30
FAC species:	5	x 3 =	15
FACU species:	55	x 4 =	220
UPL species:	10	x 5 =	50
Column Totals:	85 (A)		315 (B)

Prevalence Index = B/A = 3.71

Hydrophytic Vegetation Indicators:

- Dominance Test >50%
- Prevalence Index is ≤3.0[1]
- Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes:** **No: X**

Remarks: Upland plant community.

SOILS

Sampling Point: W36B

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type[1]	Redox Features Loc[2]	Texture	Remarks
0 - 18	10YR 4/2	100	-	-	-	-	clay	granular

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) **(LRR C)**
- ____ 1 cm Muck (A9) **(LRR D)**
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) **(LRR C)**
- ____ 2 cm Muck (A10) **(LRR B)**
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: No: X

Remarks: Red fragments of native stone present. No redox observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- _____ Water Marks (B1) **(Riverine)**
- _____ Sediment Deposits (B2) **(Riverine)**
- _____ Drift Deposits (B3) **(Riverine)**
- _____ Drainage patterns (B10)
- _____ Dry-Season Water Table (C2)
- _____ Crayfish Burrows (C8)
- _____ Saturation Visible on Aerial Imagery (C9)
- _____ Shallow Aquitard (D3)
- FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ____ No X Depth (inches): _____

Water Table Present? Yes: ____ No X Depth (inches): _____

Saturation Present? (incl. capillary fringe) Yes: No X Depth (inches):

Wetland Hydrology Present? Yes: No: X

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Dry and friable.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: June 5, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W37A
Investigator(s): Jeff Bolce, Collin Covington	Section, Township, Range: 13, 39S, 6W	
Landform (hillslope, terrace, etc.): drainage floor	Local relief (concave, convex, none): none	Slope (%): 2
Subregion (LRR): D	Easting: 368747	Northing: 4143012 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X	No: (If no, explain in Remarks.)	
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X	No:
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes: X No:	**Is the Sampled Area within a Wetland? Yes: X No:**
Hydric Soil Present?	Yes: X No:	
Wetland Hydrology Present?	Yes: X No:	

Remarks: Sample point is adjacent to intermittent stream channel below reservior. Photos of site: 1159 - soil, 1160 - southeast, 1161 - northwest.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Carex nebrascensis	95	Y	OBL
2. Carex sp.	3	N	-
3. Carex praegracilis	TR	N	FACW
4.			
5.			
6.			
7.			
8.			
	98	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
Total Cover: 0			

% Bare Ground in Herb Stratum 2 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:	95	x 1=	95
FACW species:		x 2 =	0
FAC species:		x 3 =	0
FACU species:		x 4 =	0
UPL species:		x 5 =	0
Column Totals:	95 (A)		95 (B)

Prevalence Index = B/A = 1.00

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

X Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes: X No:

Remarks: Wetland plant community.

SOILS

Sampling Point: W37A

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 18	10YR 4/1	90	10YR 5/6	10	C	M	clay	black organic streaking

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) (**LRR C**)
- ____ 1 cm Muck (A9) (**LRR D**)
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) (**LRR C**)
- ____ 2 cm Muck (A10) (**LRR B**)
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: X No:

Remarks: Dense root matter throughout the column.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- _____ Water Marks (B1) (**Riverine**)
- _____ Sediment Deposits (B2) (**Riverine**)
- _____ Drift Deposits (B3) (**Riverine**)
- _____ Drainage patterns (B10)
- _____ Dry-Season Water Table (C2)
- _____ Crayfish Burrows (C8)
- _____ Saturation Visible on Aerial Imagery (C9)
- _____ Shallow Aquitard (D3)
- FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ____ No X Depth (inches): _____

Water Table Present? Yes: ____ No X Depth (inches): _____

Saturation Present? (incl. capillary fringe) Yes: No X Depth (inches):

Wetland Hydrology Present? Yes: X No:

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Soil is moist. It is assumed that early season water levels are sufficient to support wetland conditions. Wetland is below reservoir.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: June 5, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W37B
Investigator(s): Jeff Boice, Collin Covington	Section, Township, Range: 13, 39S, 6W	
Landform (hillslope, terrace, etc.): hillslope	Local relief (concave, convex, none): none	Slope (%): 15
Subregion (LRR): D	Easting: 368741	Northing: 4143012 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X	No: (If no, explain in Remarks.)	
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X	No:
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes:	No: X	**Is the Sampled Area within a Wetland?** **Yes:** **No: X**
Hydric Soil Present?	Yes:	No: X	
Wetland Hydrology Present?	Yes:	No: X	

Remarks: Located on hillslope above the drainage floor approximately 18 inches above the wetland sample point. Photos of site: 1162 - soil and 1163 - west.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:)			
1. Artemisia tridentata	10	Y	UPL
2.			
3.			
4.			
	10	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Achillea millefolium	20	Y	FACU
2. Melilotus officinalis	20	Y	FACU
3. Thinopyrum intermedium	20	Y	UPL
4. Juncus arcticus	10	N	FACW
5. Medicago sativa	5	N	UPL
6. Poa pratensis	5	N	FAC
7. Agropyron cristatum	5	N	UPL
8.			
	85	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
Total Cover:	0		

% Bare Ground in Herb Stratum 15 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:	10	x 2 =	20
FAC species:	5	x 3 =	15
FACU species:	40	x 4 =	160
UPL species:	40	x 5 =	200
Column Totals:	95 (A)		395 (B)

Prevalence Index = B/A = 4.16

Hydrophytic Vegetation Indicators:

- Dominance Test >50%
- Prevalence Index is ≤3.0[1]
- Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes:** **No: X**

Remarks: Upland plant community.

SOILS

Sampling Point: W37B

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features					
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 18	10YR 5/2	100	-	-	-	-	clay	granular

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) (**LRR C**)
- ____ 1 cm Muck (A9) (**LRR D**)
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) (**LRR C**)
- ____ 2 cm Muck (A10) (**LRR B**)
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: No: X

Remarks: Native red stone material found throughout the column. No redox observed. Calcium carbonate nodules present throughout the column.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- _____ Water Marks (B1) (**Riverine**)
- _____ Sediment Deposits (B2) (**Riverine**)
- _____ Drift Deposits (B3) (**Riverine**)
- _____ Drainage patterns (B10)
- _____ Dry-Season Water Table (C2)
- _____ Crayfish Burrows (C8)
- _____ Saturation Visible on Aerial Imagery (C9)
- _____ Shallow Aquitard (D3)
- FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ____ No X Depth (inches): _____

Water Table Present? Yes: ____ No X Depth (inches): _____

Saturation Present? (incl. capillary fringe) Yes: ____ No X Depth (inches):

Wetland Hydrology Present? Yes: No: X

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Dry. Higher in elevation than the wetland sample point.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: June 5, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W38A
Investigator(s): Jeff Boice, Collin Covington	Section, Township, Range: 12, 39S, 6W	
Landform (hillslope, terrace, etc.): hillslope	Local relief (concave, convex, none): none	Slope (%): 4
Subregion (LRR): D	Easting: 368733	Northing: 4143270 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X	No: (If no, explain in Remarks.)	
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X	No:
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes: X No:	Is the Sampled Area within a Wetland? Yes: X	No:
Hydric Soil Present? Yes: X No:		
Wetland Hydrology Present? Yes: X No:		

Remarks: Groundwater surfacing in the area and draining towards the reservoir, no defined channel. Photos of site: 1164 - soil, 1165 - soil, 1166 - northwest, 1167 - southeast.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Juncus arcticus	100	Y	FACW
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	100	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
	Total Cover: 0		

% Bare Ground in Herb Stratum 0 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:	Multiply by:	
OBL species:	x 1=	0
FACW species: 100	x 2 =	200
FAC species:	x 3 =	0
FACU species:	x 4 =	0
UPL species:	x 5 =	0
Column Totals: 100 (A)		200 (B)

Prevalence Index = B/A = 2.00

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

X Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes: X No:

Remarks: Wetland plant community.

SOILS

Sampling Point: W38A

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (Inches)	Matrix		Redox Features					
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 18	Gley 1 2.5/N	100	-	-	-	-	clay	-

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___ Histosol (A1)	___ Sandy Redox (S5)	___ 1 cm Muck (A9) (**LRR C**)
___ Histic Epipedon (A2)	___ Stripped Matrix (S6)	___ 2 cm Muck (A10) (**LRR B**)
___ Black Histic (A3)	___ Loamy Mucky Mineral (F1)	___ Reduced Vertic (F18)
X Hydrogen Sulfide (A4)	___ Loamy Gleyed Matrix (F2)	___ Red Parent Material (TF2)
___ Stratified Layers (A5) (**LRR C**)	___ Depleted Matrix (F3)	___ Other (Explain in Remarks)
___ 1 cm Muck (A9) (**LRR D**)	___ Redox Dark Surface (F6)	
___ Depleted Below Dark Surface (A11)	___ Depleted Dark Surface (F7)	
___ Thick Dark Surface (A12)	___ Redox Depressions (F8)	
___ Sandy Mucky Mineral (S1)	___ Vernal Pools (F9)	
___ Sandy Gleyed Matrix (S4)		

Indicators for Problematic Hydric Soils[3]:

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: X No:

Remarks: -

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)		Secondary Indicators (2 or more required)
___ Surface Water (A1)	___ Salt Crust (B11)	___ Water Marks (B1) (**Riverine**)
X High Water Table (A2)	___ Biotic Crust (B12)	___ Sediment Deposits (B2) (**Riverine**)
X Saturation (A3)	___ Aquatic Invertebrates (B13)	___ Drift Deposits (B3) (**Riverine**)
___ Water Marks (B1) (**Nonriverine**)	X Hydrogen Sulfide Odor (C1)	___ Drainage patterns (B10)
___ Sediment Deposits (B2) (**Nonriverine**)	___ Oxidized Rhizospheres along Living Roots	___ Dry-Season Water Table (C2)
___ Drift Deposits (B3) (**Nonriverine**)	___ Presence of Reduced Iron (C4)	___ Crayfish Burrows (C8)
___ Surface Soil Cracks (B6)	___ Recent Iron Reduction in Plowed Soils (C6)	___ Saturation Visible on Aerial Imagery (C9)
___ Inundation Visible on Aerial Imagery (B7)	___ Thin Muck Surface (C7)	___ Shallow Aquitard (D3)
___ Water-Stained Leaves (B9)	Other (Explain in Remarks)	___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes: ___	No X	Depth (inches): ___		
Water Table Present?	Yes: X	No ___	Depth (inches): 4	**Wetland Hydrology Present?**	**Yes: X No:**
Saturation Present? (incl. capillary fringe)	Yes: X	No	Depth (inches): 0		

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: -

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: June 5, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W38B
Investigator(s): Jeff Boice, Collin Covington	Section, Township, Range: 12, 39S, 6W	
Landform (hillslope, terrace, etc.): hillslope	Local relief (concave, convex, none): none	Slope (%): 10
Subregion (LRR): D	Easting: 368729	Northing: 4143275 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X	No: (If no, explain in Remarks.)	
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X	No:
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes: ____ No: X	**Is the Sampled Area within a Wetland? Yes: No: X**	
Hydric Soil Present? Yes: ____ No: X		
Wetland Hydrology Present? Yes: No: X		

Remarks: Transitional area impacted by upgradient groundwater surfacing. Photos of site: 1168 - soil and 1169 - west.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:____)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Thinopyrum intermedium	55	Y	UPL
2. Poa pratensis	30	Y	FAC
3. Juncus arcticus	5	N	FACW
4. Plantago eriopoda	3	N	FACW
5.			
6.			
7.			
8.			
	93	= Total Cover	
Woody Vine Stratum (Plot Size:____)			
1.			
2.			
Total Cover: 0			
% Bare Ground in Herb Stratum 7	% Cover of Biotic Crust____		

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:	8	x 2 =	16
FAC species:	30	x 3 =	90
FACU species:		x 4 =	0
UPL species:	55	x 5 =	275
Column Totals:	93 (A)		381 (B)

Prevalence Index = B/A = 4.10

Hydrophytic Vegetation Indicators:

Dominance Test >50%

Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes: No: X

Remarks: Upland plant community.

SOILS

Sampling Point: W38B

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features					
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 18	10YR 4/1	100	-	-	-	-	clay	-

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: No: X

Remarks: No redox observed. Calcium carbonate nodules present in the column. Dense roots and rocks also present.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ___ No X Depth (inches): ___

Water Table Present? Yes: ___ No X Depth (inches): ___

Saturation Present? (incl. capillary fringe) Yes: ___ No X Depth (inches): ___

Wetland Hydrology Present? Yes: No: X

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Dry and friable to 4 inches and moist below that, not saturated.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: June 5, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W39A
Investigator(s): Jeff Boice, Collin Covington	Section, Township, Range: 12, 39S, 6W	
Landform (hillslope, terrace, etc.): hillslope	Local relief (concave, convex, none): none	Slope (%): 2
Subregion (LRR): D	Easting: 368651	Northing: 4143264 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X	No: (If no, explain in Remarks.)	
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X	No:
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes: X	No:	**Is the Sampled Area within a Wetland?** **Yes: X** **No:**
Hydric Soil Present?	Yes: X	No:	
Wetland Hydrology Present?	Yes: X	No:	

Remarks: Hillslope drainage area seep. It appears the boundary line has been established for agricultural uses. Photos of site: 1177 - soil, 1178 - south, 1179 - north.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:_____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:_____)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Juncus arcticus	90	Y	FACW
2. Carex sp.	5	N	-
3. Juncus sp.	5	N	-
4. Juncus sp.	TR	N	-
5. Thinopyrum intermedium	TR	N	UPL
6.			
7.			
8.			
	100	= Total Cover	
Woody Vine Stratum (Plot Size:_____)			
1.			
2.			
Total Cover:	0		

% Bare Ground in Herb Stratum 0 % Cover of Biotic Crust_____

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:	90	x 2 =	180
FAC species:		x 3 =	0
FACU species:		x 4 =	0
UPL species:		x 5 =	0
Column Totals:	90 (A)		180 (B)

Prevalence Index = B/A = 2.00

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

X Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes: X** **No:**

Remarks: Wetland plant community.

SOILS

Sampling Point: W39A

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 18	Gley 1 2.5/N	100	-	-	-	-	clay	-

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- X Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: X No:

Remarks: -

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ___ No X Depth (inches): ___

Water Table Present? Yes: X No ___ Depth (inches): 15

Saturation Present? (incl. capillary fringe) Yes: X No Depth (inches): 0

Wetland Hydrology Present? Yes: X No:

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Groundwater seepage area.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: June 5, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W39B
Investigator(s): Jeff Boice, Collin Covington	Section, Township, Range: 12, 39S, 6W	
Landform (hillslope, terrace, etc.): hillslope	Local relief (concave, convex, none): none	Slope (%): 2
Subregion (LRR): D	Easting: 368647	Northing: 4143265 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	

Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X No: (If no, explain in Remarks.)

Are Vegetation: , Soil: , or Hydrology: significantly disturbed? Are "Normal Circumstances" present? Yes: X No:

Are Vegetation: , Soil: , or Hydrology: naturally disturbed? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes:	No: X	**Is the Sampled Area within a Wetland? Yes: No: X**
Hydric Soil Present?	Yes:	No: X	
Wetland Hydrology Present?	Yes:	No: X	

Remarks: Area has been tilled and replanted for agriculture. Photos of site: 1180 - soil and 1181 - east.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Melilotus officinalis	40	Y	FACU
2. Bromus inermis	20	Y	FACU
3. Agropyron cristatum	10	N	UPL
4. Helianthus annuus	5	N	FACU
5.			
6.			
7.			
8.			
	75	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
Total Cover:	0		

% Bare Ground in Herb Stratum 25 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:		x 2 =	0
FAC species:		x 3 =	0
FACU species:	65	x 4 =	260
UPL species:	10	x 5 =	50
Column Totals:	75 (A)		310 (B)

Prevalence Index = B/A = 4.13

Hydrophytic Vegetation Indicators:

Dominance Test >50%

Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes: No: X

Remarks: Upland plant community.

SOILS

Sampling Point: W39B

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features					
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 18	10YR 5/2	100	-	-	-	-	clay	granular

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) (**LRR C**)
- ____ 1 cm Muck (A9) (**LRR D**)
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) (**LRR C**)
- ____ 2 cm Muck (A10) (**LRR B**)
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: No: X

Remarks: No redox observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- _____ Water Marks (B1) (**Riverine**)
- _____ Sediment Deposits (B2) (**Riverine**)
- _____ Drift Deposits (B3) (**Riverine**)
- _____ Drainage patterns (B10)
- _____ Dry-Season Water Table (C2)
- _____ Crayfish Burrows (C8)
- _____ Saturation Visible on Aerial Imagery (C9)
- _____ Shallow Aquitard (D3)
- FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ____ No X Depth (inches): _____

Water Table Present? Yes: ____ No X Depth (inches): _____

Saturation Present? (incl. capillary fringe) Yes: No X Depth (inches):

Wetland Hydrology Present? Yes: No: X

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Dry and friable.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: June 5, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W40A
Investigator(s): Jeff Bolce, Collin Covington	Section, Township, Range: 12, 39S, 6W	
Landform (hillslope, terrace, etc.): drainage floor	Local relief (concave, convex, none): none	Slope (%): 2
Subregion (LRR): D	Easting: 368519	Northing: 4143293 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X	No: (If no, explain in Remarks.)	
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X	No:
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes: X No:	**Is the Sampled Area within a Wetland? Yes: X No:**	
Hydric Soil Present? Yes: X No:		
Wetland Hydrology Present? Yes: X No:		

Remarks: Wetland drainage swale, no defined channel. Photos of site: 1182 - soil, 1183 - northwest, 1184 - southwest.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:_____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:_____)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Juncus arcticus	60	Y	FACW
2. Carex praegracilis	40	Y	FACW
3.			
4.			
5.			
6.			
7.			
8.			
	100	= Total Cover	
Woody Vine Stratum (Plot Size:_____)			
1.			
2.			
Total Cover: 0			
% Bare Ground in Herb Stratum 0	% Cover of Biotic Crust		

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:	Multiply by:	
OBL species:	x 1=	0
FACW species: 100	x 2 =	200
FAC species:	x 3 =	0
FACU species:	x 4 =	0
UPL species:	x 5 =	0
Column Totals: 100 (A)		200 (B)

Prevalence Index = B/A = 2.00

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

X Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes: X No:

Remarks: Wetland plant community.

SOILS

Sampling Point: W40A

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 18	10YR 3/2	90	10YR 5/6	10	C	M	clay	granular

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) **(LRR C)**
- ____ 1 cm Muck (A9) **(LRR D)**
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- X Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) **(LRR C)**
- ____ 2 cm Muck (A10) **(LRR B)**
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: X No:

Remarks: -

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- _____ Water Marks (B1) **(Riverine)**
- _____ Sediment Deposits (B2) **(Riverine)**
- _____ Drift Deposits (B3) **(Riverine)**
- _____ Drainage patterns (B10)
- _____ Dry-Season Water Table (C2)
- _____ Crayfish Burrows (C8)
- _____ Saturation Visible on Aerial Imagery (C9)
- _____ Shallow Aquitard (D3)
- FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ____ No X Depth (inches): _____

Water Table Present? Yes: ____ No X Depth (inches): _____

Saturation Present? (incl. capillary fringe) Yes: ____ No X Depth (inches): _____

Wetland Hydrology Present? Yes: X No:

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Soil is moist, not saturated. It is assumed that early season water levels are sufficient to support wetland conditions.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: June 5, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W40B
Investigator(s): Jeff Boice, Collin Covington	Section, Township, Range: 12, 39S, 6W	
Landform (hillslope, terrace, etc.): hillslope	Local relief (concave, convex, none): none	Slope (%): 5
Subregion (LRR): D	Easting: 368518	Northing: 4143289 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X No:	(If no, explain in Remarks.)	
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X No:	
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes:	No: X	**Is the Sampled Area within a Wetland?** **Yes:** **No: X**
Hydric Soil Present?	Yes:	No: X	
Wetland Hydrology Present?	Yes:	No: X	

Remarks: On the hillslope near the top of the terrace. Approximately 3 feet above the wetland sample point. Photos of site: 1185 - soil and 1186 - northeast.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Melilotus officinalis	40	Y	FACU
2. Achillea millefolium	15	Y	FACU
3. Bromus tectorum	10	N	UPL
4. Helianthus annuus	1	N	FACU
5.			
6.			
7.			
8.			
	66	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
Total Cover:	0		

% Bare Ground in Herb Stratum 34 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:		x 2 =	0
FAC species:		x 3 =	0
FACU species:	56	x 4 =	224
UPL species:	10	x 5 =	50
Column Totals:	66 (A)		274 (B)

Prevalence Index = B/A = 4.15

Hydrophytic Vegetation Indicators:

Dominance Test >50%

Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes:** **No: X**

Remarks: Upland plant community.

SOILS

Sampling Point: W40B

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features					
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 18	10YR 5/2	100	-	-	-	-	clay	granular

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) (**LRR C**)
- ____ 1 cm Muck (A9) (**LRR D**)
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) (**LRR C**)
- ____ 2 cm Muck (A10) (**LRR B**)
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: No: X

Remarks: No redox observed. Soil appears to be worked.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- _____ Water Marks (B1) (**Riverine**)
- _____ Sediment Deposits (B2) (**Riverine**)
- _____ Drift Deposits (B3) (**Riverine**)
- _____ Drainage patterns (B10)
- _____ Dry-Season Water Table (C2)
- _____ Crayfish Burrows (C8)
- _____ Saturation Visible on Aerial Imagery (C9)
- _____ Shallow Aquitard (D3)
- FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ___ No X Depth (inches): _____

Water Table Present? Yes: ___ No X Depth (inches): _____

Saturation Present? (incl. capillary fringe) Yes: No X Depth (inches):

Wetland Hydrology Present? Yes: No: X

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Dry and friable.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: June 5, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W41A
Investigator(s): Jeff Boice, Collin Covington	Section, Township, Range: 12, 39S, 6W	
Landform (hillslope, terrace, etc.): drainage floor	Local relief (concave, convex, none): none	Slope (%): 1
Subregion (LRR): D	Easting: 368559	Northing: 4143393 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X	No: (If no, explain in Remarks.)	
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X	No:
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes: X	No:	**Is the Sampled Area within a Wetland?**	**Yes: X** **No:**
Hydric Soil Present?	Yes: X	No:		
Wetland Hydrology Present?	Yes: X	No:		

Remarks: Located in a wetland drainage swale, no defined channel. Photos of site: 1187 - pit, 1188 - soil, 1189 - northeast, 1190 - northwest.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Juncus arcticus	40	Y	FACW
2. Carex nebrascensis	20	Y	OBL
3. Carex praegracilis	20	Y	FACW
4. Phleum pratense	10	N	FACU
5. Poa pratensis	10	N	FAC
6.			
7.			
8.			
	100	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
Total Cover: 0			

% Bare Ground in Herb Stratum 0 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:	20	x 1=	20
FACW species:	60	x 2 =	120
FAC species:	10	x 3 =	30
FACU species:	10	x 4 =	40
UPL species:		x 5 =	0
Column Totals:	100 (A)		210 (B)

Prevalence Index = B/A = 2.10

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

X Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes: X** **No:**

Remarks: Wetland plant community.

SOILS

Sampling Point: W41A

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features					
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 18	10YR 4/1	100	-	-	-	-	clay	-

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- X Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- X Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: X No:

Remarks: Mostly decaying root material and organics, minimal amount of soil.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- X Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes: ___	No X	Depth (inches): ___		
Water Table Present?	Yes: X	No ___	Depth (inches): 8	**Wetland Hydrology Present?**	**Yes: X No:**
Saturation Present? (Incl. capillary fringe)	Yes: X	No	Depth (inches): 0		

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: -

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: June 5, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W41B
Investigator(s): Jeff Boice, Collin Covington	Section, Township, Range: 12, 39S, 6W	
Landform (hillslope, terrace, etc.): terrace hillslope	Local relief (concave, convex, none): none	Slope (%): 10
Subregion (LRR): D	Easting: 368563	Northing: 4143391 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X No: (If no, explain in Remarks.)		
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X No:	
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes:	No: X	**Is the Sampled Area within a Wetland? Yes: No: X**
Hydric Soil Present?	Yes:	No: X	
Wetland Hydrology Present?	Yes:	No: X	

Remarks: Located on hillslope adjacent to wetland. Approximately 18 inches above the wetland sample point. Photos of site: 1191 - soil and 1192 - southwest.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size: 6' x 6')			
1. Artemisia tridentata	15	Y	UPL
2.			
3.			
4.			
	15	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Juncus arcticus	30	Y	FACW
2. Achillea millefolium	20	Y	FACU
3. Poa pratensis	20	Y	FAC
4. Melilotus officinalis	10	N	FACU
5. Thinopyrum intermedium	10	N	UPL
6. Cirsium sp.	TR	N	-
7. Taraxacum officinale	TR	N	FACU
8.			
	90	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
Total Cover: 0			

% Bare Ground in Herb Stratum 10 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:	30	x 2 =	60
FAC species:	20	x 3 =	60
FACU species:	30	x 4 =	120
UPL species:	25	x 5 =	125
Column Totals:	105 (A)		365 (B)

Prevalence Index = B/A = 3.48

Hydrophytic Vegetation Indicators:

- Dominance Test >50%
- Prevalence Index is ≤3.0[1]
- Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes: No: X

Remarks: Upland plant community.

SOILS

Sampling Point: W41B

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 18	10YR 5/2	100	-	-	-	-	clay	granular

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) (**LRR C**)
- ____ 1 cm Muck (A9) (**LRR D**)
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) (**LRR C**)
- ____ 2 cm Muck (A10) (**LRR B**)
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: No: X

Remarks: No redox observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- _____ Water Marks (B1) (**Riverine**)
- _____ Sediment Deposits (B2) (**Riverine**)
- _____ Drift Deposits (B3) (**Riverine**)
- _____ Drainage patterns (B10)
- _____ Dry-Season Water Table (C2)
- _____ Crayfish Burrows (C8)
- _____ Saturation Visible on Aerial Imagery (C9)
- _____ Shallow Aquitard (D3)
- FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ____ No _X_ Depth (inches): _____

Water Table Present? Yes: ____ No _X_ Depth (inches): _____

Saturation Present? (incl. capillary fringe) Yes: ____ No X Depth (inches): _____

Wetland Hydrology Present? Yes: No: X

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Dry and friable.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: June 6, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W42A
Investigator(s): Jeff Boice, Collin Covington	Section, Township, Range: 12, 39S, 6W	
Landform (hillslope, terrace, etc.): drainage floor	Local relief (concave, convex, none): none	Slope (%): 1
Subregion (LRR): D	Easting: 368568	Northing: 4143485 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X	No: (If no, explain in Remarks.)	
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X	No:
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes: X	No:	**Is the Sampled Area within a Wetland?**	**Yes: X** **No:**
Hydric Soil Present?	Yes: X	No:		
Wetland Hydrology Present?	Yes: X	No:		

Remarks: Trampled by livestock. Photos of site: 1193 - soil, 1194 - north, 1195 - south.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Juncus arcticus	50	Y	FACW
2. Eleocharis palustris	30	Y	OBL
3. Carex nebrascensis	15	N	OBL
4.			
5.			
6.			
7.			
8.			
	95	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
	Total Cover: 0		
% Bare Ground in Herb Stratum 5	% Cover of Biotic Crust		

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:	45	x 1=	45
FACW species:	50	x 2 =	100
FAC species:		x 3 =	0
FACU species:		x 4 =	0
UPL species:		x 5 =	0
Column Totals:	95 (A)		145 (B)

Prevalence Index = B/A = 1.53

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

X Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes: X** **No:**

Remarks: Wetland plant community. Grazed upon by livestock.

SOILS

Sampling Point: W42A

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 5	10YR 5/2	100	-	-	-	-	clay	-
5 - 18	Gley 1 2.5/N	100	-	-	-	-	clay	-

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___ Histosol (A1)	___ Sandy Redox (S5)	___ 1 cm Muck (A9) **(LRR C)**
___ Histic Epipedon (A2)	___ Stripped Matrix (S6)	___ 2 cm Muck (A10) **(LRR B)**
___ Black Histic (A3)	___ Loamy Mucky Mineral (F1)	___ Reduced Vertic (F18)
X Hydrogen Sulfide (A4)	___ Loamy Gleyed Matrix (F2)	___ Red Parent Material (TF2)
___ Stratified Layers (A5) **(LRR C)**	___ Depleted Matrix (F3)	___ Other (Explain in Remarks)
___ 1 cm Muck (A9) **(LRR D)**	___ Redox Dark Surface (F6)	
___ Depleted Below Dark Surface (A11)	___ Depleted Dark Surface (F7)	
___ Thick Dark Surface (A12)	___ Redox Depressions (F8)	
___ Sandy Mucky Mineral (S1)	___ Vernal Pools (F9)	
___ Sandy Gleyed Matrix (S4)		

Indicators for Problematic Hydric Soils[3]:

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: X No:

Remarks: Soil is saturated and trampled by livestock.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)		Secondary Indicators (2 or more required)
X Surface Water (A1)	___ Salt Crust (B11)	___ Water Marks (B1) **(Riverine)**
___ High Water Table (A2)	___ Biotic Crust (B12)	___ Sediment Deposits (B2) **(Riverine)**
___ Saturation (A3)	___ Aquatic Invertebrates (B13)	___ Drift Deposits (B3) **(Riverine)**
___ Water Marks (B1) **(Nonriverine)**	X Hydrogen Sulfide Odor (C1)	___ Drainage patterns (B10)
___ Sediment Deposits (B2) **(Nonriverine)**	___ Oxidized Rhizospheres along Living Roots	___ Dry-Season Water Table (C2)
___ Drift Deposits (B3) **(Nonriverine)**	___ Presence of Reduced Iron (C4)	___ Crayfish Burrows (C8)
___ Surface Soil Cracks (B6)	___ Recent Iron Reduction in Plowed Soils (C6)	___ Saturation Visible on Aerial Imagery (C9)
___ Inundation Visible on Aerial Imagery (B7)	___ Thin Muck Surface (C7)	___ Shallow Aquitard (D3)
___ Water-Stained Leaves (B9)	___ Other (Explain in Remarks)	___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: X No ___ Depth (inches): 1

Water Table Present? Yes: X No ___ Depth (inches): ___

Saturation Present? (incl. capillary fringe) Yes: X No ___ Depth (inches): ___

Wetland Hydrology Present? Yes: X No:

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Surface water present.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: June 6, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W42B
Investigator(s): Jeff Boice, Collin Covington	Section, Township, Range: 12, 39S, 6W	
Landform (hillslope, terrace, etc.): hillslope	Local relief (concave, convex, none): none	Slope (%): 5
Subregion (LRR): D	Easting: 368564	Northing: 4143485	Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X	No:	(If no, explain in Remarks.)	
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X	No:
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes:	No: X	**Is the Sampled Area within a Wetland?** **Yes:** **No: X**
Hydric Soil Present?	Yes:	No: X	
Wetland Hydrology Present?	Yes:	No: X	

Remarks: Sample point is approximately 18 inches above wetland sample point. Photos of site: 1196 - soil and 1197 - east.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size: 6' x 6')	Absolute % Cover	Dominant Species?	Indicator Status
1. Juniperus osteosperma	15	Y	UPL
2.			
3.			
4.			
	15	= Total Cover	
Sapling/Shrub Stratum (Plot Size: 6' x 6')			
1. Rosa woodsii	15	Y	FACU
2.			
3.			
4.			
	15	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Juncus arcticus	40	Y	FACW
2. Poa pratensis	20	Y	FAC
3. Melilotus officinalis	15	N	FACU
4. Achillea millefolium	5	N	FACU
5. Agropyron cristatum	5	N	UPL
6. Bromus inermis	5	N	FACU
7. Bromus tectorum	5	N	UPL
8.			
	95	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
Total Cover: 0			
% Bare Ground in Herb Stratum 5	% Cover of Biotic Crust		

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:	40	x 2 =	80
FAC species:	20	x 3 =	60
FACU species:	40	x 4 =	160
UPL species:	25	x 5 =	125
Column Totals:	125 (A)		425 (B)

Prevalence Index = B/A = 3.40

Hydrophytic Vegetation Indicators:

Dominance Test >50%

Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes:** **No: X**

Remarks:

SOILS

Sampling Point: W42B

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 18	10YR 5/2	100	-	-	-	-	clay	granular

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) (**LRR C**)
- ____ 1 cm Muck (A9) (**LRR D**)
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) (**LRR C**)
- ____ 2 cm Muck (A10) (**LRR B**)
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: No: X

Remarks: No redox observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- _____ Water Marks (B1) (**Riverine**)
- _____ Sediment Deposits (B2) (**Riverine**)
- _____ Drift Deposits (B3) (**Riverine**)
- _____ Drainage patterns (B10)
- _____ Dry-Season Water Table (C2)
- _____ Crayfish Burrows (C8)
- _____ Saturation Visible on Aerial Imagery (C9)
- _____ Shallow Aquitard (D3)
- FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ____ No _X_ Depth (inches): _____

Water Table Present? Yes: ____ No _X_ Depth (inches): _____

Saturation Present? (incl. capillary fringe) Yes: ____ No X Depth (inches):

Wetland Hydrology Present? Yes: No: X

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Dry and friable.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: June 5, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W43A
Investigator(s): Jeff Boice, Collin Covington	Section, Township, Range: 12, 39S, 6W	
Landform (hillslope, terrace, etc.): drainage floor	Local relief (concave, convex, none): none	Slope (%): 1
Subregion (LRR): D	Easting: 368517	Northing: 4143573 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X	No: (If no, explain in Remarks.)	
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X	No:
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes: X No:	**Is the Sampled Area within a Wetland? Yes: X No:**
Hydric Soil Present?	Yes: X No:	
Wetland Hydrology Present?	Yes: X No:	

Remarks: Wetland drainage swale. Photos of site: 1198 - soil, 1199 - north, 1200 - south.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Juncus arcticus	35	Y	FACW
2. Carex nebrascensis	30	Y	OBL
3. Eleocharis palustris	20	Y	OBL
4. Carex praegracilis	10	N	FACW
5. Mentha piperita	5	N	FACW
6.			
7.			
8.			
	100	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
Total Cover:	0		

% Bare Ground in Herb Stratum 0 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:	50	x 1=	50
FACW species:	50	x 2 =	100
FAC species:		x 3 =	0
FACU species:		x 4 =	0
UPL species:		x 5 =	0
Column Totals:	100 (A)		150 (B)

Prevalence Index = B/A = 1.50

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

X Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes: X No:

Remarks: Wetland plant community.

SOILS

Sampling Point: W43A

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features					
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 18	10YR 4/1	100	-	-	-	-	clay	-

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- X Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: X No:

Remarks: Pit is mostly fibric material, minimal soil development. No redox observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- X Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes:	___	No	X	Depth (inches):	
Water Table Present?	Yes:	X	No	___	Depth (inches):	5
Saturation Present? (incl. capillary fringe)	Yes:	X	No		Depth (inches):	0

Wetland Hydrology Present? Yes: X No:

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: -

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: June 6, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W43B
Investigator(s): Jeff Boice, Collin Covington	Section, Township, Range: 12, 39S, 6W	
Landform (hillslope, terrace, etc.): hillslope	Local relief (concave, convex, none): none	Slope (%): 3
Subregion (LRR): D	Easting: 368518	Northing: 4143576 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X	No:	(If no, explain in Remarks.)
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X	No:
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes:	No: X	**Is the Sampled Area within a Wetland?** **Yes:** **No: X**
Hydric Soil Present?	Yes:	No: X	
Wetland Hydrology Present?	Yes:	No: X	

Remarks: Hillslope off upland terrace. Approximately 18 inches above the wetland sample point. Photos of site: 1201 - soil and 1202 - west.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:_____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:_____)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Melilotus officinalis	35	Y	FACU
2. Juncus arcticus	30	Y	FACW
3. Carex praegracilis	10	N	FACW
4. Poa pratensis	10	N	FAC
5. Thinopyrum intermedium	10	N	UPL
6.			
7.			
8.			
	95	= Total Cover	
Woody Vine Stratum (Plot Size:_____)			
1.			
2.			
	Total Cover: 0		

% Bare Ground in Herb Stratum 5 % Cover of Biotic Crust_____

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:	40	x 2 =	80
FAC species:	10	x 3 =	30
FACU species:	35	x 4 =	140
UPL species:	10	x 5 =	50
Column Totals:	95 (A)		300 (B)

Prevalence Index = B/A = 3.16

Hydrophytic Vegetation Indicators:

- Dominance Test >50%
- Prevalence Index is ≤3.0[1]
- Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes:** **No: X**

Remarks: Upland plant community.

SOILS

Sampling Point: W43B

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 18	10YR 5/2	100	-	-	-	-	clay	granular

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) **(LRR C)**
- ____ 1 cm Muck (A9) **(LRR D)**
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) **(LRR C)**
- ____ 2 cm Muck (A10) **(LRR B)**
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: No: X

Remarks: No redox observed. Densely compacted.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- _____ Water Marks (B1) **(Riverine)**
- _____ Sediment Deposits (B2) **(Riverine)**
- _____ Drift Deposits (B3) **(Riverine)**
- _____ Drainage patterns (B10)
- _____ Dry-Season Water Table (C2)
- _____ Crayfish Burrows (C8)
- _____ Saturation Visible on Aerial Imagery (C9)
- _____ Shallow Aquitard (D3)
- FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ____ No _X_ Depth (inches): _____

Water Table Present? Yes: ____ No _X_ Depth (inches): _____

Saturation Present? (incl. capillary fringe) Yes: ____ No X Depth (inches):

Wetland Hydrology Present? Yes: No: X

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Soil is moist, not saturated.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: June 6, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W44A
Investigator(s): Jeff Bolce, Collin Covington	Section, Township, Range: 12, 39S, 6W	
Landform (hillslope, terrace, etc.): drainage floor	Local relief (concave, convex, none): none	Slope (%): 3
Subregion (LRR): D	Easting: 368636	Northing: 4143464 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X No: (If no, explain in Remarks.)		
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X No:	
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes: X No:	Is the Sampled Area within a Wetland? Yes: X No:	
Hydric Soil Present? Yes: X No:		
Wetland Hydrology Present? Yes: X No:		

Remarks: Wetland drainage swale, no channel present. Photos of site: 1203 - soil, 1204 - west, 1205 - north, 1206 - south.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:_____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:_____)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Carex praegracilis	55	Y	FACW
2. Juncus arcticus	35	Y	FACW
3. Poa sp.	10	N	-
4.			
5.			
6.			
7.			
8.			
	100	= Total Cover	
Woody Vine Stratum (Plot Size:_____)			
1.			
2.			
Total Cover: 0			
% Bare Ground in Herb Stratum 0	% Cover of Biotic Crust_____		

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:	90	x 2 =	180
FAC species:		x 3 =	0
FACU species:		x 4 =	0
UPL species:		x 5 =	0
Column Totals:	90 (A)		180 (B)

Prevalence Index = B/A = 2.00

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

X Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes: X No:

Remarks: Wetland plant community.

SOILS

Sampling Point: W44A

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]		
0 - 8	10YR 5/2	98	10YR 5/6	2	C	M	clay	densely rooted
8 - 18	10YR 5/1	95	10YR 5/6	5	C	M	clay	-

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___	Histosol (A1)	___	Sandy Redox (S5)
___	Histic Epipedon (A2)	___	Stripped Matrix (S6)
___	Black Histic (A3)	___	Loamy Mucky Mineral (F1)
___	Hydrogen Sulfide (A4)	___	Loamy Gleyed Matrix (F2)
___	Stratified Layers (A5) (**LRR C**)	X	Depleted Matrix (F3)
___	1 cm Muck (A9) (**LRR D**)	___	Redox Dark Surface (F6)
___	Depleted Below Dark Surface (A11)	___	Depleted Dark Surface (F7)
___	Thick Dark Surface (A12)	___	Redox Depressions (F8)
___	Sandy Mucky Mineral (S1)	___	Vernal Pools (F9)
	Sandy Gleyed Matrix (S4)		

Indicators for Problematic Hydric Soils[3]:

___ 1 cm Muck (A9) (**LRR C**)
___ 2 cm Muck (A10) (**LRR B**)
___ Reduced Vertic (F18)
___ Red Parent Material (TF2)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: X No:

Remarks: Densely compacted

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)			Secondary Indicators (2 or more required)		
___	Surface Water (A1)	___	Salt Crust (B11)	___	Water Marks (B1) (**Riverine**)
___	High Water Table (A2)	___	Biotic Crust (B12)	___	Sediment Deposits (B2) (**Riverine**)
___	Saturation (A3)	___	Aquatic Invertebrates (B13)	___	Drift Deposits (B3) (**Riverine**)
___	Water Marks (B1) (**Nonriverine**)	___	Hydrogen Sulfide Odor (C1)	___	Drainage patterns (B10)
___	Sediment Deposits (B2) (**Nonriverine**)	___	Oxidized Rhizospheres along Living Roots	___	Dry-Season Water Table (C2)
___	Drift Deposits (B3) (**Nonriverine**)	___	Presence of Reduced Iron (C4)	___	Crayfish Burrows (C8)
___	Surface Soil Cracks (B6)	___	Recent Iron Reduction in Plowed Soils (C6)	___	Saturation Visible on Aerial Imagery (C9)
___	Inundation Visible on Aerial Imagery (B7)	___	Thin Muck Surface (C7)	___	Shallow Aquitard (D3)
	Water-Stained Leaves (B9)		Other (Explain in Remarks)		FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ___ No _X_ Depth (inches): ___

Water Table Present? Yes: ___ No _X_ Depth (inches): ___

Saturation Present? (incl. capillary fringe) Yes: ___ No X Depth (inches): ___

Wetland Hydrology Present? Yes: X No:

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Dry and friable. It is assumed that early season water levels are sufficient to support wetland conditions.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: June 6, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W44B
Investigator(s): Jeff Boice, Dennis Wenger, Collin Covington	Section, Township, Range: 12, 39S, 6W	
Landform (hillslope, terrace, etc.): hillslope	Local relief (concave, convex, none): none	Slope (%): 5
Subregion (LRR): D	Easting: 368630 Northing: 4143469	Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X No: (If no, explain in Remarks.)		
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X No:	
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes: X No:	Is the Sampled Area within a Wetland? Yes: X No:	
Hydric Soil Present? Yes: X No:		
Wetland Hydrology Present? Yes: X No:		

Remarks: Hillslope that is potential groundwater seepage area. Photos of site: 1207 - soil and 1208 - west.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:_____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:_____)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Juncus arcticus	35	Y	FACW
2. Carex praegracilis	20	Y	FACW
3. Melilotus officinalis	20	Y	FACU
4. Plantago major	10	N	FAC
5. Achillea millefolium	5	N	FACU
6. Taraxacum officinale	2	N	FACU
7.			
8.			
	92	= Total Cover	
Woody Vine Stratum (Plot Size:_____)			
1.			
2.			
Total Cover: 0			
% Bare Ground in Herb Stratum 8	% Cover of Biotic Crust		

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 66.7 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:	55	x 2 =	110
FAC species:	10	x 3 =	30
FACU species:	27	x 4 =	108
UPL species:		x 5 =	0
Column Totals:	92 (A)		248 (B)

Prevalence Index = B/A = 2.70

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

X Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes: X No:

Remarks: Wetland plant community.

SOILS

Sampling Point: W44B

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 7	10YR 5/2	98	10YR 5/6	2	C	M	clay	root material
7 - 18	10YR 7/1	90	10YR 5/6	10	C	M	clay	-

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___ Histosol (A1)	___ Sandy Redox (S5)	___ 1 cm Muck (A9) (**LRR C**)
___ Histic Epipedon (A2)	___ Stripped Matrix (S6)	___ 2 cm Muck (A10) (**LRR B**)
___ Black Histic (A3)	___ Loamy Mucky Mineral (F1)	___ Reduced Vertic (F18)
___ Hydrogen Sulfide (A4)	___ Loamy Gleyed Matrix (F2)	___ Red Parent Material (TF2)
___ Stratified Layers (A5) (**LRR C**)	_X_ Depleted Matrix (F3)	___ Other (Explain in Remarks)
___ 1 cm Muck (A9) (**LRR D**)	___ Redox Dark Surface (F6)	
___ Depleted Below Dark Surface (A11)	___ Depleted Dark Surface (F7)	
___ Thick Dark Surface (A12)	___ Redox Depressions (F8)	
___ Sandy Mucky Mineral (S1)	___ Vernal Pools (F9)	
___ Sandy Gleyed Matrix (S4)		

Indicators for Problematic Hydric Soils[3]:

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: X No:

Remarks: -

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)		Secondary Indicators (2 or more required)
___ Surface Water (A1)	___ Salt Crust (B11)	___ Water Marks (B1) (**Riverine**)
___ High Water Table (A2)	___ Biotic Crust (B12)	___ Sediment Deposits (B2) (**Riverine**)
___ Saturation (A3)	___ Aquatic Invertebrates (B13)	___ Drift Deposits (B3) (**Riverine**)
___ Water Marks (B1) (**Nonriverine**)	___ Hydrogen Sulfide Odor (C1)	___ Drainage patterns (B10)
___ Sediment Deposits (B2) (**Nonriverine**)	___ Oxidized Rhizospheres along Living Roots	___ Dry-Season Water Table (C2)
___ Drift Deposits (B3) (**Nonriverine**)	___ Presence of Reduced Iron (C4)	___ Crayfish Burrows (C8)
___ Surface Soil Cracks (B6)	___ Recent Iron Reduction in Plowed Soils (C6)	___ Saturation Visible on Aerial Imagery (C9)
___ Inundation Visible on Aerial Imagery (B7)	___ Thin Muck Surface (C7)	___ Shallow Aquitard (D3)
___ Water-Stained Leaves (B9)	___ Other (Explain in Remarks)	___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes: ___	No _X_	Depth (inches): ___		
Water Table Present?	Yes: ___	No _X_	Depth (inches): ___	**Wetland Hydrology Present?**	**Yes: X No:**
Saturation Present? (incl. capillary fringe)	Yes:	No X	Depth (inches):		

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Moist, not saturated. Potential groundwater seepage on terrace. It is assumed that early season water levels are sufficient to support wetland conditions.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: June 6, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W44C
Investigator(s): Dennis Wenger, Collin Covington	Section, Township, Range: 12, 39S, 6W	
Landform (hillslope, terrace, etc.): terrace	Local relief (concave, convex, none): none	Slope (%): >1
Subregion (LRR): D	Easting: 368324	Northing: 4143473 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X	No: (If no, explain in Remarks.)	
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X	No:
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes: ____ No: X	**Is the Sampled Area within a Wetland? Yes: No: X**	
Hydric Soil Present? Yes: ____ No: X		
Wetland Hydrology Present? Yes: No: X		

Remarks: Terrace outside of drainage and the seepage area influence. Photos of site: 1209 - soil, 1210 - east, 1211 - south.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size: 6' x 6')	Absolute % Cover	Dominant Species?	Indicator Status
1. Juniperus osteosperma	5	Y	UPL
2.			
3.			
4.			
	5	= Total Cover	
Sapling/Shrub Stratum (Plot Size:)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Melilotus officinalis	25	Y	FACU
2. Achillea millefolium	20	Y	FACU
3. Poa pratensis	20	Y	FAC
4. Juncus arcticus	10	N	FACW
5. Bromus tectorum	5	N	UPL
6. Chenopodium sp.	5	N	-
7. Thinopyrum intermedium	3	N	UPL
8. Bromus inermis	2	N	FACU
	90	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
Total Cover: 0			
% Bare Ground in Herb Stratum 10	% Cover of Biotic Crust		

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 25 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:	10	x 2 =	20
FAC species:	20	x 3 =	60
FACU species:	47	x 4 =	188
UPL species:	13	x 5 =	65
Column Totals:	90 (A)		333 (B)

Prevalence Index = B/A = 3.70

Hydrophytic Vegetation Indicators:

- Dominance Test >50%
- Prevalence Index is ≤3.0[1]
- Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes: No: X

Remarks: Upland plant community.

SOILS

Sampling Point: W44C

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features					
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 18	10YR 5/2	100	-	-	-	-	clay	granular

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) **(LRR C)**
- ____ 1 cm Muck (A9) **(LRR D)**
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) **(LRR C)**
- ____ 2 cm Muck (A10) **(LRR B)**
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: No: X

Remarks: No redox observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- _____ Water Marks (B1) **(Riverine)**
- _____ Sediment Deposits (B2) **(Riverine)**
- _____ Drift Deposits (B3) **(Riverine)**
- _____ Drainage patterns (B10)
- _____ Dry-Season Water Table (C2)
- _____ Crayfish Burrows (C8)
- _____ Saturation Visible on Aerial Imagery (C9)
- _____ Shallow Aquitard (D3)
- FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ____ No X Depth (inches): _____

Water Table Present? Yes: ____ No X Depth (inches): _____

Saturation Present? (incl. capillary fringe) Yes: ____ No X Depth (inches): _____

Wetland Hydrology Present? Yes: No: X

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Dry and friable. Soil was moist at 15 inches, not saturated.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: June 6, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W45
Investigator(s): Dennis Wenger, Collin Covington	Section, Township, Range: 12, 39S, 6W	
Landform (hillslope, terrace, etc.): drainage swale	Local relief (concave, convex, none): none	Slope (%): 2
Subregion (LRR): D	Easting: 368640	Northing: 4143639 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X	No: (If no, explain in Remarks.)	
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X	No:
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes: X	No:	**Is the Sampled Area within a Wetland?** **Yes: X** **No:**
Hydric Soil Present?	Yes: X	No:	
Wetland Hydrology Present?	Yes: X	No:	

Remarks: In bottom of drainage swale. Photos of site: 1216 - soil, 1217 - south, 1218 - north, 1219 - east.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Carex praegracilis	50	Y	FACW
2. Juncus arcticus	40	Y	FACW
3. Hordeum jubatum	TR	N	FAC
4.			
5.			
6.			
7.			
8.			
	90	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
Total Cover: 0			

% Bare Ground in Herb Stratum 10 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:	90	x 2 =	180
FAC species:		x 3 =	0
FACU species:		x 4 =	0
UPL species:		x 5 =	0
Column Totals:	90 (A)		180 (B)

Prevalence Index = B/A = 2.00

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

X Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes: X** **No:**

Remarks: Wetland plant community.

SOILS

Sampling Point: W45

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features					
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 18	10YR 5/2	90	10YR 5/6	10	C	M	clay	granular

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

____ Histosol (A1)	____ Sandy Redox (S5)	____ 1 cm Muck (A9) **(LRR C)**
____ Histic Epipedon (A2)	____ Stripped Matrix (S6)	____ 2 cm Muck (A10) **(LRR B)**
____ Black Histic (A3)	____ Loamy Mucky Mineral (F1)	____ Reduced Vertic (F18)
____ Hydrogen Sulfide (A4)	____ Loamy Gleyed Matrix (F2)	____ Red Parent Material (TF2)
____ Stratified Layers (A5) **(LRR C)**	__X__ Depleted Matrix (F3)	____ Other (Explain in Remarks)
____ 1 cm Muck (A9) **(LRR D)**	____ Redox Dark Surface (F6)	
____ Depleted Below Dark Surface (A11)	____ Depleted Dark Surface (F7)	
____ Thick Dark Surface (A12)	____ Redox Depressions (F8)	
____ Sandy Mucky Mineral (S1)	____ Vernal Pools (F9)	
____ Sandy Gleyed Matrix (S4)		

Indicators for Problematic Hydric Soils[3]:

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: X No:

Remarks: Soil held together with the high amount of clay. Calcium concretion nodules present.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)		Secondary Indicators (2 or more required)
___ Surface Water (A1)	___ Salt Crust (B11)	_____ Water Marks (B1) **(Riverine)**
___ High Water Table (A2)	___ Biotic Crust (B12)	_____ Sediment Deposits (B2) **(Riverine)**
___ Saturation (A3)	___ Aquatic Invertebrates (B13)	_____ Drift Deposits (B3) **(Riverine)**
___ Water Marks (B1) **(Nonriverine)**	___ Hydrogen Sulfide Odor (C1)	_____ Drainage patterns (B10)
___ Sediment Deposits (B2) **(Nonriverine)**	___ Oxidized Rhizospheres along Living Roots	_____ Dry-Season Water Table (C2)
___ Drift Deposits (B3) **(Nonriverine)**	___ Presence of Reduced Iron (C4)	_____ Crayfish Burrows (C8)
___ Surface Soil Cracks (B6)	___ Recent Iron Reduction in Plowed Soils (C6)	_____ Saturation Visible on Aerial Imagery (C9)
___ Inundation Visible on Aerial Imagery (B7)	___ Thin Muck Surface (C7)	_____ Shallow Aquitard (D3)
___ Water-Stained Leaves (B9)	___ Other (Explain in Remarks)	_____ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes: ____	No __X__	Depth (inches): _____		
Water Table Present?	Yes: ____	No __X__	Depth (inches): _____	**Wetland Hydrology Present?**	**Yes: X No:**
Saturation Present? (incl. capillary fringe)	Yes:	No X	Depth (inches):		

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Dry. Alkali powder on surface. It is assumed that early season water levels are sufficient to support wetland conditions.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: June 6, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W46
Investigator(s): Dennis Wenger, Collin Covington	Section, Township, Range: 12, 39S, 6W	
Landform (hillslope, terrace, etc.): drainage swale	Local relief (concave, convex, none): none	Slope (%): 1
Subregion (LRR): D	Easting: 368643 Northing: 4143673	Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X No: (If no, explain in Remarks.)		
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X No:	
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes: X No:	Is the Sampled Area within a Wetland? Yes:	No: X
Hydric Soil Present? Yes: No: X		
Wetland Hydrology Present? Yes: No: X		

Remarks: Located in a drainage swale. Photos of site: 1220 - soil, 1221 - west, 1222 - south, 1223 - north.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:_____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:_____)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Juncus arcticus	25	Y	FACW
2. Melilotus officinalis	25	Y	FACU
3. Poa pratensis	20	Y	FAC
4. Achillea millefolium	10	N	FACU
5. Thinopyrum intermedium	5	N	UPL
6.			
7.			
8.			
	85	= Total Cover	
Woody Vine Stratum (Plot Size:_____)			
1.			
2.			
Total Cover:	0		

% Bare Ground in Herb Stratum 15 % Cover of Biotic Crust_____

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 66.7 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:	25	x 2 =	50
FAC species:	20	x 3 =	60
FACU species:	35	x 4 =	140
UPL species:	5	x 5 =	25
Column Totals:	85 (A)		275 (B)

Prevalence Index = B/A = 3.24

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes: X No:

Remarks: Marginal wetland plant community.

SOILS

Sampling Point: W46

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0 - 18	10YR 5/3	99	10YR 5/6	>1	C	M	clay	granular

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) (**LRR C**)
- ____ 1 cm Muck (A9) (**LRR D**)
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) (**LRR C**)
- ____ 2 cm Muck (A10) (**LRR B**)
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: No: X

Remarks: Marginal redox that is faint and minimal.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ____ Water Marks (B1) (**Riverine**)
- ____ Sediment Deposits (B2) (**Riverine**)
- ____ Drift Deposits (B3) (**Riverine**)
- ____ Drainage patterns (B10)
- ____ Dry-Season Water Table (C2)
- ____ Crayfish Burrows (C8)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Shallow Aquitard (D3)
- ____ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ___ No X Depth (inches): ____

Water Table Present? Yes: ___ No X Depth (inches): ____

Saturation Present? (incl. capillary fringe) Yes: ___ No X Depth (inches): ____

Wetland Hydrology Present? Yes: No: X

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Dry and friable.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: June 6, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W47
Investigator(s): Dennis Wenger, Collin Covington	Section, Township, Range: 12, 39S, 6W	
Landform (hillslope, terrace, etc.): drainage swale	Local relief (concave, convex, none): none	Slope (%): 1
Subregion (LRR): D	Easting: 368639	Northing: 4143579	Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X	No: (If no, explain in Remarks.)	
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X	No:
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes: X No:	**Is the Sampled Area within a Wetland?**	**Yes: X** **No:**
Hydric Soil Present? Yes: X No:		
Wetland Hydrology Present? Yes: X No:		

Remarks: Drainage swale that is heavily grazed by livestock. Photos of site: 1224 - soil, 1225 - west, 1226 - south, 1227 - north, 1228 - vegetation.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Poa pratensis	15	Y	FAC
2. Carex praegracilis	10	Y	FACW
3. Juncus arcticus	10	Y	FACW
4. Medicago sativa	10	Y	UPL
5. Symphyotrichum ascendens	10	Y	FAC
6. Thinopyrum intermedium	5	N	UPL
7.			
8.			
	60	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
	Total Cover: 0		

% Bare Ground in Herb Stratum 40 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 80 (A/B)

Prevalence Index Worksheet:

Total % Cover of:	Multiply by:	
OBL species:	x 1=	0
FACW species: 20	x 2 =	40
FAC species: 25	x 3 =	75
FACU species:	x 4 =	0
UPL species: 15	x 5 =	75
Column Totals: 60 (A)		190 (B)

Prevalence Index = B/A = 3.17

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes: X** **No:**

Remarks: Marginal wetland plant community that only passes the dominance test.

SOILS

Sampling Point: W47

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0 - 3	10YR 5/2	100	-	-	-	-	clay	granular
3 - 18	10YR 5/2	97	10YR 5/6	3	C	M	clay	granular

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___ Histosol (A1)	___ Sandy Redox (S5)	
___ Histic Epipedon (A2)	___ Stripped Matrix (S6)	
___ Black Histic (A3)	___ Loamy Mucky Mineral (F1)	
___ Hydrogen Sulfide (A4)	___ Loamy Gleyed Matrix (F2)	
___ Stratified Layers (A5) (**LRR C**)	_X_ Depleted Matrix (F3)	
___ 1 cm Muck (A9) (**LRR D**)	___ Redox Dark Surface (F6)	
___ Depleted Below Dark Surface (A11)	___ Depleted Dark Surface (F7)	
___ Thick Dark Surface (A12)	___ Redox Depressions (F8)	
___ Sandy Mucky Mineral (S1)	___ Vernal Pools (F9)	
___ Sandy Gleyed Matrix (S4)		

Indicators for Problematic Hydric Soils[3]:

___ 1 cm Muck (A9) (**LRR C**)
___ 2 cm Muck (A10) (**LRR B**)
___ Reduced Vertic (F18)
___ Red Parent Material (TF2)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: X No:

Remarks: -

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)		Secondary Indicators (2 or more required)
___ Surface Water (A1)	___ Salt Crust (B11)	___ Water Marks (B1) (**Riverine**)
___ High Water Table (A2)	___ Biotic Crust (B12)	___ Sediment Deposits (B2) (**Riverine**)
___ Saturation (A3)	___ Aquatic Invertebrates (B13)	___ Drift Deposits (B3) (**Riverine**)
___ Water Marks (B1) (**Nonriverine**)	___ Hydrogen Sulfide Odor (C1)	___ Drainage patterns (B10)
___ Sediment Deposits (B2) (**Nonriverine**)	___ Oxidized Rhizospheres along Living Roots	___ Dry-Season Water Table (C2)
___ Drift Deposits (B3) (**Nonriverine**)	___ Presence of Reduced Iron (C4)	___ Crayfish Burrows (C8)
___ Surface Soil Cracks (B6)	___ Recent Iron Reduction in Plowed Soils (C6)	___ Saturation Visible on Aerial Imagery (C9)
___ Inundation Visible on Aerial Imagery (B7)	___ Thin Muck Surface (C7)	___ Shallow Aquitard (D3)
___ Water-Stained Leaves (B9)	___ Other (Explain in Remarks)	___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes: ___	No _X_	Depth (Inches): ___		
Water Table Present?	Yes: ___	No _X_	Depth (Inches): ___	**Wetland Hydrology Present?**	**Yes: X No:**
Saturation Present? (incl. capillary fringe)	Yes:	No X	Depth (Inches):		

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Located in drainage immediately above a headcut. Soil column was dry and friable. It is assumed that early season water levels are sufficient to support wetland conditions.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: June 6, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W48
Investigator(s): Dennis Wenger, Collin Covington	Section, Township, Range: 12, 39S, 6W	
Landform (hillslope, terrace, etc.): drainage swale	Local relief (concave, convex, none): concave	Slope (%): 2
Subregion (LRR): D	Easting: 368642	Northing: 4143529 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X	No: (If no, explain in Remarks.)	
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X	No:
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes:	No: X	**Is the Sampled Area within a Wetland?** **Yes:** **No: X**
Hydric Soil Present?	Yes:	No: X	
Wetland Hydrology Present?	Yes:	No: X	

Remarks: Located in a drainage swale that has headcuts upstream and downstream. Area is heavily grazed. Photos of site: 1229 - soil and 1230 - west.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size: 6' x 6')			
1. Artemisia tridentata	10	Y	UPL
2.			
3.			
4.			
	10	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Bromus inermis	25	Y	FACU
2. Juncus arcticus	20	Y	FACW
3. Poa pratensis	15	N	FAC
4. Achillea millefolium	5	N	FACU
5. Melilotus officinalis	5	N	FACU
6. Symphyotrichum ascendens	5	N	FAC
7. Thinopyrum intermedium	2	N	UPL
8.			
	77	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
	Total Cover: 0		

% Bare Ground in Herb Stratum 23 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 33.3 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:	20	x 2 =	40
FAC species:	20	x 3 =	60
FACU species:	35	x 4 =	140
UPL species:	12	x 5 =	60
Column Totals:	87 (A)		300 (B)

Prevalence Index = B/A = 3.45

Hydrophytic Vegetation Indicators:

Dominance Test >50%

Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes:** **No: X**

Remarks: Upland plant community.

SOILS

Sampling Point: W48

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features					
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 8	10YR 4/2	99	10YR 5/6	>1	C	M	clay	granular
8 - 12	10YR 4/2	100	-	-	-	-	clay	no redox, granular
12 - 18	10YR 5/2	95	10YR 5/6	5	C	M	clay	granular

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: No: X

Remarks: The redox is either too minimal or too deep in the column to meet hydric conditions.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ___ No X Depth (inches): ___

Water Table Present? Yes: ___ No X Depth (inches): ___

Saturation Present? (incl. capillary fringe) Yes: ___ No X Depth (inches): ___

Wetland Hydrology Present? Yes: No: X

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Dry and friable.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: June 6, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W49A
Investigator(s): Dennis Wenger, Collin Covington	Section, Township, Range: 12, 39S, 6W	
Landform (hillslope, terrace, etc.): meadow	Local relief (concave, convex, none): none	Slope (%): 1
Subregion (LRR): D	Easting: 368661	Northing: 4143747 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X	No: (If no, explain in Remarks.)	
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X	No:
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes: X	No:	**Is the Sampled Area within a Wetland? Yes: X No:**
Hydric Soil Present?	Yes: X	No:	
Wetland Hydrology Present?	Yes: X	No:	

Remarks: Wet meadow below an alfalfa field. Photos of site: 1234 - soil, 1235 - east, 1236 - northeast.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Juncus arcticus	70	Y	FACW
2. Poa pratensis	10	N	FAC
3. Symphyotrichum ascendens	10	N	FAC
4. Carex praegracilis	5	N	FACW
5.			
6.			
7.			
8.			
	95	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
	Total Cover: 0		

% Bare Ground in Herb Stratum 5 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:	75	x 2 =	150
FAC species:	20	x 3 =	60
FACU species:		x 4 =	0
UPL species:		x 5 =	0
Column Totals:	95 (A)		210 (B)

Prevalence Index = B/A = 2.21

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

X Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes: X No:

Remarks: Wetland plant community.

SOILS

Sampling Point: W49A

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features					
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 3	-	-	-	-	-	-	organics	fibrous root zone
3 - 16	10YR 5/2	65	10YR 5/6	15	C	M, PL	clay	granular, 20% calcium nodules

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: X No:

Remarks: No soil in the top 3 inches of the column, just organic material. Calcium concretion nodules account for 20% of the column below 3 inches.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ___ No X Depth (inches): ___

Water Table Present? Yes: ___ No X Depth (inches): ___

Saturation Present? (incl. capillary fringe) Yes: ___ No X Depth (inches): ___

Wetland Hydrology Present? Yes: X No:

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Dry and friable. It is assumed that early season water levels are sufficient to support wetland conditions.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: June 6, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W49B
Investigator(s): Dennis Wenger, Collin Covington	Section, Township, Range: 12, 39S, 6W	
Landform (hillslope, terrace, etc.): meadow	Local relief (concave, convex, none): none	Slope (%): 1
Subregion (LRR): D	Easting: 368670	Northing: 4143743	Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X No: (If no, explain in Remarks.)		
Are Vegetation: , Soil: , or Hydrology: significantly disturbed? Are "Normal Circumstances" present? Yes: X No:		
Are Vegetation: , Soil: , or Hydrology: naturally disturbed? (If needed, explain any answers in Remarks.)		

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes:	No: X	**Is the Sampled Area within a Wetland? Yes: No: X**
Hydric Soil Present?	Yes:	No: X	
Wetland Hydrology Present?	Yes:	No: X	

Remarks: Located in transitional area from wet meadow to sagebrush/juniper upland area. Photos of site: 1137 - soil, 1138 - west, 1139 - southwest.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:_____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:_____)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Polygonum douglasii	45	Y	FACU
2. Chenopodium album	35	Y	FACU
3. Poa secunda	5	N	FACU
4. Poa pratensis	2	N	FAC
5.			
6.			
7.			
8.			
	87	= Total Cover	
Woody Vine Stratum (Plot Size:_____)			
1.			
2.			
Total Cover:	0		

% Bare Ground in Herb Stratum 13 % Cover of Biotic Crust_____

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:		x 2 =	0
FAC species:	2	x 3 =	6
FACU species:	85	x 4 =	340
UPL species:		x 5 =	0
Column Totals:	87 (A)		346 (B)

Prevalence Index = B/A = 3.98

Hydrophytic Vegetation Indicators:

Dominance Test >50%

Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes: No: X

Remarks: Upland plant community.

SOILS

Sampling Point: W49B

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0 - 7	10YR 4/2	100	-	-	-	-	clay	granular
7 - 16	10YR 5/2	90	-	-	-	-	clay	10% calcium nodules
16 - 18	10YR 5/2	89	10YR 5/6	>1	C	M	clay	10% calcium nodules

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) **(LRR C)**
- ____ 1 cm Muck (A9) **(LRR D)**
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) **(LRR C)**
- ____ 2 cm Muck (A10) **(LRR B)**
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: No: X

Remarks: Redox is located too deep in the column to meet hydric characteristics.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ____ Water Marks (B1) **(Riverine)**
- ____ Sediment Deposits (B2) **(Riverine)**
- ____ Drift Deposits (B3) **(Riverine)**
- ____ Drainage patterns (B10)
- ____ Dry-Season Water Table (C2)
- ____ Crayfish Burrows (C8)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Shallow Aquitard (D3)
- FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ____ No X Depth (inches): ____

Water Table Present? Yes: ____ No X Depth (inches): ____

Saturation Present? (incl. capillary fringe) Yes: ____ No X Depth (inches): ____

Wetland Hydrology Present? Yes: No: X

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Dry and friable.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: June 6, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W50A
Investigator(s): Dennis Wenger, Collin Covington	Section, Township, Range: 12, 39S, 6W	
Landform (hillslope, terrace, etc.): meadow	Local relief (concave, convex, none): none	Slope (%): 1
Subregion (LRR): D	Easting: 368697	Northing: 4143801 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X	No: (If no, explain in Remarks.)	
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X	No:
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes: X	No:	**Is the Sampled Area within a Wetland?** Yes: X No:
Hydric Soil Present?	Yes: X	No:	
Wetland Hydrology Present?	Yes: X	No:	

Remarks: Drainage swale depression off of irrigated agriculture field. Photos of site: 1241 - soil, 1242 - west, 1243 - southwest.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Poa pratensis	50	Y	FAC
2. Hordeum jubatum	30	Y	FAC
3. Medicago sativa	5	N	UPL
4. Melilotus officinalis	TR	N	FACU
5.			
6.			
7.			
8.			
	85	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
Total Cover: 0			

% Bare Ground in Herb Stratum 15 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:		x 2 =	0
FAC species:	80	x 3 =	240
FACU species:		x 4 =	0
UPL species:	5	x 5 =	25
Column Totals:	85 (A)		265 (B)

Prevalence Index = B/A = 3.12

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes: X No:

Remarks: Marginal wetland plant community.

SOILS

Sampling Point: W50A

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0 - 5	10YR 4/2	90	-	-	-	-	clay	no redox, 10% calcium nodules
5 - 16	10YR 5/2	60	10YR 5/6	30	C	M	clay	10% calcium nodules

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

____ Histosol (A1)	____ Sandy Redox (S5)
____ Histic Epipedon (A2)	____ Stripped Matrix (S6)
____ Black Histic (A3)	____ Loamy Mucky Mineral (F1)
____ Hydrogen Sulfide (A4)	____ Loamy Gleyed Matrix (F2)
____ Stratified Layers (A5) (**LRR C**)	__X__ Depleted Matrix (F3)
____ 1 cm Muck (A9) (**LRR D**)	____ Redox Dark Surface (F6)
____ Depleted Below Dark Surface (A11)	____ Depleted Dark Surface (F7)
____ Thick Dark Surface (A12)	____ Redox Depressions (F8)
____ Sandy Mucky Mineral (S1)	____ Vernal Pools (F9)
____ Sandy Gleyed Matrix (S4)	

Indicators for Problematic Hydric Soils[3]:

____ 1 cm Muck (A9) (**LRR C**)
____ 2 cm Muck (A10) (**LRR B**)
____ Reduced Vertic (F18)
____ Red Parent Material (TF2)
____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: X No:

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

___ Surface Water (A1)	___ Salt Crust (B11)
___ High Water Table (A2)	___ Biotic Crust (B12)
___ Saturation (A3)	___ Aquatic Invertebrates (B13)
___ Water Marks (B1) (**Nonriverine**)	___ Hydrogen Sulfide Odor (C1)
___ Sediment Deposits (B2) (**Nonriverine**)	___ Oxidized Rhizospheres along Living Roots
___ Drift Deposits (B3) (**Nonriverine**)	___ Presence of Reduced Iron (C4)
___ Surface Soil Cracks (B6)	___ Recent Iron Reduction in Plowed Soils (C6)
___ Inundation Visible on Aerial Imagery (B7)	___ Thin Muck Surface (C7)
___ Water-Stained Leaves (B9)	Other (Explain in Remarks)

Secondary Indicators (2 or more required)

_____ Water Marks (B1) (**Riverine**)
_____ Sediment Deposits (B2) (**Riverine**)
_____ Drift Deposits (B3) (**Riverine**)
_____ Drainage patterns (B10)
_____ Dry-Season Water Table (C2)
_____ Crayfish Burrows (C8)
_____ Saturation Visible on Aerial Imagery (C9)
_____ Shallow Aquitard (D3)
FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ____ No __X__ Depth (inches): _____

Water Table Present? Yes: ____ No __X__ Depth (inches): _____

Saturation Present? (incl. capillary fringe) Yes: ____ No X Depth (inches): _____

Wetland Hydrology Present? Yes: X No:

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Soil was moist, not saturated. It is assumed that early season water levels are sufficient to support wetland conditions.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: June 6, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W50B
Investigator(s): Dennis Wenger, Collin Covington	Section, Township, Range: 12, 39S, 6W	
Landform (hillslope, terrace, etc.): agriculture field terrace	Local relief (concave, convex, none): none	Slope (%): 1
Subregion (LRR): D	Easting: 368685	Northing: 4143805 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X	No: (If no, explain in Remarks.)	
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X	No:
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes:	No: X	**Is the Sampled Area within a Wetland?** **Yes:** **No: X**
Hydric Soil Present?	Yes:	No: X	
Wetland Hydrology Present?	Yes:	No: X	

Remarks: Approximately 6 - 8 inches higher in elevation than the adjacent wetland sample point. Located in an alfalfa field. Photos of site: 1244 - soil and 1245 - east.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:_____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:_____)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Medicago sativa	90	Y	UPL
2. Poa sp.	5	N	-
3.			
4.			
5.			
6.			
7.			
8.			
	95	= Total Cover	
Woody Vine Stratum (Plot Size:_____)			
1.			
2.			
Total Cover: 0			
% Bare Ground in Herb Stratum 5	% Cover of Biotic Crust		

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0 (A/B)

Prevalence Index Worksheet:

Total % Cover of:	Multiply by:	
OBL species:	x 1=	0
FACW species:	x 2 =	0
FAC species:	x 3 =	0
FACU species:	x 4 =	0
UPL species: 90	x 5 =	450
Column Totals: 90 (A)		450 (B)

Prevalence Index = B/A = 5.00

Hydrophytic Vegetation Indicators:

Dominance Test >50%

Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes:** **No: X**

Remarks: Upland plant community. Planted alfalfa field.

SOILS

Sampling Point: W50B

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 18	10YR 4/2	97	10YR 5/6	>1	C	M	clay	granular, >2% white calcium nodules

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: No: X

Remarks: -

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ___ No X Depth (inches): ___

Water Table Present? Yes: ___ No X Depth (inches): ___

Saturation Present? (incl. capillary fringe) Yes: No X Depth (inches):

Wetland Hydrology Present? Yes: No: X

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Dry and friable.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: June 6, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W51A
Investigator(s): Dennis Wenger, Collin Covington	Section, Township, Range: 12, 39S, 6W	
Landform (hillslope, terrace, etc.): agriculture field terrace	Local relief (concave, convex, none): none	Slope (%): 1
Subregion (LRR): D	Easting: 368595 Northing: 4143848	Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X No: (If no, explain in Remarks.)		
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X No:	
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes:	No: X	**Is the Sampled Area within a Wetland?** Yes: No: X
Hydric Soil Present?	Yes: X	No:	
Wetland Hydrology Present?	Yes:	No: X	

Remarks: Alfalfa field. Photos of site: 1252 - soil and 1253 - southwest.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Medicago sativa	80	Y	UPL
2. Bromus inermis	15	N	FACU
3. Lactuca serriola	5	N	FACU
4. Chenopodium album	TR	N	FACU
5.			
6.			
7.			
8.			
	100	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
Total Cover:	0		

% Bare Ground in Herb Stratum 0 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:		x 2 =	0
FAC species:		x 3 =	0
FACU species:	20	x 4 =	80
UPL species:	80	x 5 =	400
Column Totals:	100 (A)		480 (B)

Prevalence Index = B/A = 4.80

Hydrophytic Vegetation Indicators:

- Dominance Test >50%
- Prevalence Index is ≤3.0[1]
- Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes: No: X

Remarks: Upland plant community.

SOILS

Sampling Point: W51A

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features					
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 8	10YR 3/1	100	-	-	-	-	clay loam	till zone
8 - 18	10YR 4/2	75	10YR 5/6	25	C	M	clay	-

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) **(LRR C)**
- ____ 1 cm Muck (A9) **(LRR D)**
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) **(LRR C)**
- ____ 2 cm Muck (A10) **(LRR B)**
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: X No:

Remarks: -

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- _____ Water Marks (B1) **(Riverine)**
- _____ Sediment Deposits (B2) **(Riverine)**
- _____ Drift Deposits (B3) **(Riverine)**
- _____ Drainage patterns (B10)
- _____ Dry-Season Water Table (C2)
- _____ Crayfish Burrows (C8)
- _____ Saturation Visible on Aerial Imagery (C9)
- _____ Shallow Aquitard (D3)
- FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ____ No X Depth (inches): _____

Water Table Present? Yes: ____ No X Depth (inches): _____

Saturation Present? (incl. capillary fringe) Yes: No X Depth (inches):

Wetland Hydrology Present? Yes: No: X

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Soil is moist, not saturated.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: June 6, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W51B
Investigator(s): Dennis Wenger, Collin Covington	Section, Township, Range: 12, 39S, 6W	
Landform (hillslope, terrace, etc.): meadow	Local relief (concave, convex, none): none	Slope (%): 1
Subregion (LRR): D	Easting: 368582 Northing: 4143821	Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X No: (If no, explain in Remarks.)		
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X No:	
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes: X	No:	**Is the Sampled Area within a Wetland?** Yes: X No:
Hydric Soil Present?	Yes: X	No:	
Wetland Hydrology Present?	Yes: X	No:	

Remarks: Wet meadow downgradient of alfalfa field. Photos of site: 1254 - soil, 1255 - west, 1256 - north.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Juncus arcticus	75	Y	FACW
2. Poa pratensis	15	N	FAC
3. Symphyotrichum ascendens	10	N	FAC
4. Cirsium sp.	1	N	-
5. Pascopyrum smithii	TR	N	FAC
6. Lactuca serriola	TR	N	FACU
7.			
8.			
	101	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
Total Cover: 0			

% Bare Ground in Herb Stratum 0 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:	Multiply by:	
OBL species:	x 1=	0
FACW species: 75	x 2 =	150
FAC species: 25	x 3 =	75
FACU species:	x 4 =	0
UPL species:	x 5 =	0
Column Totals: 100 (A)		225 (B)

Prevalence Index = B/A = 2.25

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

X Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes: X No:

Remarks: Wetland plant community.

SOILS

Sampling Point: W51B

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0 - 2	-	-	-	-	-	-	organics	fibrous material
2 - 10	10YR 5/1	50	73.5YR 4/6	50	C	M	clay	granular
10 - 18	7.5YR 4/1	80	7.5YR 4/6	20	C	M	clay	compacted

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___ Histosol (A1)	___ Sandy Redox (S5)	___ 1 cm Muck (A9) **(LRR C)**
___ Histic Epipedon (A2)	___ Stripped Matrix (S6)	___ 2 cm Muck (A10) **(LRR B)**
___ Black Histic (A3)	___ Loamy Mucky Mineral (F1)	___ Reduced Vertic (F18)
___ Hydrogen Sulfide (A4)	___ Loamy Gleyed Matrix (F2)	___ Red Parent Material (TF2)
___ Stratified Layers (A5) **(LRR C)**	X Depleted Matrix (F3)	___ Other (Explain in Remarks)
___ 1 cm Muck (A9) **(LRR D)**	___ Redox Dark Surface (F6)	
___ Depleted Below Dark Surface (A11)	___ Depleted Dark Surface (F7)	
___ Thick Dark Surface (A12)	___ Redox Depressions (F8)	
___ Sandy Mucky Mineral (S1)	___ Vernal Pools (F9)	
___ Sandy Gleyed Matrix (S4)		

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: X No:

Remarks: -

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)		Secondary Indicators (2 or more required)
___ Surface Water (A1)	___ Salt Crust (B11)	___ Water Marks (B1) **(Riverine)**
___ High Water Table (A2)	___ Biotic Crust (B12)	___ Sediment Deposits (B2) **(Riverine)**
___ Saturation (A3)	___ Aquatic Invertebrates (B13)	___ Drift Deposits (B3) **(Riverine)**
___ Water Marks (B1) **(Nonriverine)**	___ Hydrogen Sulfide Odor (C1)	___ Drainage patterns (B10)
___ Sediment Deposits (B2) **(Nonriverine)**	___ Oxidized Rhizospheres along Living Roots	___ Dry-Season Water Table (C2)
___ Drift Deposits (B3) **(Nonriverine)**	___ Presence of Reduced Iron (C4)	___ Crayfish Burrows (C8)
___ Surface Soil Cracks (B6)	___ Recent Iron Reduction in Plowed Soils (C6)	___ Saturation Visible on Aerial Imagery (C9)
___ Inundation Visible on Aerial Imagery (B7)	___ Thin Muck Surface (C7)	___ Shallow Aquitard (D3)
___ Water-Stained Leaves (B9)	___ Other (Explain in Remarks)	___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes: ___	No X	Depth (inches): ___	
Water Table Present?	Yes: ___	No X	Depth (inches): ___	**Wetland Hydrology Present? Yes: X No:**
Saturation Present? (incl. capillary fringe)	Yes:	No X	Depth (inches):	

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Dry. It is assumed that early season water levels are sufficient to support wetland conditions.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: June 6, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W51C
Investigator(s): Dennis Wenger, Collin Covington	Section, Township, Range: 12, 39S, 6W	
Landform (hillslope, terrace, etc.): meadow	Local relief (concave, convex, none): none	Slope (%): 1
Subregion (LRR): D	Easting: 368565	Northing: 4143835 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X	No: (If no, explain in Remarks.)	
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X	No:
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes: X	No:	**Is the Sampled Area within a Wetland?**	**Yes: X** **No:**
Hydric Soil Present?	Yes: X	No:		
Wetland Hydrology Present?	Yes: X	No:		

Remarks: Meadow area that has a vegetation break from wetland to the east. Photos of site: 1257 - soil, 1258 - east, 1259 - west.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Pascopyrum smithii	55	Y	FAC
2. Poa pratensis	15	N	FAC
3. Juncus arcticus	10	N	FACW
4. Juncus sp.	5	N	-
5. Symphyotrichum ascendens	5	N	FAC
6. Carex praegracilis	2	N	FACW
7.			
8.			
	92	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
Total Cover:	0		

% Bare Ground in Herb Stratum 8 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:	12	x 2 =	24
FAC species:	75	x 3 =	225
FACU species:		x 4 =	0
UPL species:		x 5 =	0
Column Totals:	87 (A)		249 (B)

Prevalence Index = B/A = 2.86

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

X Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes: X No:

Remarks: Wetland plant community.

SOILS

Sampling Point: W51C

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features					
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 1	-	-	-	-	-	-	organics	fibrous root zone
1 - 2	10YR 3/2	88	10YR 5/6	>2	C	M	clay	granular, 10% white calcium nodules
2 - 16	10YR 4/1	70	7.5YR 4/6	30	C	M	clay	granular

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___ Histosol (A1)	___ Sandy Redox (S5)	___ 1 cm Muck (A9) (**LRR C**)
___ Histic Epipedon (A2)	___ Stripped Matrix (S6)	___ 2 cm Muck (A10) (**LRR B**)
___ Black Histic (A3)	___ Loamy Mucky Mineral (F1)	___ Reduced Vertic (F18)
___ Hydrogen Sulfide (A4)	___ Loamy Gleyed Matrix (F2)	___ Red Parent Material (TF2)
___ Stratified Layers (A5) (**LRR C**)	X Depleted Matrix (F3)	___ Other (Explain in Remarks)
___ 1 cm Muck (A9) (**LRR D**)	___ Redox Dark Surface (F6)	
___ Depleted Below Dark Surface (A11)	___ Depleted Dark Surface (F7)	
___ Thick Dark Surface (A12)	___ Redox Depressions (F8)	
___ Sandy Mucky Mineral (S1)	___ Vernal Pools (F9)	
___ Sandy Gleyed Matrix (S4)		

Indicators for Problematic Hydric Soils[3]:

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: X No:

Remarks: -

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)		Secondary Indicators (2 or more required)
___ Surface Water (A1)	___ Salt Crust (B11)	___ Water Marks (B1) (**Riverine**)
___ High Water Table (A2)	___ Biotic Crust (B12)	___ Sediment Deposits (B2) (**Riverine**)
___ Saturation (A3)	___ Aquatic Invertebrates (B13)	___ Drift Deposits (B3) (**Riverine**)
___ Water Marks (B1) (**Nonriverine**)	___ Hydrogen Sulfide Odor (C1)	___ Drainage patterns (B10)
___ Sediment Deposits (B2) (**Nonriverine**)	___ Oxidized Rhizospheres along Living Roots	___ Dry-Season Water Table (C2)
___ Drift Deposits (B3) (**Nonriverine**)	___ Presence of Reduced Iron (C4)	___ Crayfish Burrows (C8)
___ Surface Soil Cracks (B6)	___ Recent Iron Reduction in Plowed Soils (C6)	___ Saturation Visible on Aerial Imagery (C9)
___ Inundation Visible on Aerial Imagery (B7)	___ Thin Muck Surface (C7)	___ Shallow Aquitard (D3)
___ Water-Stained Leaves (B9)	___ Other (Explain in Remarks)	___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes: ___	No X	Depth (inches): ___	
Water Table Present?	Yes: ___	No X	Depth (inches): ___	**Wetland Hydrology Present? Yes: X No:**
Saturation Present? (Incl. capillary fringe)	Yes:	No X	Depth (inches):	

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Dry and friable. It is assumed that early season water levels are sufficient to support wetland conditions.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: June 6, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W51D
Investigator(s): Dennis Wenger, Collin Covington	Section, Township, Range: 12, 39S, 6W	
Landform (hillslope, terrace, etc.): meadow	Local relief (concave, convex, none): none	Slope (%): 1
Subregion (LRR): D	Easting: 368530	Northing: 4143862 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X No: (If no, explain in Remarks.)		
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X No:	
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes: X	No:	**Is the Sampled Area within a Wetland?** **Yes:** **No: X**
Hydric Soil Present?	Yes:	No: X	
Wetland Hydrology Present?	Yes:	No: X	

Remarks: Upland meadow that is heavily grazed by livestock. Approximately 12 inches higher than adjacent wetland sample point. Photos of site: 1060 - soil and 1061 - east.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:_____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:_____)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Pascopyrum smithii	40	Y	FAC
2. Poa pratensis	15	Y	FAC
3. Achillea millefolium	5	N	FACU
4.			
5.			
6.			
7.			
8.			
	60	= Total Cover	
Woody Vine Stratum (Plot Size:_____)			
1.			
2.			
Total Cover:	0		
% Bare Ground in Herb Stratum 40	% Cover of Biotic Crust		

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:		x 2 =	0
FAC species:	55	x 3 =	165
FACU species:	5	x 4 =	20
UPL species:		x 5 =	0
Column Totals:	60 (A)		185 (B)

Prevalence Index = B/A = 3.08

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes: X** **No:**

Remarks: Marginal wetland plant community that passes only the dominance test.

SOILS

Sampling Point: W51D

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]		
0 - 9	10YR 5/2	100	-	-	-	-	clay	granular
9 - 18	10YR 5/2	95	-	-	-	-	clay	granular, 5% white calcium nodules

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) **(LRR C)**
- ____ 1 cm Muck (A9) **(LRR D)**
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) **(LRR C)**
- ____ 2 cm Muck (A10) **(LRR B)**
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: No: X

Remarks: No redox observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- _____ Water Marks (B1) **(Riverine)**
- _____ Sediment Deposits (B2) **(Riverine)**
- _____ Drift Deposits (B3) **(Riverine)**
- _____ Drainage patterns (B10)
- _____ Dry-Season Water Table (C2)
- _____ Crayfish Burrows (C8)
- _____ Saturation Visible on Aerial Imagery (C9)
- _____ Shallow Aquitard (D3)
- FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ____ No X Depth (inches): _____

Water Table Present? Yes: ____ No X Depth (inches): _____

Saturation Present? (incl. capillary fringe) Yes: ____ No X Depth (inches): _____

Wetland Hydrology Present? Yes: No: X

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Dry and friable.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: June 6, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W52
Investigator(s): Dennis Wenger, Collin Covington	Section, Township, Range: 12, 39S, 6W	
Landform (hillslope, terrace, etc.): valley bottom	Local relief (concave, convex, none): none	Slope (%): 1
Subregion (LRR): D	Easting: 369654	Northing: 4143587	Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X	No:	(If no, explain in Remarks.)	
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X	No:	
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)		

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes: X	No:	**Is the Sampled Area within a Wetland?** Yes: No: X
Hydric Soil Present?	Yes:	No: X	
Wetland Hydrology Present?	Yes:	No: X	

Remarks: Meadow area on the valley bottom. Photos of site: 1268 - soil and 1269 - north.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size: 6' x 6')			
1. Rosa woodsii	10	Y	FACU
2.			
3.			
4.			
	10	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Juncus arcticus	30	Y	FACW
2. Poa pratensis	25	Y	FAC
3. Achillea millefolium	10	N	FACU
4. Fescue sp.	10	N	-
5. Juncus mexicanus	5	N	FACW
6. Thinopyrum intermedium	5	N	UPL
7. Symphyotrichum ascendens	5	N	FAC
8. Tragopogon dubius	2	N	UPL
	92	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
Total Cover:	0		

% Bare Ground in Herb Stratum 8 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 66.7 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:	35	x 2 =	70
FAC species:	30	x 3 =	90
FACU species:	20	x 4 =	80
UPL species:	7	x 5 =	35
Column Totals:	92 (A)		275 (B)

Prevalence Index = B/A = 2.99

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

X Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes: X No:

Remarks: Wetland plant community.

SOILS

Sampling Point: W52

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features					
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 0.5	-	-	-	-	-	-	organics	Fibrous root material
0.5 - 10	10YR 5/2	100	-	-	-	-	clay	granular
10 - 18	10YR 4/1	100	-	-	-	-	clay	granular

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) (**LRR C**)
- ____ 1 cm Muck (A9) (**LRR D**)
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) (**LRR C**)
- ____ 2 cm Muck (A10) (**LRR B**)
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: No: X

Remarks: No redox observed. Does not meet hydric conditions.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- _____ Water Marks (B1) (**Riverine**)
- _____ Sediment Deposits (B2) (**Riverine**)
- _____ Drift Deposits (B3) (**Riverine**)
- _____ Drainage patterns (B10)
- _____ Dry-Season Water Table (C2)
- _____ Crayfish Burrows (C8)
- _____ Saturation Visible on Aerial Imagery (C9)
- _____ Shallow Aquitard (D3)
- FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes: ___	No ___	Depth (inches):	X	
Water Table Present?	Yes: ___	No ___	Depth (inches):	X	**Wetland Hydrology Present? Yes: No: X**
Saturation Present? (incl. capillary fringe)	Yes:	No	Depth (inches):	X	

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Dry and friable. Vegetation was stressed from what appears to be lack of water.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: June 6, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W53A
Investigator(s): Dennis Wenger, Collin Covington	Section, Township, Range: 12, 39S, 6W	
Landform (hillslope, terrace, etc.): hillslope	Local relief (concave, convex, none): none	Slope (%): 3
Subregion (LRR): D	Easting: 369236	Northing: 4143493 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X No: (If no, explain in Remarks.)		
Are Vegetation: , Soil: , or Hydrology: significantly disturbed? Are "Normal Circumstances" present? Yes: X No:		
Are Vegetation: , Soil: , or Hydrology: naturally disturbed? (If needed, explain any answers in Remarks.)		

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes: X No:	**Is the Sampled Area within a Wetland? Yes: X No:**	
Hydric Soil Present? Yes: X No:		
Wetland Hydrology Present? Yes: X No:		

Remarks: Potential seepage area. Photos of site: 1273 - soil, 1274 - west, 1275 - northeast.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size: 6' x 6')	Absolute % Cover	Dominant Species?	Indicator Status
1. Elaeagnus angustifolia	10	Y	FAC
2.			
3.			
4.			
	10	= Total Cover	
Sapling/Shrub Stratum (Plot Size:)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Juncus arcticus	70	Y	FACW
2. Symphyotrichum ascendens	15	N	FAC
3. Medicago sativa	5	N	UPL
4. Thinopyrum intermedium	2	N	UPL
5.			
6.			
7.			
8.			
	92	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
Total Cover: 0			
% Bare Ground in Herb Stratum 8	% Cover of Biotic Crust		

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:	70	x 2 =	140
FAC species:	25	x 3 =	75
FACU species:		x 4 =	0
UPL species:	7	x 5 =	35
Column Totals:	102 (A)		250 (B)

Prevalence Index = B/A = 2.45

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

X Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes: X No:

Remarks: Wetland plant community.

SOILS

Sampling Point: W53A

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 6	10YR 4/2	25	-	-	-	-	loam	75% fibrous root material
6 - 18	10YR 4/1	75	10YR 5/6	25	C	M	clay	blocky

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___ Histosol (A1)	___ Sandy Redox (S5)	___ 1 cm Muck (A9) (**LRR C**)
___ Histic Epipedon (A2)	___ Stripped Matrix (S6)	___ 2 cm Muck (A10) (**LRR B**)
___ Black Histic (A3)	___ Loamy Mucky Mineral (F1)	___ Reduced Vertic (F18)
___ Hydrogen Sulfide (A4)	___ Loamy Gleyed Matrix (F2)	___ Red Parent Material (TF2)
___ Stratified Layers (A5) (**LRR C**)	_X_ Depleted Matrix (F3)	___ Other (Explain in Remarks)
___ 1 cm Muck (A9) (**LRR D**)	___ Redox Dark Surface (F6)	
___ Depleted Below Dark Surface (A11)	___ Depleted Dark Surface (F7)	
___ Thick Dark Surface (A12)	___ Redox Depressions (F8)	
___ Sandy Mucky Mineral (S1)	___ Vernal Pools (F9)	
___ Sandy Gleyed Matrix (S4)		

Indicators for Problematic Hydric Soils[3]:

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: X No:

Remarks: Mixed profile appears to be result of slumping.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)		Secondary Indicators (2 or more required)
___ Surface Water (A1)	___ Salt Crust (B11)	___ Water Marks (B1) (**Riverine**)
___ High Water Table (A2)	___ Biotic Crust (B12)	___ Sediment Deposits (B2) (**Riverine**)
___ Saturation (A3)	___ Aquatic Invertebrates (B13)	___ Drift Deposits (B3) (**Riverine**)
___ Water Marks (B1) (**Nonriverine**)	___ Hydrogen Sulfide Odor (C1)	___ Drainage patterns (B10)
___ Sediment Deposits (B2) (**Nonriverine**)	___ Oxidized Rhizospheres along Living Roots	___ Dry-Season Water Table (C2)
___ Drift Deposits (B3) (**Nonriverine**)	___ Presence of Reduced Iron (C4)	___ Crayfish Burrows (C8)
___ Surface Soil Cracks (B6)	___ Recent Iron Reduction in Plowed Soils (C6)	___ Saturation Visible on Aerial Imagery (C9)
___ Inundation Visible on Aerial Imagery (B7)	___ Thin Muck Surface (C7)	___ Shallow Aquitard (D3)
___ Water-Stained Leaves (B9)	___ Other (Explain in Remarks)	___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes: ___	No _X_	Depth (inches): ___	
Water Table Present?	Yes: ___	No _X_	Depth (inches): ___	**Wetland Hydrology Present? Yes: X No:**
Saturation Present? (Incl. capillary fringe)	Yes:	No X	Depth (inches):	

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Soil was moist, not saturated. It is assumed that early season water levels are sufficient to support wetland conditions.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: June 6, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W53B
Investigator(s): Dennis Wenger, Collin Covington	Section, Township, Range: 12, 39S, 6W	
Landform (hillslope, terrace, etc.): hillslope	Local relief (concave, convex, none): none	Slope (%): 10
Subregion (LRR): D	Easting: 369228	Northing: 4143500 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X	No:	(If no, explain in Remarks.)
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X	No:
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes:	No: X	**Is the Sampled Area within a Wetland?** **Yes:** **No: X**
Hydric Soil Present?	Yes:	No: X	
Wetland Hydrology Present?	Yes:	No: X	

Remarks: Located on a hillslope into drainage. Approximately 5 feet above the adjacent wetland sample point. Photos of site: 1276 - soil and 1277 - east.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size: 6' x 6')	Absolute % Cover	Dominant Species?	Indicator Status
1. Elaeagnus angustifolia	5	Y	FAC
2.			
3.			
4.			
	5	= Total Cover	
Sapling/Shrub Stratum (Plot Size: 6' x 6')			
1. Artemisia tridentata	10	Y	UPL
2.			
3.			
4.			
	10	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Thinopyrum intermedium	45	Y	UPL
2. Agropyron cristatum	15	Y	UPL
3. Medicago sativa	10	N	UPL
4. Symphyotrichum ascendens	10	N	FAC
5. Carex praegracilis	TR	N	FACW
6.			
7.			
8.			
	80	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
	Total Cover: 0		

% Bare Ground in Herb Stratum 20 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 25 (A/B)

Prevalence Index Worksheet:

Total % Cover of:	Multiply by:	
OBL species:	x 1=	0
FACW species:	x 2 =	0
FAC species: 15	x 3 =	45
FACU species:	x 4 =	0
UPL species: 80	x 5 =	400
Column Totals: 95 (A)		445 (B)

Prevalence Index = B/A = 4.68

Hydrophytic Vegetation Indicators:

- Dominance Test >50%
- Prevalence Index is ≤3.0[1]
- Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes:** **No: X**

Remarks: Upland plant community.

SOILS

Sampling Point: W53B

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features					
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 18	10YR 5/2	95	-	-	-	-	clay	granular, 5% white calcium nodules

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) (**LRR C**)
- ____ 1 cm Muck (A9) (**LRR D**)
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) (**LRR C**)
- ____ 2 cm Muck (A10) (**LRR B**)
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: No: X

Remarks: No redox observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- _____ Water Marks (B1) (**Riverine**)
- _____ Sediment Deposits (B2) (**Riverine**)
- _____ Drift Deposits (B3) (**Riverine**)
- _____ Drainage patterns (B10)
- _____ Dry-Season Water Table (C2)
- _____ Crayfish Burrows (C8)
- _____ Saturation Visible on Aerial Imagery (C9)
- _____ Shallow Aquitard (D3)
- FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ____ No X Depth (inches): _____

Water Table Present? Yes: ____ No X Depth (inches): _____

Saturation Present? (incl. capillary fringe) Yes: ____ No X Depth (inches):

Wetland Hydrology Present? Yes: No: X

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Dry and friable.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: June 6, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W54A
Investigator(s): Jeff Boice, Collin Covington	Section, Township, Range: 12, 39S, 6W	
Landform (hillslope, terrace, etc.): meadow terrace	Local relief (concave, convex, none): none	Slope (%): 1
Subregion (LRR): D	Easting: 369233	Northing: 4143550 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X	No: (If no, explain in Remarks.)	
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X	No:
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes: ____ No: X	**Is the Sampled Area within a Wetland? Yes: No: X**	
Hydric Soil Present? Yes: ____ No: X		
Wetland Hydrology Present? Yes: No: X		

Remarks: Upland meadow area outside of drainage swale. Photos of site: 1282 - soil, 1283 - west, 1285 - north.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size: ____)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Thinopyrum intermedium	45	Y	UPL
2. Pascopyrum smithii	30	Y	FAC
3.			
4.			
5.			
6.			
7.			
8.			
	75	= Total Cover	
Woody Vine Stratum (Plot Size: ____)			
1.			
2.			
	Total Cover: 0		

% Bare Ground in Herb Stratum 25 % Cover of Biotic Crust ____

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:		x 2 =	0
FAC species:	30	x 3 =	90
FACU species:		x 4 =	0
UPL species:	45	x 5 =	225
Column Totals:	75 (A)		315 (B)

Prevalence Index = B/A = 4.20

Hydrophytic Vegetation Indicators:

Dominance Test >50%

Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes: No: X

Remarks: Upland plant community.

SOILS

Sampling Point: W54A

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features					
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 18	10YR 5/2	100	-	-	-	-	clay	granular

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: No: X

Remarks: No redox observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ___ No X Depth (inches): ___

Water Table Present? Yes: ___ No X Depth (inches): ___

Saturation Present? (incl. capillary fringe) Yes: ___ No X Depth (inches): ___

Wetland Hydrology Present? Yes: No: X

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Dry and friable.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: June 6, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W54B
Investigator(s): Jeff Boice, Dennis Wenger, Collin Covington	Section, Township, Range: 12, 39S, 6W	
Landform (hillslope, terrace, etc.): meadow	Local relief (concave, convex, none): none	Slope (%): 1
Subregion (LRR): D	Easting: 369262 Northing: 4143564	Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X No: (If no, explain in Remarks.)		
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X No:	
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes:	No: X	**Is the Sampled Area within a Wetland?** **Yes:** **No: X**
Hydric Soil Present?	Yes:	No: X	
Wetland Hydrology Present?	Yes:	No: X	

Remarks: Hummock area in a meadow. Photos of site: 1287 - soil, 1288 - west, 1289 - north.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Thinopyrum intermedium	55	Y	UPL
2. Carex praegracilis	20	Y	FACW
3. Pascopyrum smithii	10	N	FAC
4.			
5.			
6.			
7.			
8.			
	85	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
Total Cover:	0		

% Bare Ground in Herb Stratum 15 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:	20	x 2 =	40
FAC species:	10	x 3 =	30
FACU species:		x 4 =	0
UPL species:	55	x 5 =	275
Column Totals:	85 (A)		345 (B)

Prevalence Index = B/A = 4.06

Hydrophytic Vegetation Indicators:

Dominance Test >50%

Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes:** **No: X**

Remarks: Upland plant community.

SOILS

Sampling Point: W54B

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0 - 18	10YR 4/2	75	10YR 5/6	>1	C	M	clay	granular, 25% white calcium nodules

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) (**LRR C**)
- ____ 1 cm Muck (A9) (**LRR D**)
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) (**LRR C**)
- ____ 2 cm Muck (A10) (**LRR B**)
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (If present):

Type:

Depth (inches):

Hydric Soil Present? Yes: No: X

Remarks: Redox is faint and not in high enough concentration to qualify for hydric conditions.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ____ Water Marks (B1) (**Riverine**)
- ____ Sediment Deposits (B2) (**Riverine**)
- ____ Drift Deposits (B3) (**Riverine**)
- ____ Drainage patterns (B10)
- ____ Dry-Season Water Table (C2)
- ____ Crayfish Burrows (C8)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Shallow Aquitard (D3)
- ____ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ___ No X Depth (inches): ____

Water Table Present? Yes: ___ No X Depth (inches): ____

Saturation Present? (incl. capillary fringe) Yes: ___ No X Depth (inches): ____

Wetland Hydrology Present? Yes: No: X

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Dry.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: June 6, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W54C
Investigator(s): Jeff Boice, Dennis Wenger, Collin Covington	Section, Township, Range: 12, 39S, 6W	
Landform (hillslope, terrace, etc.): drainage swale	Local relief (concave, convex, none): none	Slope (%): 1
Subregion (LRR): D	Easting: 369240	Northing: 4143569 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X No: (If no, explain in Remarks.)		
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X No:	
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes: X No:	Is the Sampled Area within a Wetland? Yes: X No:	
Hydric Soil Present? Yes: X No:		
Wetland Hydrology Present? Yes: X No:		

Remarks: Drainage swale that does not have a defined channel. Photos of site: 1290 - soil, 1291 - south, 1292 - east.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Carex praegracilis	60	Y	FACW
2. Juncus arcticus	20	Y	FACW
3. Poa pratensis	10	N	FAC
4. Pascopyrum smithii	TR	N	FAC
5.			
6.			
7.			
8.			
	90	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
	Total Cover: 0		
% Bare Ground in Herb Stratum 10	% Cover of Biotic Crust		

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:	80	x 2 =	160
FAC species:	10	x 3 =	30
FACU species:		x 4 =	0
UPL species:		x 5 =	0
Column Totals:	90 (A)		190 (B)

Prevalence Index = B/A = 2.11

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

X Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes: X No:

Remarks: Wetland plant community.

SOILS

Sampling Point: W54C

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]		
0 - 5	10YR 4/1	90	10YR 5/6	10	C	M	clay	granular
5 - 18	10YR 4/1	70	10YR 5/6	25	C	M	clay	granular, 5% white calcium nodules

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___	Histosol (A1)	___	Sandy Redox (S5)	___	1 cm Muck (A9) (**LRR C**)
___	Histic Epipedon (A2)	___	Stripped Matrix (S6)	___	2 cm Muck (A10) (**LRR B**)
___	Black Histic (A3)	___	Loamy Mucky Mineral (F1)	___	Reduced Vertic (F18)
___	Hydrogen Sulfide (A4)	___	Loamy Gleyed Matrix (F2)	___	Red Parent Material (TF2)
___	Stratified Layers (A5) (**LRR C**)	X	Depleted Matrix (F3)	___	Other (Explain in Remarks)
___	1 cm Muck (A9) (**LRR D**)	___	Redox Dark Surface (F6)		
___	Depleted Below Dark Surface (A11)	___	Depleted Dark Surface (F7)		
___	Thick Dark Surface (A12)	___	Redox Depressions (F8)		
___	Sandy Mucky Mineral (S1)	___	Vernal Pools (F9)		
___	Sandy Gleyed Matrix (S4)				

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: X No:

Remarks: -

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)				Secondary Indicators (2 or more required)	
___	Surface Water (A1)	___	Salt Crust (B11)	_____	Water Marks (B1) (**Riverine**)
___	High Water Table (A2)	___	Biotic Crust (B12)	_____	Sediment Deposits (B2) (**Riverine**)
___	Saturation (A3)	___	Aquatic Invertebrates (B13)	_____	Drift Deposits (B3) (**Riverine**)
___	Water Marks (B1) (**Nonriverine**)	___	Hydrogen Sulfide Odor (C1)	_____	Drainage patterns (B10)
___	Sediment Deposits (B2) (**Nonriverine**)	___	Oxidized Rhizospheres along Living Roots	_____	Dry-Season Water Table (C2)
___	Drift Deposits (B3) (**Nonriverine**)	___	Presence of Reduced Iron (C4)	_____	Crayfish Burrows (C8)
___	Surface Soil Cracks (B6)	___	Recent Iron Reduction in Plowed Soils (C6)	_____	Saturation Visible on Aerial Imagery (C9)
___	Inundation Visible on Aerial Imagery (B7)	___	Thin Muck Surface (C7)	_____	Shallow Aquitard (D3)
	Water-Stained Leaves (B9)		Other (Explain in Remarks)		FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes: ___	No X	Depth (inches):	___	
Water Table Present?	Yes: ___	No X	Depth (inches):	___	**Wetland Hydrology Present? Yes: X No:**
Saturation Present? (incl. capillary fringe)	Yes:	No X	Depth (inches):		

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Dry. It is assumed that early season water levels are sufficient to support wetland conditions in the topographically lower swale.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: June 7, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W55A
Investigator(s): Collin Covington	Section, Township, Range: 12, 39S, 6W	
Landform (hillslope, terrace, etc.): swale	Local relief (concave, convex, none): concave	Slope (%): 2
Subregion (LRR): D	Easting: 369096	Northing: 4143524 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X	No: (If no, explain in Remarks.)	
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X	No:
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes: X	No:	**Is the Sampled Area within a Wetland?** Yes: X No:
Hydric Soil Present?	Yes: X	No:	
Wetland Hydrology Present?	Yes: X	No:	

Remarks: Located in a drainage swale, no defined channel associated with swale. Photos of site: 1308 - soil, 1309 - north, 1310 - west.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:_____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:_____)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Carex praegracilis	50	Y	FACW
2. Juncus arcticus	45	Y	FACW
3.			
4.			
5.			
6.			
7.			
8.			
	95	= Total Cover	
Woody Vine Stratum (Plot Size:_____)			
1.			
2.			
Total Cover:	0		

% Bare Ground in Herb Stratum 5 % Cover of Biotic Crust_____

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:	Multiply by:	
OBL species:	x 1=	0
FACW species: 95	x 2 =	190
FAC species:	x 3 =	0
FACU species:	x 4 =	0
UPL species:	x 5 =	0
Column Totals: 95 (A)		190 (B)

Prevalence Index = B/A = 2.00

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

X Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes: X No:

Remarks: Wetland plant community.

SOILS

Sampling Point: W55A

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 3	10YR 4/2	20	-	-	-	-	organics	80% fibrous root material
3 - 18	10YR 4/1	80	10YR 5/6	20	C	M	clay	granular

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___ Histosol (A1)	___ Sandy Redox (S5)	___ 1 cm Muck (A9) (**LRR C**)
___ Histic Epipedon (A2)	___ Stripped Matrix (S6)	___ 2 cm Muck (A10) (**LRR B**)
___ Black Histic (A3)	___ Loamy Mucky Mineral (F1)	___ Reduced Vertic (F18)
___ Hydrogen Sulfide (A4)	___ Loamy Gleyed Matrix (F2)	___ Red Parent Material (TF2)
___ Stratified Layers (A5) (**LRR C**)	_X_ Depleted Matrix (F3)	___ Other (Explain in Remarks)
___ 1 cm Muck (A9) (**LRR D**)	___ Redox Dark Surface (F6)	
___ Depleted Below Dark Surface (A11)	___ Depleted Dark Surface (F7)	
___ Thick Dark Surface (A12)	___ Redox Depressions (F8)	
___ Sandy Mucky Mineral (S1)	___ Vernal Pools (F9)	
___ Sandy Gleyed Matrix (S4)		

Indicators for Problematic Hydric Soils[3]:

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: X No:

Remarks: Tightly compacted.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)		Secondary Indicators (2 or more required)
___ Surface Water (A1)	___ Salt Crust (B11)	___ Water Marks (B1) (**Riverine**)
___ High Water Table (A2)	___ Biotic Crust (B12)	___ Sediment Deposits (B2) (**Riverine**)
___ Saturation (A3)	___ Aquatic Invertebrates (B13)	___ Drift Deposits (B3) (**Riverine**)
___ Water Marks (B1) (**Nonriverine**)	___ Hydrogen Sulfide Odor (C1)	___ Drainage patterns (B10)
___ Sediment Deposits (B2) (**Nonriverine**)	___ Oxidized Rhizospheres along Living Roots	___ Dry-Season Water Table (C2)
___ Drift Deposits (B3) (**Nonriverine**)	___ Presence of Reduced Iron (C4)	___ Crayfish Burrows (C8)
___ Surface Soil Cracks (B6)	___ Recent Iron Reduction in Plowed Soils (C6)	___ Saturation Visible on Aerial Imagery (C9)
___ Inundation Visible on Aerial Imagery (B7)	___ Thin Muck Surface (C7)	___ Shallow Aquitard (D3)
___ Water-Stained Leaves (B9)	___ Other (Explain in Remarks)	___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes: ___	No _X_	Depth (inches): ___		
Water Table Present?	Yes: ___	No _X_	Depth (inches): ___	**Wetland Hydrology Present?**	**Yes: X No:**
Saturation Present? (incl. capillary fringe)	Yes:	No X	Depth (inches):		

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Dry. It is assumed that early season water levels are sufficient to support wetland conditions in the topographically lower swale.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: June 7, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W55B
Investigator(s): Collin Covington	Section, Township, Range: 12, 39S, 6W	
Landform (hillslope, terrace, etc.): terrace	Local relief (concave, convex, none): none	Slope (%): >1
Subregion (LRR): D	Easting: 369094	Northing: 4143519 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X No: (If no, explain in Remarks.)		
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X No:	
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes:	No: X	**Is the Sampled Area within a Wetland?** Yes: No: X
Hydric Soil Present?	Yes:	No: X	
Wetland Hydrology Present?	Yes:	No: X	

Remarks: Grazed area located approximately 12 inches above the adjacent wetland sample point. Photos of site: 1311 - soil and 1312 - east.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size: 6' x 6')			
1. Artemisia tridentata	35	Y	UPL
2.			
3.			
4.			
	35	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Bromus inermis	30	Y	FACU
2. Agropyron cristatum	10	Y	UPL
3. Iva axillaris	10	Y	FAC
4. Thinopyrum intermedium	10	Y	UPL
5. Fescue sp.	5	N	-
6. Juncus arcticus	2	N	FACW
7.			
8.			
	67	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
	Total Cover: 0		

% Bare Ground in Herb Stratum 33 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 20 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:	2	x 2 =	4
FAC species:	10	x 3 =	30
FACU species:	30	x 4 =	120
UPL species:	55	x 5 =	275
Column Totals:	97 (A)		429 (B)

Prevalence Index = B/A = 4.42

Hydrophytic Vegetation Indicators:

Dominance Test >50%

Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes: No: X

Remarks: Upland plant community.

SOILS

Sampling Point: W55B

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features					
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 5	10YR 5/3	100	-	-	-	-	clay	granular
5 - 18	10YR 3/2	100	-	-	-	-	clay	granular

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) **(LRR C)**
- ____ 1 cm Muck (A9) **(LRR D)**
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) **(LRR C)**
- ____ 2 cm Muck (A10) **(LRR B)**
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: No: X

Remarks: No redox observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ____ Water Marks (B1) **(Riverine)**
- ____ Sediment Deposits (B2) **(Riverine)**
- ____ Drift Deposits (B3) **(Riverine)**
- ____ Drainage patterns (B10)
- ____ Dry-Season Water Table (C2)
- ____ Crayfish Burrows (C8)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Shallow Aquitard (D3)
- ____ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ____ No X Depth (inches): ____

Water Table Present? Yes: ____ No X Depth (inches): ____

Saturation Present? (incl. capillary fringe) Yes: ____ No X Depth (inches): ____

Wetland Hydrology Present? Yes: No: X

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Dry and friable.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: June 7, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W56A
Investigator(s): Jeff Boice, Collin Covington	Section, Township, Range: 12, 39S, 6W	
Landform (hillslope, terrace, etc.): drainage bottom	Local relief (concave, convex, none): none	Slope (%): 1
Subregion (LRR): D	Easting: 368984	Northing: 4143744 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X	No: (If no, explain in Remarks.)	
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X	No:
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes: X	No:	**Is the Sampled Area within a Wetland? Yes: X No:**
Hydric Soil Present?	Yes: X	No:	
Wetland Hydrology Present?	Yes: X	No:	

Remarks: Adjacent to agriculture field of alfalfa, located near drainage bottom. Photos of site: 1317 - soil, 1318 - north, 1319 - west.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Poa palustris	45	Y	FAC
2. Hordeum jubatum	20	Y	FAC
3. Polygonum aviculare	15	N	FACW
4. Medicago sativa	5	N	UPL
5.			
6.			
7.			
8.			
	85	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
Total Cover:	0		

% Bare Ground in Herb Stratum 15 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:	15	x 2 =	30
FAC species:	65	x 3 =	195
FACU species:		x 4 =	0
UPL species:	5	x 5 =	25
Column Totals:	85 (A)		250 (B)

Prevalence Index = B/A = 2.94

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

X Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes: X No:

Remarks: Wetland plant community.

SOILS

Sampling Point: W56A

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features					
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 5	10YR 5/2	99	10YR 5/6	>1	C	M	clay	granular
5 - 18	10YR 5/2	88	10YR 5/6	2	C	M	clay	granular, 10% white calcium nodules

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___ Histosol (A1)	___ Sandy Redox (S5)	___ 1 cm Muck (A9) (**LRR C**)
___ Histic Epipedon (A2)	___ Stripped Matrix (S6)	___ 2 cm Muck (A10) (**LRR B**)
___ Black Histic (A3)	___ Loamy Mucky Mineral (F1)	___ Reduced Vertic (F18)
___ Hydrogen Sulfide (A4)	___ Loamy Gleyed Matrix (F2)	___ Red Parent Material (TF2)
___ Stratified Layers (A5) (**LRR C**)	_X_ Depleted Matrix (F3)	___ Other (Explain in Remarks)
___ 1 cm Muck (A9) (**LRR D**)	___ Redox Dark Surface (F6)	
___ Depleted Below Dark Surface (A11)	___ Depleted Dark Surface (F7)	
___ Thick Dark Surface (A12)	___ Redox Depressions (F8)	
___ Sandy Mucky Mineral (S1)	___ Vernal Pools (F9)	
___ Sandy Gleyed Matrix (S4)		

Indicators for Problematic Hydric Soils[3]:

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: X No:

Remarks: -

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)		Secondary Indicators (2 or more required)
___ Surface Water (A1)	___ Salt Crust (B11)	___ Water Marks (B1) (**Riverine**)
___ High Water Table (A2)	___ Biotic Crust (B12)	___ Sediment Deposits (B2) (**Riverine**)
___ Saturation (A3)	___ Aquatic Invertebrates (B13)	___ Drift Deposits (B3) (**Riverine**)
___ Water Marks (B1) (**Nonriverine**)	___ Hydrogen Sulfide Odor (C1)	___ Drainage patterns (B10)
___ Sediment Deposits (B2) (**Nonriverine**)	___ Oxidized Rhizospheres along Living Roots	___ Dry-Season Water Table (C2)
___ Drift Deposits (B3) (**Nonriverine**)	___ Presence of Reduced Iron (C4)	___ Crayfish Burrows (C8)
___ Surface Soil Cracks (B6)	___ Recent Iron Reduction in Plowed Soils (C6)	___ Saturation Visible on Aerial Imagery (C9)
___ Inundation Visible on Aerial Imagery (B7)	___ Thin Muck Surface (C7)	___ Shallow Aquitard (D3)
___ Water-Stained Leaves (B9)	___ Other (Explain in Remarks)	___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ___ No _X_ Depth (inches): ___

Water Table Present? Yes: ___ No _X_ Depth (inches): ___

Saturation Present? (incl. capillary fringe) Yes: ___ No X Depth (inches): ___

Wetland Hydrology Present? Yes: X No:

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Soil was moist, not saturated. It is assumed that early season water levels are sufficient to support wetland conditions.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: June 7, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W56B
Investigator(s): Jeff Boice, Collin Covington	Section, Township, Range: 12, 39S, 6W	
Landform (hillslope, terrace, etc.): hillslope	Local relief (concave, convex, none): none	Slope (%): 5
Subregion (LRR): D	Easting: 368978	Northing: 4143739 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X No: (If no, explain in Remarks.)		
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X No:	
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes:	No: X	**Is the Sampled Area within a Wetland?** **Yes:** **No: X**
Hydric Soil Present?	Yes: X	No:	
Wetland Hydrology Present?	Yes: X	No:	

Remarks: Located on a hillslope in an alfalfa field. Photos of site: 1320 - soil and 1321 - east.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:_____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:_____)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Medicago sativa	40	Y	UPL
2. Polygonum douglasii	20	Y	FACU
3. Hordeum jubatum	10	N	FAC
4. Melilotus officinalis	5	N	FACU
5. Poa palustris	2	N	FAC
6.			
7.			
8.			
	77	= Total Cover	
Woody Vine Stratum (Plot Size:_____)			
1.			
2.			
Total Cover: 0			
% Bare Ground in Herb Stratum 23	% Cover of Biotic Crust		

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:		x 2 =	0
FAC species:	12	x 3 =	36
FACU species:	25	x 4 =	100
UPL species:	40	x 5 =	200
Column Totals:	77 (A)		336 (B)

Prevalence Index = B/A = 4.36

Hydrophytic Vegetation Indicators:

- Dominance Test >50%
- Prevalence Index is ≤3.0[1]
- Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes:** **No: X**

Remarks: Upland plant community.

SOILS

Sampling Point: W56B

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]		
0 - 8	10YR 5/1	99	10YR 5/6	>1	C	M	clay	granular
8 - 18	10YR 5/3	100	-	-	-	-	clay	granular

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: X No:

Remarks: No redox below 8 inches. Between 6 inches and 8 inches there is the presence of the white calcium concretion nodules.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- X Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ___ No X Depth (inches): ___

Water Table Present? Yes: ___ No X Depth (inches): ___

Saturation Present? (incl. capillary fringe) Yes: No X Depth (inches):

Wetland Hydrology Present? Yes: X No:

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Moist. Surface soil cracks are likely from the pivot irrigation for the alfalfa.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: June 7, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W57A
Investigator(s): Dennis Wenger, Collin Covington	Section, Township, Range: 12, 39S, 6W	
Landform (hillslope, terrace, etc.): meadow	Local relief (concave, convex, none): none	Slope (%): 1
Subregion (LRR): D	Easting: 369043	Northing: 4143843 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X	No: (If no, explain in Remarks.)	
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X	No:
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes: X No:	**Is the Sampled Area within a Wetland? Yes: X No:**
Hydric Soil Present?	Yes: X No:	
Wetland Hydrology Present?	Yes: X No:	

Remarks: Wet meadow adjacent to alfalfa field. Photos of site: 1322 - soil, 1323 - north, 1324 - east.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:_____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:_____)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Juncus arcticus	45	Y	FACW
2. Carex praegracilis	40	Y	FACW
3. Poa pratensis	10	N	FAC
4. Symphyotrichum ascendens	7	N	FAC
5. Medicago sativa	3	N	UPL
6. Taraxacum officinale	TR	N	FACU
7.			
8.			
	105	= Total Cover	
Woody Vine Stratum (Plot Size:_____)			
1.			
2.			
Total Cover: 0			
% Bare Ground in Herb Stratum 0	% Cover of Biotic Crust		

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:	Multiply by:	
OBL species:	x 1=	0
FACW species: 85	x 2 =	170
FAC species: 17	x 3 =	51
FACU species:	x 4 =	0
UPL species: 3	x 5 =	15
Column Totals: 105 (A)		236 (B)

Prevalence Index = B/A = 2.25

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

X Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes: X No:

Remarks: Wetland plant community.

SOILS

Sampling Point: W57A

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0 - 3	-	-	-	-	-	-	organics	fibrous root material
3 - 18	10YR 5/2	50	7.5YR 5/6	50	C	M	clay	granular

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: X No:

Remarks: -

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ___ No X Depth (inches): ___

Water Table Present? Yes: ___ No X Depth (inches): ___

Saturation Present? (incl. capillary fringe) Yes: No X Depth (inches):

Wetland Hydrology Present? Yes: X No:

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Soil was moist, not saturated. It is assumed that early season water levels are sufficient to support wetland conditions.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: June 7, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W57B
Investigator(s): Dennis Wenger, Collin Covington	Section, Township, Range: 12, 39S, 6W	
Landform (hillslope, terrace, etc.): agriculture field	Local relief (concave, convex, none): none	Slope (%): 1
Subregion (LRR): D	Easting: 369042 Northing: 4143855	Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X No: (If no, explain in Remarks.)		
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X No:	
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes:	No: X	**Is the Sampled Area within a Wetland?** **Yes:** **No: X**
Hydric Soil Present?	Yes:	No: X	
Wetland Hydrology Present?	Yes:	No: X	

Remarks: Located in an alfalfa field. Photos of site: 1325 - soil and 1326 - south.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Medicago sativa	90	Y	UPL
2. Bromus inermis	5	N	FACU
3.			
4.			
5.			
6.			
7.			
8.			
	95	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
Total Cover: 0			

% Bare Ground in Herb Stratum 5 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:		x 2 =	0
FAC species:		x 3 =	0
FACU species:	5	x 4 =	20
UPL species:	90	x 5 =	450
Column Totals:	95 (A)		470 (B)

Prevalence Index = B/A = 4.95

Hydrophytic Vegetation Indicators:

Dominance Test >50%

Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes:** **No: X**

Remarks: Upland plant community.

SOILS

Sampling Point: W57B

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features					
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 6	10YR 4/2	100	-	-	-	-	clay loam	granular, till zone
6 - 18	10YR 3/1	70	7.5YR 5/8	30	C	M	clay	granular

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) (**LRR C**)
- ____ 1 cm Muck (A9) (**LRR D**)
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) (**LRR C**)
- ____ 2 cm Muck (A10) (**LRR B**)
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: No: X

Remarks: No root pore linings present. There is no redox present in the top 6 inches of the soil profile and the darker colored layer exceeds past the 12 inches below the surface so the soil does not contain hydric characteristics.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- _____ Water Marks (B1) (**Riverine**)
- _____ Sediment Deposits (B2) (**Riverine**)
- _____ Drift Deposits (B3) (**Riverine**)
- _____ Drainage patterns (B10)
- _____ Dry-Season Water Table (C2)
- _____ Crayfish Burrows (C8)
- _____ Saturation Visible on Aerial Imagery (C9)
- _____ Shallow Aquitard (D3)
- FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ____ No X Depth (inches): _____

Water Table Present? Yes: ____ No X Depth (inches): _____

Saturation Present? (incl. capillary fringe) Yes: ____ No X Depth (inches):

Wetland Hydrology Present? Yes: No: X

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Dry.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: June 7, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W58A
Investigator(s): Dennis Wenger, Collin Covington	Section, Township, Range: 12, 39S, 6W	
Landform (hillslope, terrace, etc.): drainage swale	Local relief (concave, convex, none): none	Slope (%): 1
Subregion (LRR): D	Easting: 369133 Northing: 4143587	Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X No: (If no, explain in Remarks.)		
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X No:	
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes: X No:	**Is the Sampled Area within a Wetland? Yes: X No:**	
Hydric Soil Present? Yes: X No:		
Wetland Hydrology Present? Yes: X No:		

Remarks: Drainage swale off of wetland meadow. Photo of site: 1328 - soil, 1329 - south, 1330 - east, 1331 - north.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:_____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:_____)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Carex praegracilis	50	Y	FACW
2. Juncus arcticus	15	N	FACW
3. Hordeum jubatum	TR	N	FAC
4.			
5.			
6.			
7.			
8.			
	65	= Total Cover	
Woody Vine Stratum (Plot Size:_____)			
1.			
2.			
	Total Cover: 0		

% Bare Ground in Herb Stratum 35 % Cover of Biotic Crust_____

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:	65	x 2 =	130
FAC species:		x 3 =	0
FACU species:		x 4 =	0
UPL species:		x 5 =	0
Column Totals:	65 (A)		130 (B)

Prevalence Index = B/A = 2.00

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

X Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes: X No:

Remarks: Wetland plant community.

SOILS

Sampling Point: W58A

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features					
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 6.5	10YR 4/2	98	-	-	-	-	silty loam	granular, 2% white calcium nodules
6.5 - 18	10YR 5/2	85	10YR 5/6	10	C	M	clay	granular, 5% white calcium nodules

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___ Histosol (A1)	___ Sandy Redox (S5)	___ 1 cm Muck (A9) (**LRR C**)
___ Histic Epipedon (A2)	___ Stripped Matrix (S6)	___ 2 cm Muck (A10) (**LRR B**)
___ Black Histic (A3)	___ Loamy Mucky Mineral (F1)	___ Reduced Vertic (F18)
___ Hydrogen Sulfide (A4)	___ Loamy Gleyed Matrix (F2)	___ Red Parent Material (TF2)
___ Stratified Layers (A5) (**LRR C**)	_X_ Depleted Matrix (F3)	___ Other (Explain in Remarks)
___ 1 cm Muck (A9) (**LRR D**)	___ Redox Dark Surface (F6)	
___ Depleted Below Dark Surface (A11)	___ Depleted Dark Surface (F7)	
___ Thick Dark Surface (A12)	___ Redox Depressions (F8)	
___ Sandy Mucky Mineral (S1)	___ Vernal Pools (F9)	
___ Sandy Gleyed Matrix (S4)		

Indicators for Problematic Hydric Soils[3]:

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: X No:

Remarks: -

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)		Secondary Indicators (2 or more required)
___ Surface Water (A1)	___ Salt Crust (B11)	___ Water Marks (B1) (**Riverine**)
___ High Water Table (A2)	___ Biotic Crust (B12)	___ Sediment Deposits (B2) (**Riverine**)
___ Saturation (A3)	___ Aquatic Invertebrates (B13)	___ Drift Deposits (B3) (**Riverine**)
___ Water Marks (B1) (**Nonriverine**)	___ Hydrogen Sulfide Odor (C1)	___ Drainage patterns (B10)
___ Sediment Deposits (B2) (**Nonriverine**)	___ Oxidized Rhizospheres along Living Roots	___ Dry-Season Water Table (C2)
___ Drift Deposits (B3) (**Nonriverine**)	___ Presence of Reduced Iron (C4)	___ Crayfish Burrows (C8)
___ Surface Soil Cracks (B6)	___ Recent Iron Reduction in Plowed Soils (C6)	___ Saturation Visible on Aerial Imagery (C9)
___ Inundation Visible on Aerial Imagery (B7)	___ Thin Muck Surface (C7)	___ Shallow Aquitard (D3)
___ Water-Stained Leaves (B9)	___ Other (Explain in Remarks)	___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes: ___	No _X_	Depth (inches): ___		
Water Table Present?	Yes: ___	No _X_	Depth (inches): ___	**Wetland Hydrology Present?**	**Yes: X No:**
Saturation Present? (incl. capillary fringe)	Yes:	No X	Depth (inches):		

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Dry and friable. It is assumed that early season water levels are sufficient to support wetland conditions.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: June 7, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W58B
Investigator(s): Dennis Wenger, Collin Covington	Section, Township, Range: 12, 39S, 6W	
Landform (hillslope, terrace, etc.): drainage	Local relief (concave, convex, none): none	Slope (%): 1
Subregion (LRR): D	Easting: 369138	Northing: 4143573 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X No: (If no, explain in Remarks.)		
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X No:	
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes:	No: X	**Is the Sampled Area within a Wetland?** **Yes:** **No: X**
Hydric Soil Present?	Yes:	No: X	
Wetland Hydrology Present?	Yes:	No: X	

Remarks: Dry drainage swale below the wetland sample point. Trampled and grazed. Photos of site: 1332 - soil, 1333 - north, 1334 - west.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:_____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:_____)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Poa secunda	30	Y	FACU
2. Hordeum jubatum	5	N	FAC
3. Polygonum douglasii	5	N	FACU
4.			
5.			
6.			
7.			
8.			
	40	= Total Cover	
Woody Vine Stratum (Plot Size:_____)			
1.			
2.			
	Total Cover: 0		

% Bare Ground in Herb Stratum 60 % Cover of Biotic Crust_____

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:		x 2 =	0
FAC species:	5	x 3 =	15
FACU species:	35	x 4 =	140
UPL species:		x 5 =	0
Column Totals:	40 (A)		155 (B)

Prevalence Index = B/A = 3.88

Hydrophytic Vegetation Indicators:

Dominance Test >50%

Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes:** **No: X**

Remarks: Upland plant community.

SOILS

Sampling Point: W58B

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type[1]	Redox Features Loc[2]	Texture	Remarks
0 - 15	10YR 5/2	100	-	-	-	-	clay	-
15 - 18	10YR 4/2	95	-	-	-	-	clay	5% white calcium nodules

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) (**LRR C**)
- ____ 1 cm Muck (A9) (**LRR D**)
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) (**LRR C**)
- ____ 2 cm Muck (A10) (**LRR B**)
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? **Yes:** **No: X**

Remarks: No redox observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- _____ Water Marks (B1) (**Riverine**)
- _____ Sediment Deposits (B2) (**Riverine**)
- _____ Drift Deposits (B3) (**Riverine**)
- _____ Drainage patterns (B10)
- _____ Dry-Season Water Table (C2)
- _____ Crayfish Burrows (C8)
- _____ Saturation Visible on Aerial Imagery (C9)
- _____ Shallow Aquitard (D3)
- FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ____ No X Depth (Inches): _____

Water Table Present? Yes: ____ No X Depth (Inches): _____

Saturation Present? (incl. capillary fringe) Yes: ____ No X Depth (Inches):

Wetland Hydrology Present? **Yes:** **No: X**

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Dry and friable. Surface cracks in the soil, this area does not meet the other wetland criteria and it does not fall within a basin system so it is assumed that these are temporary ponding circumstances and not indicative of wetlands.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: June 7, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W59A
Investigator(s): Dennis Wenger, Collin Covington	Section, Township, Range: 12, 39S, 6W	
Landform (hillslope, terrace, etc.): meadow	Local relief (concave, convex, none): none	Slope (%): 1
Subregion (LRR): D	Easting: 369195 Northing: 4143658	Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X No: (If no, explain in Remarks.)		
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X No:	
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes: X No:	**Is the Sampled Area within a Wetland? Yes: X No:**
Hydric Soil Present?	Yes: X No:	
Wetland Hydrology Present?	Yes: X No:	

Remarks: Wet meadow area. Photos of site: 1335 - soil, 1336 - east, 1337 - south.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:_____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:_____)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Juncus arcticus	40	Y	FACW
2. Carex praegracilis	35	Y	FACW
3. Poa pratensis	10	N	FAC
4. Medicago sativa	5	N	UPL
5. Plantago eriopoda	5	N	FACW
6. Symphyotrichum ascendens	5	N	FAC
7.			
8.			
	100	= Total Cover	
Woody Vine Stratum (Plot Size:_____)			
1.			
2.			
Total Cover:	0		

% Bare Ground in Herb Stratum 0 % Cover of Biotic Crust_____

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:	80	x 2 =	160
FAC species:	15	x 3 =	45
FACU species:		x 4 =	0
UPL species:	5	x 5 =	25
Column Totals:	100 (A)		230 (B)

Prevalence Index = B/A = 2.30

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

X Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes: X No:

Remarks: Wetland plant community.

SOILS

Sampling Point: W59A

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 2	-	-	-	-	-	-	organics	fibrous root zone
2 - 18	10YR 4/2	90	10YR 5/6	10	C	M	clay	granular

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___	Histosol (A1)	___	Sandy Redox (S5)
___	Histic Epipedon (A2)	___	Stripped Matrix (S6)
___	Black Histic (A3)	___	Loamy Mucky Mineral (F1)
___	Hydrogen Sulfide (A4)	___	Loamy Gleyed Matrix (F2)
___	Stratified Layers (A5) (**LRR C**)	X	Depleted Matrix (F3)
___	1 cm Muck (A9) (**LRR D**)	___	Redox Dark Surface (F6)
___	Depleted Below Dark Surface (A11)	___	Depleted Dark Surface (F7)
___	Thick Dark Surface (A12)	___	Redox Depressions (F8)
___	Sandy Mucky Mineral (S1)	___	Vernal Pools (F9)
___	Sandy Gleyed Matrix (S4)		

Indicators for Problematic Hydric Soils[3]:

___	1 cm Muck (A9) (**LRR C**)
___	2 cm Muck (A10) (**LRR B**)
___	Reduced Vertic (F18)
___	Red Parent Material (TF2)
___	Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: X No:

Remarks: -

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)			Secondary Indicators (2 or more required)		
___	Surface Water (A1)	___	Salt Crust (B11)	_____	Water Marks (B1) (**Riverine**)
___	High Water Table (A2)	___	Biotic Crust (B12)	_____	Sediment Deposits (B2) (**Riverine**)
___	Saturation (A3)	___	Aquatic Invertebrates (B13)	_____	Drift Deposits (B3) (**Riverine**)
___	Water Marks (B1) (**Nonriverine**)	___	Hydrogen Sulfide Odor (C1)	_____	Drainage patterns (B10)
___	Sediment Deposits (B2) (**Nonriverine**)	___	Oxidized Rhizospheres along Living Roots	_____	Dry-Season Water Table (C2)
___	Drift Deposits (B3) (**Nonriverine**)	___	Presence of Reduced Iron (C4)	_____	Crayfish Burrows (C8)
___	Surface Soil Cracks (B6)	___	Recent Iron Reduction in Plowed Soils (C6)	_____	Saturation Visible on Aerial Imagery (C9)
___	Inundation Visible on Aerial Imagery (B7)	___	Thin Muck Surface (C7)	_____	Shallow Aquitard (D3)
	Water-Stained Leaves (B9)		Other (Explain in Remarks)		FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes: ___	No X	Depth (inches): ___		
Water Table Present?	Yes: ___	No X	Depth (inches): ___	**Wetland Hydrology Present?**	**Yes: X No:**
Saturation Present? (incl. capillary fringe)	Yes:	No X	Depth (inches):		

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Soil is moist, not saturated. It is assumed that early season water levels are sufficient to support wetland conditions.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: June 7, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W59B
Investigator(s): Jeff Bolce, Dennis Wenger, Collin Covington	Section, Township, Range: 12, 39S, 6W	
Landform (hillslope, terrace, etc.): hillslope	Local relief (concave, convex, none): none	Slope (%): 1
Subregion (LRR): D	Easting: 369204	Northing: 4143657 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X No: (If no, explain in Remarks.)		
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X No:	
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes:	No: X	**Is the Sampled Area within a Wetland?** **Yes:** **No: X**
Hydric Soil Present?	Yes:	No: X	
Wetland Hydrology Present?	Yes:	No: X	

Remarks: Outside of the drainage swale. Area is heavily grazed by livestock. Photos of site: 1338 - soil and 1339 - west.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Poa secunda	40	Y	FACU
2. Thinopyrum intermedium	15	N	UPL
3. Hordeum jubatum	TR	N	FAC
4.			
5.			
6.			
7.			
8.			
	55	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
Total Cover: 0			

% Bare Ground in Herb Stratum 45 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0 (A/B)

Prevalence Index Worksheet:

Total % Cover of:	Multiply by:	
OBL species:	x 1=	0
FACW species:	x 2 =	0
FAC species:	x 3 =	0
FACU species: 40	x 4 =	160
UPL species: 15	x 5 =	75
Column Totals: 55 (A)		235 (B)

Prevalence Index = B/A = 4.27

Hydrophytic Vegetation Indicators:

Dominance Test >50%

Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes:** **No: X**

Remarks: Upland plant community.

SOILS

Sampling Point: W59B

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features					
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 18	10YR 4/2	100	-	-	-	-	clay	granular

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) **(LRR C)**
- ____ 1 cm Muck (A9) **(LRR D)**
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) **(LRR C)**
- ____ 2 cm Muck (A10) **(LRR B)**
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: No: X

Remarks: Below 6.5 inches there is approximately 2% of the soil column that is the white calcium nodules.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- _____ Water Marks (B1) **(Riverine)**
- _____ Sediment Deposits (B2) **(Riverine)**
- _____ Drift Deposits (B3) **(Riverine)**
- _____ Drainage patterns (B10)
- _____ Dry-Season Water Table (C2)
- _____ Crayfish Burrows (C8)
- _____ Saturation Visible on Aerial Imagery (C9)
- _____ Shallow Aquitard (D3)
- FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ____ No X Depth (inches): _____

Water Table Present? Yes: ____ No X Depth (inches): _____

Saturation Present? (incl. capillary fringe) Yes: ____ No X Depth (inches):

Wetland Hydrology Present? Yes: No: X

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Soil is moist, not saturated. Surface cracks in the soil, this area does not meet the other wetland criteria and it does not fall within a basin system so it is assumed that these are temporary ponding circumstances and not indicative of wetlands.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: June 7, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W60A
Investigator(s): Jeff Boice, Dennis Wenger, Collin Covington	Section, Township, Range: 12, 39S, 6W	
Landform (hillslope, terrace, etc.): drainage bottom	Local relief (concave, convex, none): none	Slope (%): 1
Subregion (LRR): D	Easting: 369180 Northing: 4143324	Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X No: (If no, explain in Remarks.)		
Are Vegetation: , Soil: , or Hydrology: significantly disturbed? Are "Normal Circumstances" present? Yes: X No:		
Are Vegetation: , Soil: , or Hydrology: naturally disturbed? (If needed, explain any answers in Remarks.)		

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes: X	No:	**Is the Sampled Area within a Wetland? Yes: X No:**
Hydric Soil Present?	Yes: X	No:	
Wetland Hydrology Present?	Yes: X	No:	

Remarks: Located in drainage bottom. Area is disturbed for a construction and maintenance access crossing, located adjacent to elk fence. Photos of site: 1340 - soil, 1341 - south, 1342 - north, 1343 - west.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:_____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:_____)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Hordeum jubatum	10	Y	FAC
2. Xanthium strumarium	3	N	FAC
3. Juncus arcticus	TR	N	FACW
4.			
5.			
6.			
7.			
8.			
	13	= Total Cover	
Woody Vine Stratum (Plot Size:_____)			
1.			
2.			
Total Cover:	0		

% Bare Ground in Herb Stratum 87 % Cover of Biotic Crust_____

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:	Multiply by:	
OBL species:	x 1=	0
FACW species:	x 2 =	0
FAC species: 13	x 3 =	39
FACU species:	x 4 =	0
UPL species:	x 5 =	0
Column Totals: 13 (A)		39 (B)

Prevalence Index = B/A = 3.00

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

X Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes: X No:

Remarks: Minimal wetland plant community coverage.

SOILS

Sampling Point: W60A

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 7	10YR 5/3	99	10YR 5/6	>1	C	M	clay	granular
7 - 18	10YR 5/2	90	10YR 5/6	10	C	M	clay	granular

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___	Histosol (A1)	___	Sandy Redox (S5)
___	Histic Epipedon (A2)	___	Stripped Matrix (S6)
___	Black Histic (A3)	___	Loamy Mucky Mineral (F1)
___	Hydrogen Sulfide (A4)	___	Loamy Gleyed Matrix (F2)
___	Stratified Layers (A5) (**LRR C**)	X	Depleted Matrix (F3)
___	1 cm Muck (A9) (**LRR D**)	___	Redox Dark Surface (F6)
___	Depleted Below Dark Surface (A11)	___	Depleted Dark Surface (F7)
___	Thick Dark Surface (A12)	___	Redox Depressions (F8)
___	Sandy Mucky Mineral (S1)	___	Vernal Pools (F9)
___	Sandy Gleyed Matrix (S4)		

Indicators for Problematic Hydric Soils[3]:

___ 1 cm Muck (A9) (**LRR C**)
___ 2 cm Muck (A10) (**LRR B**)
___ Reduced Vertic (F18)
___ Red Parent Material (TF2)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: X No:

Remarks: -

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)				Secondary Indicators (2 or more required)	
___	Surface Water (A1)	___	Salt Crust (B11)	_____	Water Marks (B1) (**Riverine**)
___	High Water Table (A2)	___	Biotic Crust (B12)	_____	Sediment Deposits (B2) (**Riverine**)
___	Saturation (A3)	___	Aquatic Invertebrates (B13)	_____	Drift Deposits (B3) (**Riverine**)
___	Water Marks (B1) (**Nonriverine**)	___	Hydrogen Sulfide Odor (C1)	_____	Drainage patterns (B10)
___	Sediment Deposits (B2) (**Nonriverine**)	___	Oxidized Rhizospheres along Living Roots	_____	Dry-Season Water Table (C2)
___	Drift Deposits (B3) (**Nonriverine**)	___	Presence of Reduced Iron (C4)	_____	Crayfish Burrows (C8)
X	Surface Soil Cracks (B6)	___	Recent Iron Reduction in Plowed Soils (C6)	_____	Saturation Visible on Aerial Imagery (C9)
___	Inundation Visible on Aerial Imagery (B7)	___	Thin Muck Surface (C7)	_____	Shallow Aquitard (D3)
	Water-Stained Leaves (B9)		Other (Explain in Remarks)		FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes: ___	No X	Depth (inches): ___		
Water Table Present?	Yes: ___	No X	Depth (inches): ___	**Wetland Hydrology Present?**	**Yes: X No:**
Saturation Present? (incl. capillary fringe)	Yes:	No X	Depth (inches):		

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Soil is moist, not saturated. Located in drainage bottom. It is assumed that early season water levels are sufficient to support wetland conditions.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: June 7, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W60B
Investigator(s): Jeff Boice, Dennis Wenger, Collin Covington	Section, Township, Range: 12, 39S, 6W	
Landform (hillslope, terrace, etc.): terrace	Local relief (concave, convex, none): none	Slope (%): 3
Subregion (LRR): D	Easting: 369173	Northing: 4143322 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X	No:	(If no, explain in Remarks.)
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X	No:
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes:	No: X	**Is the Sampled Area within a Wetland?** **Yes:** **No: X**
Hydric Soil Present?	Yes:	No: X	
Wetland Hydrology Present?	Yes:	No: X	

Remarks: Man-made crossing for construction and maintenance access of the elk fence. Approximately 3 feet higher than the adjacent wetland sample point. Photos of site: 1344 - soil, 1345 - east, 1346 - north.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size: 6' x 6')			
1. Chrysothamnus nauseosus	5	Y	UPL
2.			
3.			
4.			
	5	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Bromus inermis	25	Y	FACU
2. Melilotus officinalis	20	Y	FACU
3. Hordeum jubatum	10	N	FAC
4. Elymus elymoides	2	N	FACU
5. Dactylis glomerata	1	N	FACU
6.			
7.			
8.			
	58	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
Total Cover: 0			

% Bare Ground in Herb Stratum 42 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0 (A/B)

Prevalence Index Worksheet:

Total % Cover of:	Multiply by:	
OBL species:	x 1=	0
FACW species:	x 2 =	0
FAC species: 10	x 3 =	30
FACU species: 48	x 4 =	192
UPL species: 5	x 5 =	25
Column Totals: 63 (A)		247 (B)

Prevalence Index = B/A = 3.92

Hydrophytic Vegetation Indicators:

- Dominance Test >50%
- Prevalence Index is ≤3.0[1]
- Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes:** **No: X**

Remarks: Upland plant community.

SOILS

Sampling Point: W60B

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]		
0 - 18	10YR 5/3	100	-	-	-	-	clay	granular

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) (**LRR C**)
- ____ 1 cm Muck (A9) (**LRR D**)
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) (**LRR C**)
- ____ 2 cm Muck (A10) (**LRR B**)
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: No: X

Remarks: No redox observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- _____ Water Marks (B1) (**Riverine**)
- _____ Sediment Deposits (B2) (**Riverine**)
- _____ Drift Deposits (B3) (**Riverine**)
- _____ Drainage patterns (B10)
- _____ Dry-Season Water Table (C2)
- _____ Crayfish Burrows (C8)
- _____ Saturation Visible on Aerial Imagery (C9)
- _____ Shallow Aquitard (D3)
- FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ___ No X Depth (inches): _____

Water Table Present? Yes: ___ No X Depth (inches): _____

Saturation Present? (incl. capillary fringe) Yes: No X Depth (inches):

Wetland Hydrology Present? Yes: No: X

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Dry and friable.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: June 7, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W61A
Investigator(s): Jeff Boice, Collin Covington	Section, Township, Range: 12, 39S, 6W	
Landform (hillslope, terrace, etc.): drainage	Local relief (concave, convex, none): none	Slope (%): 1
Subregion (LRR): D	Easting: 369311	Northing: 4143615 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X	No: (If no, explain in Remarks.)	
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X	No:
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes: X	No:	**Is the Sampled Area within a Wetland?** Yes: X No:
Hydric Soil Present?	Yes: X	No:	
Wetland Hydrology Present?	Yes: X	No:	

Remarks: Drainage area. Photos of site: 1347 - soil, 1348 - west, 1349 - southwest.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Carex praegracilis	60	Y	FACW
2. Juncus arcticus	5	N	FACW
3. Pascopyrum smithii	5	N	FAC
4. Thinopyrum intermedium	5	N	UPL
5.			
6.			
7.			
8.			
	75	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
Total Cover: 0			

% Bare Ground in Herb Stratum 25 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:	Multiply by:	
OBL species:	x 1=	0
FACW species: 65	x 2 =	130
FAC species: 5	x 3 =	15
FACU species:	x 4 =	0
UPL species: 5	x 5 =	25
Column Totals: 75 (A)		170 (B)

Prevalence Index = B/A = 2.27

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

X Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes: X No:

Remarks: Wetland plant community.

SOILS

Sampling Point: W61A

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0 - 5	10YR 5/2	85	10YR 5/6	5	C	M	clay loam	granular, 10% white calcium nodules
5 - 18	10YR 5/2	78	10YR 5/6	2	C	M	clay	granular, 20% white calcium nodules

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___ Histosol (A1)	___ Sandy Redox (S5)	___ 1 cm Muck (A9) (**LRR C**)
___ Histic Epipedon (A2)	___ Stripped Matrix (S6)	___ 2 cm Muck (A10) (**LRR B**)
___ Black Histic (A3)	___ Loamy Mucky Mineral (F1)	___ Reduced Vertic (F18)
___ Hydrogen Sulfide (A4)	___ Loamy Gleyed Matrix (F2)	___ Red Parent Material (TF2)
___ Stratified Layers (A5) (**LRR C**)	X Depleted Matrix (F3)	___ Other (Explain in Remarks)
___ 1 cm Muck (A9) (**LRR D**)	___ Redox Dark Surface (F6)	
___ Depleted Below Dark Surface (A11)	___ Depleted Dark Surface (F7)	
___ Thick Dark Surface (A12)	___ Redox Depressions (F8)	
___ Sandy Mucky Mineral (S1)	___ Vernal Pools (F9)	
___ Sandy Gleyed Matrix (S4)		

Indicators for Problematic Hydric Soils[3]:

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: X No:

Remarks: Redox is higher density and prominent in the top layer.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)		Secondary Indicators (2 or more required)
___ Surface Water (A1)	___ Salt Crust (B11)	___ Water Marks (B1) (**Riverine**)
___ High Water Table (A2)	___ Biotic Crust (B12)	___ Sediment Deposits (B2) (**Riverine**)
___ Saturation (A3)	___ Aquatic Invertebrates (B13)	___ Drift Deposits (B3) (**Riverine**)
___ Water Marks (B1) (**Nonriverine**)	___ Hydrogen Sulfide Odor (C1)	___ Drainage patterns (B10)
___ Sediment Deposits (B2) (**Nonriverine**)	___ Oxidized Rhizospheres along Living Roots	___ Dry-Season Water Table (C2)
___ Drift Deposits (B3) (**Nonriverine**)	___ Presence of Reduced Iron (C4)	___ Crayfish Burrows (C8)
___ Surface Soil Cracks (B6)	___ Recent Iron Reduction in Plowed Soils (C6)	___ Saturation Visible on Aerial Imagery (C9)
___ Inundation Visible on Aerial Imagery (B7)	___ Thin Muck Surface (C7)	___ Shallow Aquitard (D3)
___ Water-Stained Leaves (B9)	___ Other (Explain in Remarks)	___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes: ___	No X	Depth (inches): ___		
Water Table Present?	Yes: ___	No X	Depth (inches): ___	**Wetland Hydrology Present?**	**Yes: X No:**
Saturation Present? (incl. capillary fringe)	Yes:	No X	Depth (inches):		

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Soil is moist, not saturated. It is assumed that early season water levels are sufficient to support wetland conditions.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: June 7, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W61B
Investigator(s): Collin Covington	Section, Township, Range: 12, 39S, 6W	
Landform (hillslope, terrace, etc.): terrace meadow	Local relief (concave, convex, none): none	Slope (%): >1
Subregion (LRR): D	Easting: 369301	Northing: 4143614 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X No: (If no, explain in Remarks.)		
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X No:	
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes: ____	No: X	**Is the Sampled Area within a Wetland?** **Yes:** **No: X**
Hydric Soil Present?	Yes: ____	No: X	
Wetland Hydrology Present?	Yes:	No: X	

Remarks: Upland meadow area that is heavily grazed. Photos of site: 1350 - soil, 1351 - north, 1352 - east.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:____)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Thinopyrum intermedium	65	Y	UPL
2. Pascopyrum smithii	20	Y	FAC
3. Carex praegracilis	5	N	FACW
4.			
5.			
6.			
7.			
8.			
	90	= Total Cover	
Woody Vine Stratum (Plot Size:____)			
1.			
2.			
	Total Cover: 0		
% Bare Ground in Herb Stratum 10	% Cover of Biotic Crust		

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:	5	x 2 =	10
FAC species:	20	x 3 =	60
FACU species:		x 4 =	0
UPL species:	65	x 5 =	325
Column Totals:	90 (A)		395 (B)

Prevalence Index = B/A = 4.39

Hydrophytic Vegetation Indicators:

Dominance Test >50%

Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes:** **No: X**

Remarks: Upland plant community.

SOILS

Sampling Point: W61B

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 18	10YR 3/2	93	10YR 5/6	5	C	M	clay	granular, 2% white calcium nodules

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: No: X

Remarks: The soil layer with redox is not entirely located within the upper 12 inches, it extends down to 18 inches, of the column which means it does not meet the F7 criteria.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ___ No X Depth (inches): ___

Water Table Present? Yes: ___ No X Depth (inches): ___

Saturation Present? (incl. capillary fringe) Yes: ___ No X Depth (inches): ___

Wetland Hydrology Present? Yes: No: X

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Dry and friable. No indications of hydrology present.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: June 7, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W62A
Investigator(s): Jeff Boice, Collin Covington	Section, Township, Range: 12, 39S, 6W	
Landform (hillslope, terrace, etc.): meadow	Local relief (concave, convex, none): none	Slope (%): >1
Subregion (LRR): D	Easting: 369242	Northing: 4143681 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X	No: (If no, explain in Remarks.)	
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X	No:
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes: X No:	**Is the Sampled Area within a Wetland? Yes: X No:**
Hydric Soil Present?	Yes: X No:	
Wetland Hydrology Present?	Yes: X No:	

Remarks: Wet meadow area. Grazed by livestock. Photos of site: 1353 - soil, 1354 - east, 1355 - south.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Carex praegracilis	65	Y	FACW
2. Plantago lanceolata	15	N	FAC
3. Juncus arcticus	10	N	FACW
4. Medicago sativa	4	N	UPL
5. Iris missouriensis	2	N	FACW
6. Thinopyrum intermedium	2	N	UPL
7.			
8.			
	98	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
	Total Cover: 0		

% Bare Ground in Herb Stratum 2 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:	Multiply by:	
OBL species:	x 1=	0
FACW species: 77	x 2 =	154
FAC species: 15	x 3 =	45
FACU species:	x 4 =	0
UPL species: 6	x 5 =	30
Column Totals: 98 (A)		229 (B)

Prevalence Index = B/A = 2.34

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

X Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes: X No:

Remarks: Wetland plant community.

SOILS

Sampling Point: W62A

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features					
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 18	10YR 5/2	83	10YR 5/6	2	C	M	clay	granular, 15% white calcium nodules

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: X No:

Remarks: -

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ___ No X Depth (inches): ___

Water Table Present? Yes: ___ No X Depth (inches): ___

Saturation Present? (incl. capillary fringe) Yes: ___ No X Depth (inches): ___

Wetland Hydrology Present? Yes: X No:

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Dry and friable. It is assumed that early season water levels are sufficient to support wetland conditions.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: June 7, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W62B
Investigator(s): Jeff Boice, Dennis Wenger, Collin Covington	Section, Township, Range: 12, 39S, 6W	
Landform (hillslope, terrace, etc.): meadow terrace	Local relief (concave, convex, none): none	Slope (%): >1
Subregion (LRR): D	Easting: 369250	Northing: 4143684 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X	No: (If no, explain in Remarks.)	
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X	No:
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes:	No: X	**Is the Sampled Area within a Wetland?** **Yes:** **No: X**
Hydric Soil Present?	Yes:	No: X	
Wetland Hydrology Present?	Yes:	No: X	

Remarks: Meadow area that is heavily grazed. Approximately 6 inches higher in elevation than the adjacent wetland sample point. Photos of site: 1356 - west and 1357 - north.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Poa secunda	35	Y	FACU
2. Achillea millefolium	20	Y	FACU
3. Medicago sativa	10	N	UPL
4. Symphyotrichum ascendens	5	N	FAC
5. Poa pratensis	2	N	FAC
6.			
7.			
8.			
	72	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
	Total Cover: 0		

% Bare Ground in Herb Stratum 28 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:		x 2 =	0
FAC species:	7	x 3 =	21
FACU species:	55	x 4 =	220
UPL species:	10	x 5 =	50
Column Totals:	72 (A)		291 (B)

Prevalence Index = B/A = 4.04

Hydrophytic Vegetation Indicators:

Dominance Test >50%

Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes:** **No: X**

Remarks: Upland plant community.

SOILS

Sampling Point: W62B

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features					
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 12	10YR 4/2	100	-	-	-	-	clay	granular
12 - 18	10YR 4/2	99	10YR 5/6	>1	C	M	clay	granular, redox is faint

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) (**LRR C**)
- ____ 1 cm Muck (A9) (**LRR D**)
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) (**LRR C**)
- ____ 2 cm Muck (A10) (**LRR B**)
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: No: X

Remarks: Redox is faint, minimal and too deep in the column. Does not meet hydric criteria. Soil is densely compacted.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- _____ Water Marks (B1) (**Riverine**)
- _____ Sediment Deposits (B2) (**Riverine**)
- _____ Drift Deposits (B3) (**Riverine**)
- _____ Drainage patterns (B10)
- _____ Dry-Season Water Table (C2)
- _____ Crayfish Burrows (C8)
- _____ Saturation Visible on Aerial Imagery (C9)
- _____ Shallow Aquitard (D3)
- FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ____ No X Depth (inches): _____

Water Table Present? Yes: ____ No X Depth (inches): _____

Saturation Present? (incl. capillary fringe) Yes: ____ No X Depth (inches):

Wetland Hydrology Present? Yes: No: X

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Dry and friable.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: June 7, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W63A
Investigator(s): Dennis Wenger, Collin Covington	Section, Township, Range: 12, 39S, 6W	
Landform (hillslope, terrace, etc.): meadow	Local relief (concave, convex, none): none	Slope (%): >1
Subregion (LRR): D	Easting: 369414	Northing: 4143759 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X	No: (If no, explain in Remarks.)	
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X	No:
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes: X	No:	**Is the Sampled Area within a Wetland?** **Yes: X** **No:**
Hydric Soil Present?	Yes: X	No:	
Wetland Hydrology Present?	Yes: X	No:	

Remarks: Wet meadow area that is grazed by livestock. Photos of site: 1358 - soil, 1359 - east, 1360 - west, 1361 - north.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:_____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:_____)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Juncus arcticus	45	Y	FACW
2. Carex praegracilis	35	Y	FACW
3. Symphyotrichum ascendens	10	N	FAC
4.			
5.			
6.			
7.			
8.			
	90	= Total Cover	
Woody Vine Stratum (Plot Size:_____)			
1.			
2.			
Total Cover: 0			
% Bare Ground in Herb Stratum 10	% Cover of Biotic Crust		

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:	80	x 2 =	160
FAC species:	10	x 3 =	30
FACU species:		x 4 =	0
UPL species:		x 5 =	0
Column Totals:	90 (A)		190 (B)

Prevalence Index = B/A = 2.11

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

X Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes: X** **No:**

Remarks: Wetland plant community.

SOILS

Sampling Point: W63A

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type[1]	Redox Features Loc[2]	Texture	Remarks
0 - 1	-	-	-	-	-	-	organics	fibrous root zone
1 - 5	10YR 4/2	93	10YR 5/6	2	C	M	clay	granular, 5% white calcium nodules
5 - 18	10YR 3/1	85	10YR 4/6	10	C	M	clay	granular, 5% white calcium nodules

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___ Histosol (A1)	___ Sandy Redox (S5)	___ 1 cm Muck (A9) (**LRR C**)
___ Histic Epipedon (A2)	___ Stripped Matrix (S6)	___ 2 cm Muck (A10) (**LRR B**)
___ Black Histic (A3)	___ Loamy Mucky Mineral (F1)	___ Reduced Vertic (F18)
___ Hydrogen Sulfide (A4)	___ Loamy Gleyed Matrix (F2)	___ Red Parent Material (TF2)
___ Stratified Layers (A5) (**LRR C**)	_X_ Depleted Matrix (F3)	___ Other (Explain in Remarks)
___ 1 cm Muck (A9) (**LRR D**)	___ Redox Dark Surface (F6)	
___ Depleted Below Dark Surface (A11)	___ Depleted Dark Surface (F7)	
___ Thick Dark Surface (A12)	___ Redox Depressions (F8)	
___ Sandy Mucky Mineral (S1)	___ Vernal Pools (F9)	
___ Sandy Gleyed Matrix (S4)		

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: X No:

Remarks: Densely compacted. Redox is fine.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)		Secondary Indicators (2 or more required)
___ Surface Water (A1)	___ Salt Crust (B11)	___ Water Marks (B1) (**Riverine**)
___ High Water Table (A2)	___ Biotic Crust (B12)	___ Sediment Deposits (B2) (**Riverine**)
___ Saturation (A3)	___ Aquatic Invertebrates (B13)	___ Drift Deposits (B3) (**Riverine**)
___ Water Marks (B1) (**Nonriverine**)	___ Hydrogen Sulfide Odor (C1)	___ Drainage patterns (B10)
___ Sediment Deposits (B2) (**Nonriverine**)	___ Oxidized Rhizospheres along Living Roots	___ Dry-Season Water Table (C2)
___ Drift Deposits (B3) (**Nonriverine**)	___ Presence of Reduced Iron (C4)	___ Crayfish Burrows (C8)
___ Surface Soil Cracks (B6)	___ Recent Iron Reduction in Plowed Soils (C6)	___ Saturation Visible on Aerial Imagery (C9)
___ Inundation Visible on Aerial Imagery (B7)	___ Thin Muck Surface (C7)	___ Shallow Aquitard (D3)
___ Water-Stained Leaves (B9)	___ Other (Explain in Remarks)	___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes: ___	No _X_	Depth (inches): ___		
Water Table Present?	Yes: ___	No _X_	Depth (inches): ___	**Wetland Hydrology Present?**	**Yes: X No:**
Saturation Present? (incl. capillary fringe)	Yes:	No X	Depth (inches):		

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Soil is moist, not saturated. It is assumed that early season water levels are sufficient to support wetland conditions.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: June 7, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W63B
Investigator(s): Jeff Boice, Dennis Wenger, Collin Covington	Section, Township, Range: 12, 39S, 6W	
Landform (hillslope, terrace, etc.): valley floor meadow	Local relief (concave, convex, none): none	Slope (%): >1
Subregion (LRR): D	Easting: 369423	Northing: 4143759 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X	No: (If no, explain in Remarks.)	
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X	No:
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes:	No: X	**Is the Sampled Area within a Wetland?** **Yes:** **No: X**
Hydric Soil Present?	Yes:	No: X	
Wetland Hydrology Present?	Yes:	No: X	

Remarks: Meadow area that is grazed. Photos of site: 1362 - west, 1363 - south, 1364 - soil.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Thinopyrum intermedium	60	Y	UPL
2. Poa pratensis	15	N	FAC
3. Bromus inermis	10	N	FACU
4. Medicago sativa	5	N	UPL
5.			
6.			
7.			
8.			
	90	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
	Total Cover: 0		

% Bare Ground in Herb Stratum 10 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:		x 2 =	0
FAC species:	15	x 3 =	45
FACU species:	10	x 4 =	40
UPL species:	65	x 5 =	325
Column Totals:	90 (A)		410 (B)

Prevalence Index = B/A = 4.56

Hydrophytic Vegetation Indicators:

Dominance Test >50%

Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes:** **No: X**

Remarks: Upland plant community.

SOILS

Sampling Point: W63B

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]		
0 - 13	10YR 5/2	100	-	-	-	-	clay	granular
13 - 18	10YR 4/2	95	10YR 5/6	>1	C	M	clay	granular, 5% white calcium nodules

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: No: X

Remarks: No redox in the top 13 inches of the soil column. Redox is too deep and minimal to qualify for hydric conditions.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Thin Muck Surface (C7)
- Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes: ___ No X Depth (inches): ___

Water Table Present? Yes: ___ No X Depth (inches): ___

Saturation Present? (incl. capillary fringe) Yes: ___ No X Depth (inches): ___

Wetland Hydrology Present? Yes: No: X

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Dry and friable.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: June 7, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W64A
Investigator(s): Jeff Bolce, Collin Covington	Section, Township, Range: 12, 39S, 6W	
Landform (hillslope, terrace, etc.): meadow	Local relief (concave, convex, none): none	Slope (%): >1
Subregion (LRR): D	Easting: 369311	Northing: 4143861 Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X	No: (If no, explain in Remarks.)	
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X	No:
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes: X	No:	**Is the Sampled Area within a Wetland? Yes: X No:**
Hydric Soil Present?	Yes: X	No:	
Wetland Hydrology Present?	Yes: X	No:	

Remarks: Wet meadow area adjacent to alfalfa field. Photos of site: 1365 - soil, 1366 - north, 1367 - west.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:_____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:_____)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Juncus arcticus	50	Y	FACW
2. Poa pratensis	25	Y	FAC
3. Iris missouriensis	10	N	FACW
4. Symphyotrichum ascendens	10	N	FAC
5. Carex praegracilis	5	N	FACW
6.			
7.			
8.			
	100	= Total Cover	
Woody Vine Stratum (Plot Size:_____)			
1.			
2.			
	Total Cover: 0		

% Bare Ground in Herb Stratum 0 % Cover of Biotic Crust_____

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:	65	x 2 =	130
FAC species:	35	x 3 =	105
FACU species:		x 4 =	0
UPL species:		x 5 =	0
Column Totals:	100 (A)		235 (B)

Prevalence Index = B/A = 2.35

Hydrophytic Vegetation Indicators:

X Dominance Test >50%

X Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes: X No:

Remarks: Wetland plant community.

SOILS

Sampling Point: W64A

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]		
0 - 3	-	-	-	-	-	-	organics	fibrous root zone
3 - 18	10YR 4/1	87	10YR 5/6	10	C	M	clay	blocky, 3% white calcium nodules

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

____ Histosol (A1)	____ Sandy Redox (S5)	____ 1 cm Muck (A9) (**LRR C**)
____ Histic Epipedon (A2)	____ Stripped Matrix (S6)	____ 2 cm Muck (A10) (**LRR B**)
____ Black Histic (A3)	____ Loamy Mucky Mineral (F1)	____ Reduced Vertic (F18)
____ Hydrogen Sulfide (A4)	____ Loamy Gleyed Matrix (F2)	____ Red Parent Material (TF2)
____ Stratified Layers (A5) (**LRR C**)	__X__ Depleted Matrix (F3)	____ Other (Explain in Remarks)
____ 1 cm Muck (A9) (**LRR D**)	____ Redox Dark Surface (F6)	
____ Depleted Below Dark Surface (A11)	____ Depleted Dark Surface (F7)	
____ Thick Dark Surface (A12)	____ Redox Depressions (F8)	
____ Sandy Mucky Mineral (S1)	____ Vernal Pools (F9)	
____ Sandy Gleyed Matrix (S4)		

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: X No:

Remarks: -

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)		Secondary Indicators (2 or more required)
___ Surface Water (A1)	___ Salt Crust (B11)	_____ Water Marks (B1) (**Riverine**)
___ High Water Table (A2)	___ Biotic Crust (B12)	_____ Sediment Deposits (B2) (**Riverine**)
___ Saturation (A3)	___ Aquatic Invertebrates (B13)	_____ Drift Deposits (B3) (**Riverine**)
___ Water Marks (B1) (**Nonriverine**)	___ Hydrogen Sulfide Odor (C1)	_____ Drainage patterns (B10)
___ Sediment Deposits (B2) (**Nonriverine**)	___ Oxidized Rhizospheres along Living Roots	_____ Dry-Season Water Table (C2)
___ Drift Deposits (B3) (**Nonriverine**)	___ Presence of Reduced Iron (C4)	_____ Crayfish Burrows (C8)
___ Surface Soil Cracks (B6)	___ Recent Iron Reduction in Plowed Soils (C6)	_____ Saturation Visible on Aerial Imagery (C9)
___ Inundation Visible on Aerial Imagery (B7)	___ Thin Muck Surface (C7)	_____ Shallow Aquitard (D3)
___ Water-Stained Leaves (B9)	___ Other (Explain in Remarks)	_____ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes: ____	No __X__	Depth (inches): ____	
Water Table Present?	Yes: ____	No __X__	Depth (inches): ____	**Wetland Hydrology Present? Yes: X No:**
Saturation Present? (incl. capillary fringe)	Yes:	No X	Depth (inches):	

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Moist, not saturated. It is assumed that early season water levels are sufficient to support wetland conditions.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: Alton Coal Tract	City/County: Alton / Kane	Sampling Date: June 7, 2012
Applicant/Owner: U.S. Bureau of Land Management	State: Utah	Sampling Point: W64B
Investigator(s): Jeff Boice, Dennis Wenger, Collin Covington	Section, Township, Range: 12, 39S, 6W	
Landform (hillslope, terrace, etc.): agriculture field	Local relief (concave, convex, none): none	Slope (%): 1
Subregion (LRR): D	Easting: 369312 Northing: 4143873	Datum: NAD83
Soil Map Unit Name: No soil survey is available	NWI classification: Not Available	
Are climatic / hydrologic conditions on the site typical for this time of year? Yes: X No: (If no, explain in Remarks.)		
Are Vegetation: , Soil: , or Hydrology: significantly disturbed?	Are "Normal Circumstances" present? Yes: X No:	
Are Vegetation: , Soil: , or Hydrology: naturally disturbed?	(If needed, explain any answers in Remarks.)	

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes:	No: X	**Is the Sampled Area within a Wetland?** Yes: No: X
Hydric Soil Present?	Yes: X	No:	
Wetland Hydrology Present?	Yes:	No: X	

Remarks: Agriculture field of alfalfa. Photos of site: 1368 - soil, 1369 - south, 1370 - east.

VEGETATION - Use scientific names of plants

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot Size:)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
Herb Stratum (Plot Size: 6' x 6')			
1. Medicago sativa	90	Y	UPL
2. Phleum pratense	5	N	FACU
3.			
4.			
5.			
6.			
7.			
8.			
	95	= Total Cover	
Woody Vine Stratum (Plot Size:)			
1.			
2.			
Total Cover:	0		

% Bare Ground in Herb Stratum 5 % Cover of Biotic Crust

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species:		x 1=	0
FACW species:		x 2 =	0
FAC species:		x 3 =	0
FACU species:	5	x 4 =	20
UPL species:	90	x 5 =	450
Column Totals:	95 (A)		470 (B)

Prevalence Index = B/A = 4.95

Hydrophytic Vegetation Indicators:

Dominance Test >50%

Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes: No: X

Remarks: Upland plant community.

SOILS

Sampling Point: W64B

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0 - 7	10YR 4/2	100	-	-	-	-	clay loam	granular
7 - 18	10YR 4/1	93	10YR 4/6	5	C	M	clay	granular, 2% white calcium nodules

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS+Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___ Histosol (A1)	___ Sandy Redox (S5)	___ 1 cm Muck (A9) (**LRR C**)
___ Histic Epipedon (A2)	___ Stripped Matrix (S6)	___ 2 cm Muck (A10) (**LRR B**)
___ Black Histic (A3)	___ Loamy Mucky Mineral (F1)	___ Reduced Vertic (F18)
___ Hydrogen Sulfide (A4)	___ Loamy Gleyed Matrix (F2)	___ Red Parent Material (TF2)
___ Stratified Layers (A5) (**LRR C**)	X Depleted Matrix (F3)	___ Other (Explain in Remarks)
___ 1 cm Muck (A9) (**LRR D**)	___ Redox Dark Surface (F6)	
___ Depleted Below Dark Surface (A11)	___ Depleted Dark Surface (F7)	
___ Thick Dark Surface (A12)	___ Redox Depressions (F8)	
___ Sandy Mucky Mineral (S1)	___ Vernal Pools (F9)	
___ Sandy Gleyed Matrix (S4)		

Indicators for Problematic Hydric Soils[3]:

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? Yes: X No:

Remarks: -

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)		Secondary Indicators (2 or more required)
___ Surface Water (A1)	___ Salt Crust (B11)	___ Water Marks (B1) (**Riverine**)
___ High Water Table (A2)	___ Biotic Crust (B12)	___ Sediment Deposits (B2) (**Riverine**)
___ Saturation (A3)	___ Aquatic Invertebrates (B13)	___ Drift Deposits (B3) (**Riverine**)
___ Water Marks (B1) (**Nonriverine**)	___ Hydrogen Sulfide Odor (C1)	___ Drainage patterns (B10)
___ Sediment Deposits (B2) (**Nonriverine**)	___ Oxidized Rhizospheres along Living Roots	___ Dry-Season Water Table (C2)
___ Drift Deposits (B3) (**Nonriverine**)	___ Presence of Reduced Iron (C4)	___ Crayfish Burrows (C8)
___ Surface Soil Cracks (B6)	___ Recent Iron Reduction in Plowed Soils (C6)	___ Saturation Visible on Aerial Imagery (C9)
___ Inundation Visible on Aerial Imagery (B7)	___ Thin Muck Surface (C7)	___ Shallow Aquitard (D3)
___ Water-Stained Leaves (B9)	___ Other (Explain in Remarks)	___ FAC-Neutral Test (D5)

Field Observations:

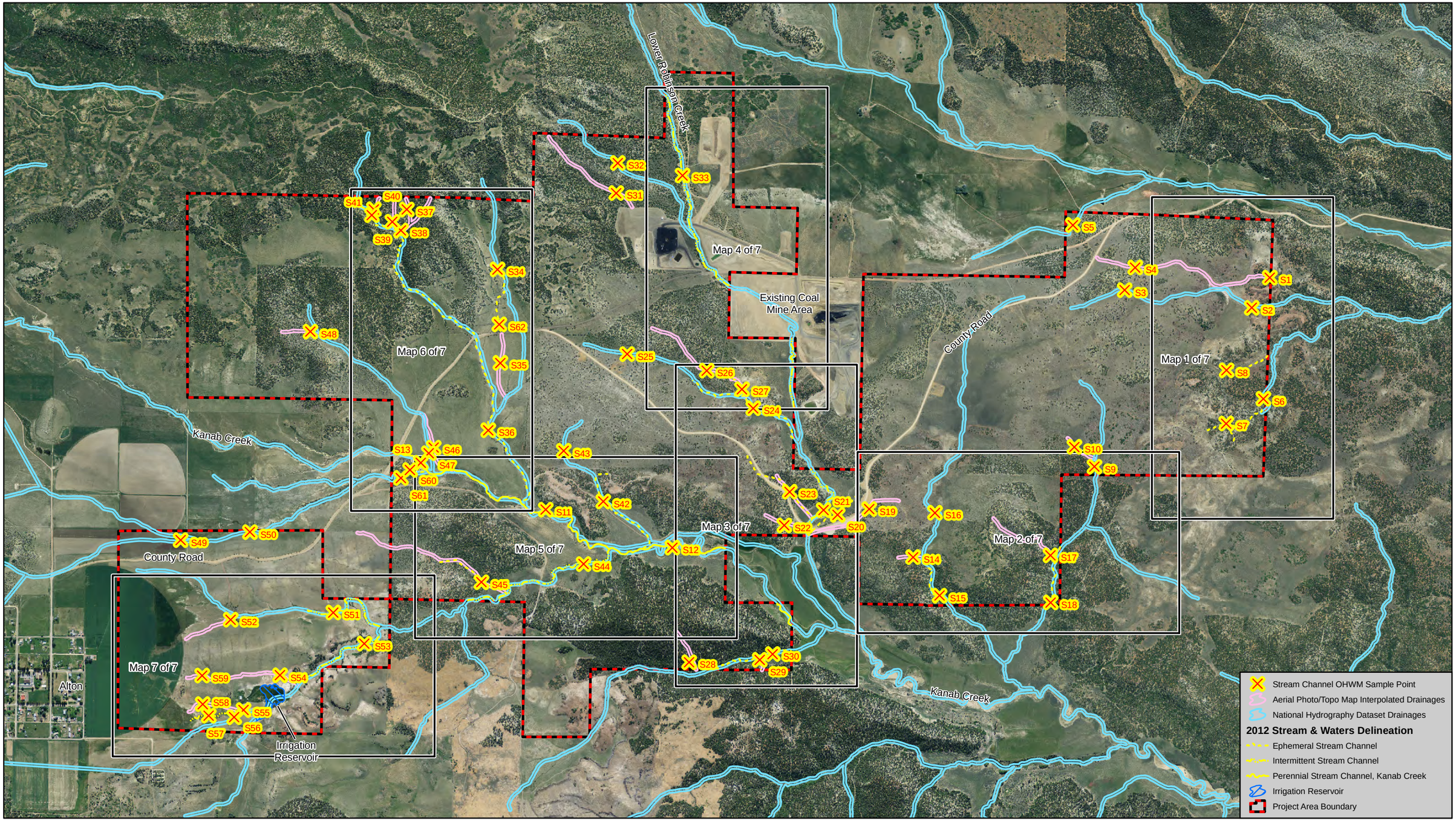
Surface Water Present?	Yes: ___	No X	Depth (inches): ___		
Water Table Present?	Yes: ___	No X	Depth (inches): ___	**Wetland Hydrology Present?**	**Yes: No: X**
Saturation Present? (incl. capillary fringe)	Yes: ___	No X	Depth (inches): ___		

Describe Recorded Data (Stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Dry and friable.

APPENDIX C

Stream Channel Delineation Maps



Appendix C. Stream Channel Delineation Index Map.

Basemap true color imagery from 2011 National Agricultural Imagery Program, 1-meter resolution.

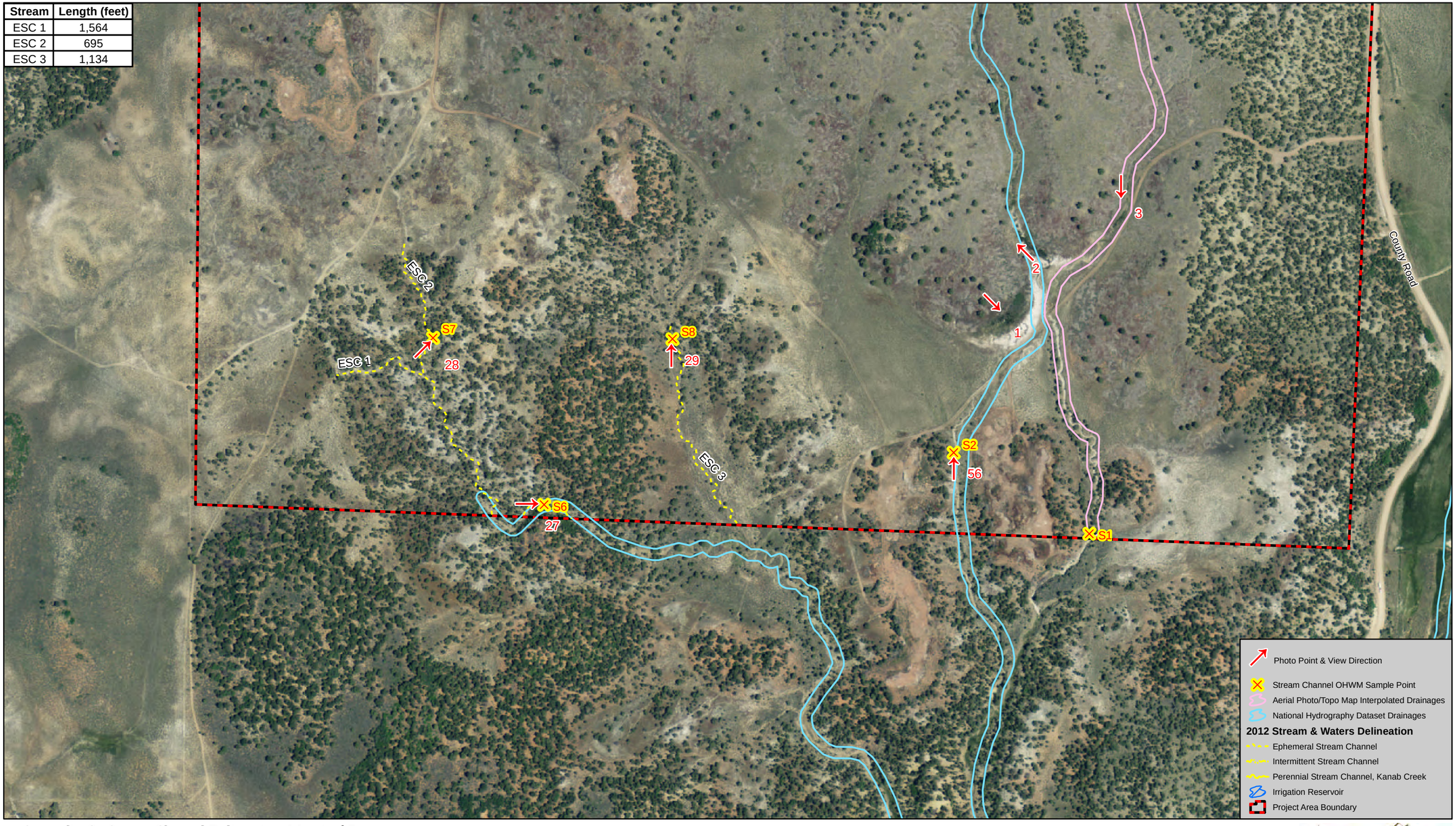
Map Date: July 3, 2012
Image Date: June 22, 2011

1 inch = 1,800 feet

0 1,000 2,000 4,000 Feet

FRONTIER CORPORATION USA
Environmental Consultants
221 N. GATEWAY DRIVE, SUITE B
PROVIDENCE, UT 84332
PHONE (435)-753-9502

Stream	Length (feet)
ESC 1	1,564
ESC 2	695
ESC 3	1,134



Appendix C. Stream Channel Delineation, Map 1 of 7.

Basemap true color imagery from 2011 National Agricultural Imagery Program, 1-meter resolution.

Map Date: July 3, 2012
Image Date: June 22, 2011

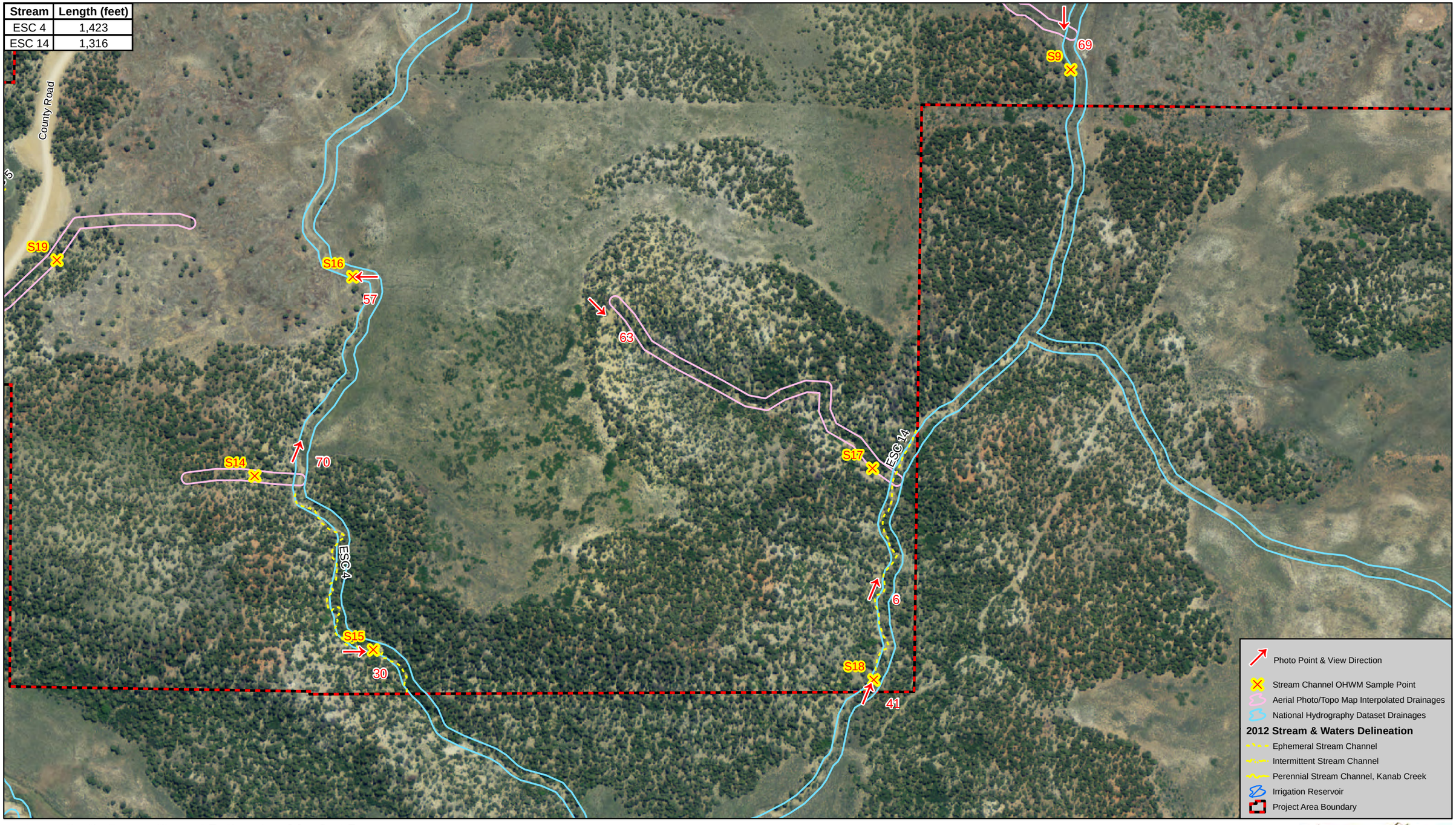
N

1 inch = 400 feet

0 200 400 800 Feet

FRONTIER CORPORATION USA
Environmental Consultants
221 N. GATEWAY DRIVE, SUITE B
PROVIDENCE, UT 84332
PHONE (435)-753-9502

Stream	Length (feet)
ESC 4	1,423
ESC 14	1,316



Appendix C. Stream Channel Delineation, Map 2 of 7.

Basemap true color imagery from 2011 National Agricultural Imagery Program, 1-meter resolution.

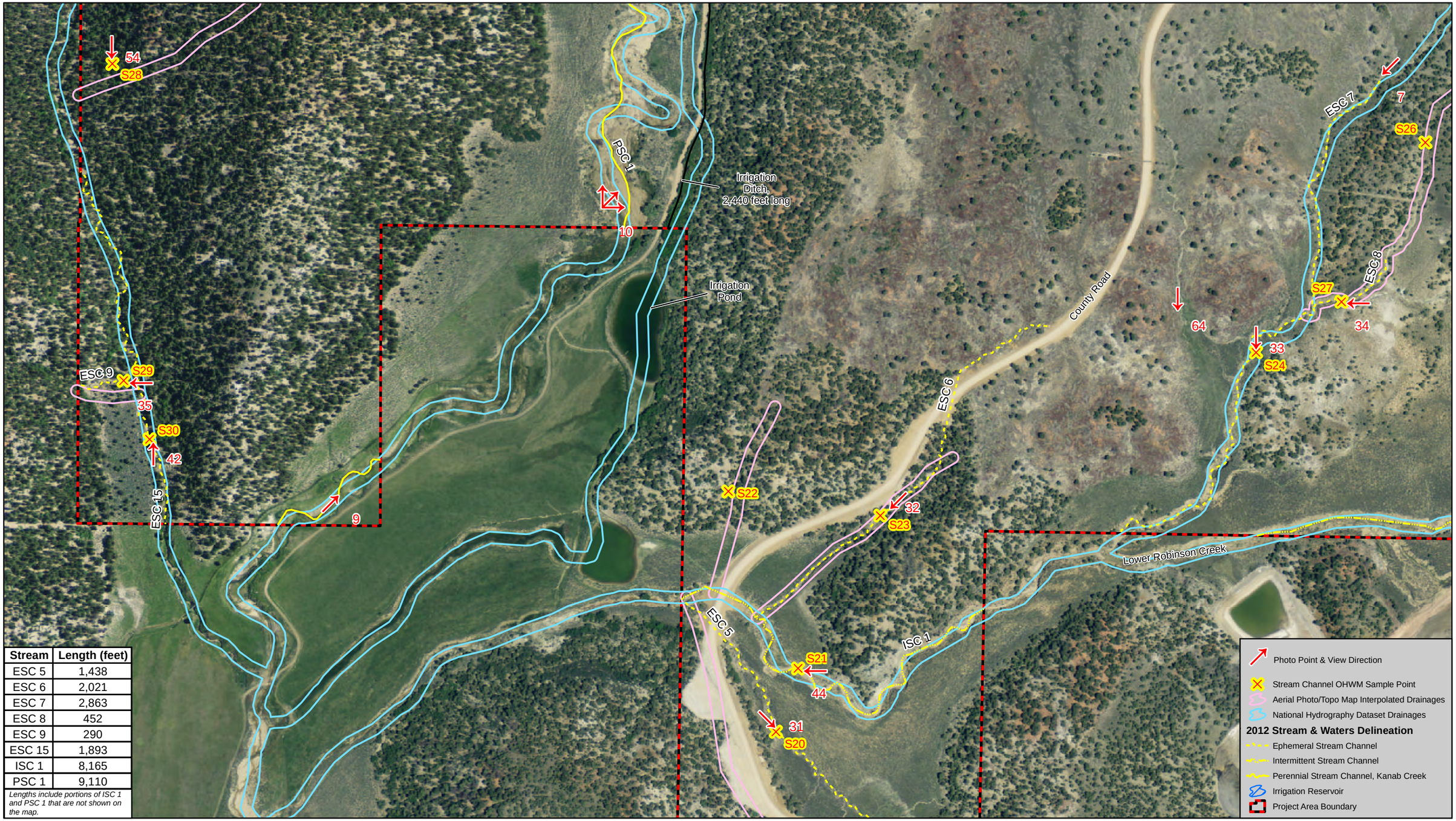
Map Date: July 3, 2012
Image Date: June 22, 2011

N

1 inch = 400 feet

0 200 400 800 Feet

FRONTIER CORPORATION USA
Environmental Consultants
221 N. GATEWAY DRIVE, SUITE B
PROVIDENCE, UT 84332
PHONE (435)-753-9502



Stream	Length (feet)
ESC 5	1,438
ESC 6	2,021
ESC 7	2,863
ESC 8	452
ESC 9	290
ESC 15	1,893
ISC 1	8,165
PSC 1	9,110

Lengths include portions of ISC 1 and PSC 1 that are not shown on the map.

Appendix C. Stream Channel Delineation, Map 3 of 7.

Basemap true color imagery from 2011 National Agricultural Imagery Program, 1-meter resolution.

Map Date: July 3, 2012
Image Date: June 22, 2011

N

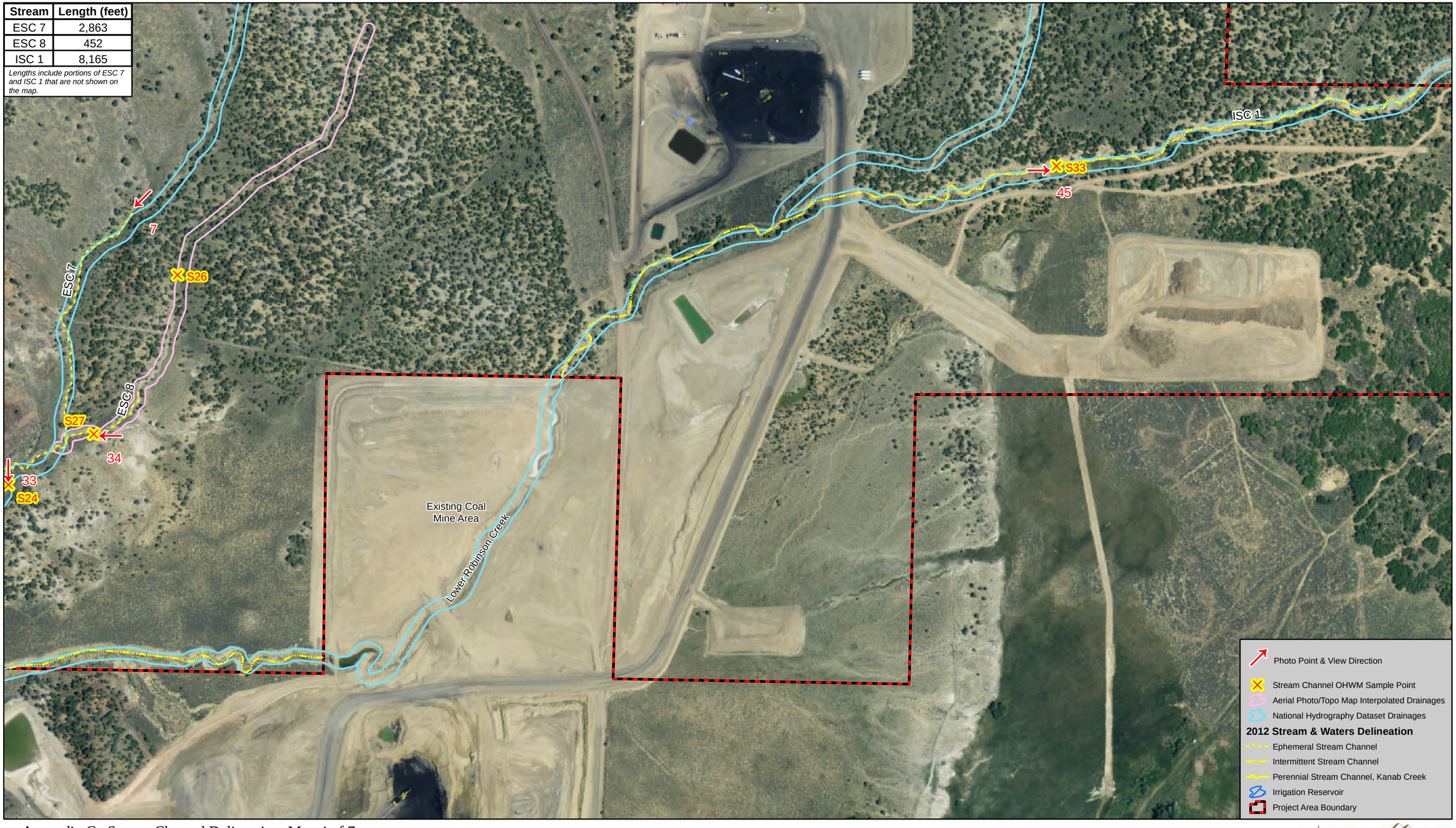
1 inch = 400 feet

0 200 400 800 Feet

FRONTIER CORPORATION USA
Environmental Consultants
221 N. GATEWAY DRIVE, SUITE B
PROVIDENCE, UT 84332
PHONE (435)-753-9502

Stream	Length (feet)
ESC 7	2,863
ESC 8	452
ISC 1	8,165

Lengths include portions of ESC 7 and ISC 1 that are not shown on the map.



Appendix C. Stream Channel Delineation, Map 4 of 7.

Basemap true color imagery from 2011 National Agricultural Imagery Program, 1-meter resolution.

Map Date: July 3, 2012
Image Date: June 22, 2011

N

1 inch = 400 feet

0 200 400 800 Feet

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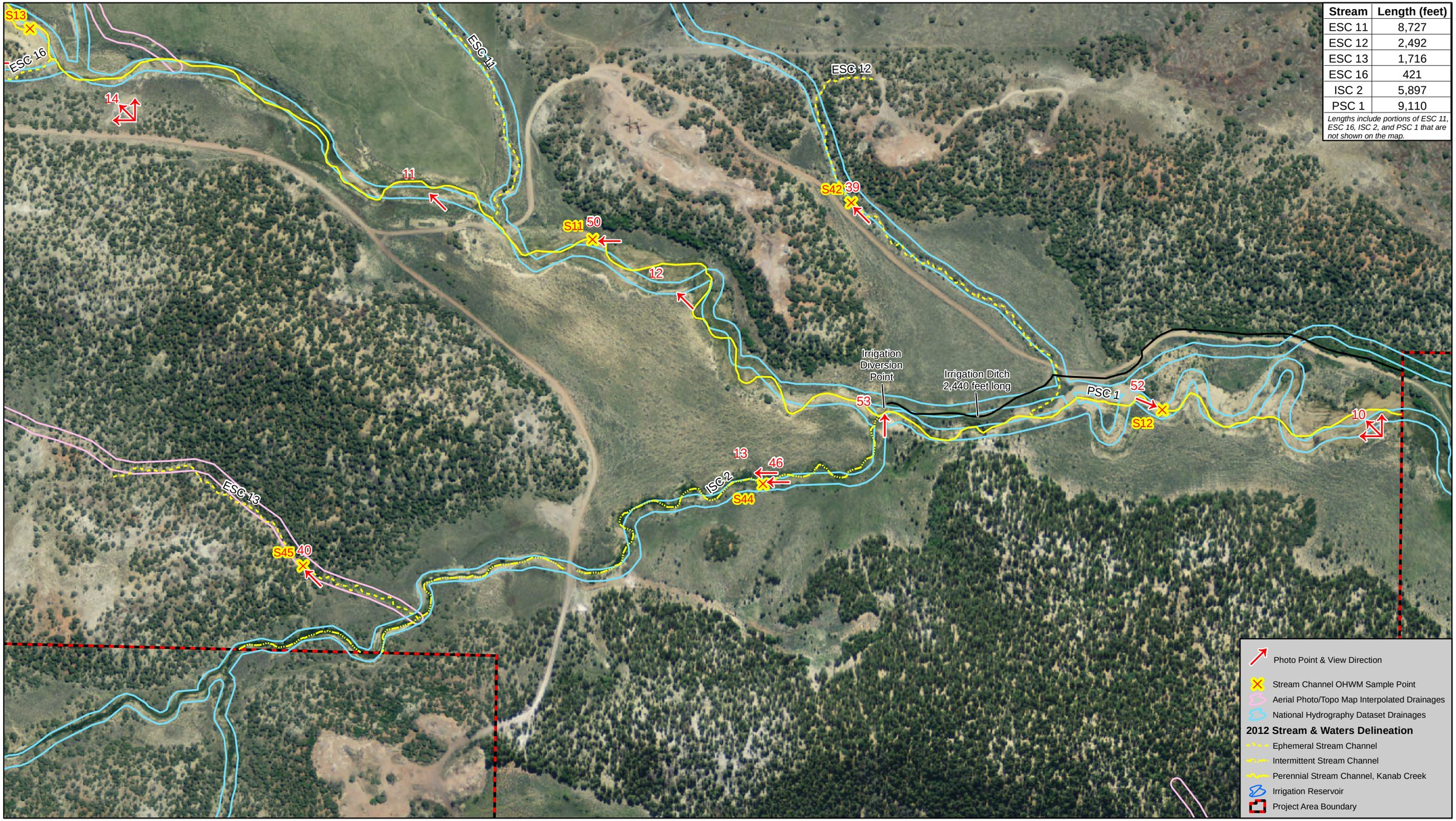
PHONE (435)-753-9502



Stream	Length (feet)
ESC 11	8,727
ESC 12	2,492
ESC 13	1,716
ESC 16	421
ISC 2	5,897
PSC 1	9,110

Lengths include portions of ESC 11, ESC 16, ISC 2, and PSC 1 that are not shown on the map.

Appendix C. Stream Channel Delineation, Map 5 of 7.

Basemap true color imagery from 2011 National Agricultural Imagery Program, 1-meter resolution.

Map Date: July 3, 2012
Image Date: June 22, 2011

N

1 inch = 400 feet

0 200 400 800 Feet

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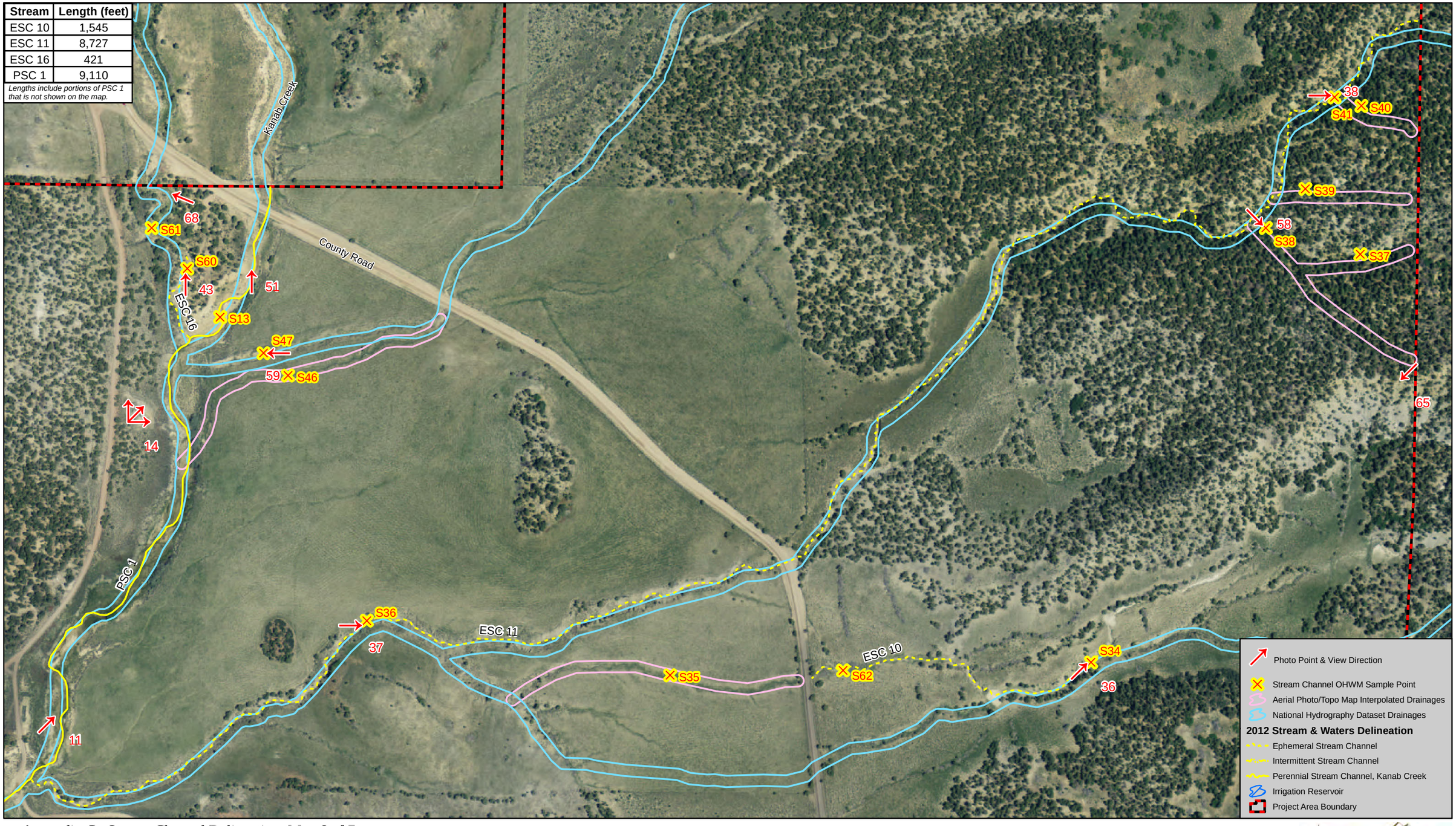
Environmental Consultants
221 N. GATEWAY DRIVE, SUITE B
PROVIDENCE, UT 84332
PHONE (435)-753-9502

Stream	Length (feet)
ESC 10	1,545
ESC 11	8,727
ESC 16	421
PSC 1	9,110

Lengths include portions of PSC 1 that is not shown on the map.



Appendix C. Stream Channel Delineation, Map 6 of 7.

Basemap true color imagery from 2011 National Agricultural Imagery Program, 1-meter resolution.

Map Date: July 3, 2012
Image Date: June 22, 2011

N

1 inch = 400 feet

0 200 400 800 Feet

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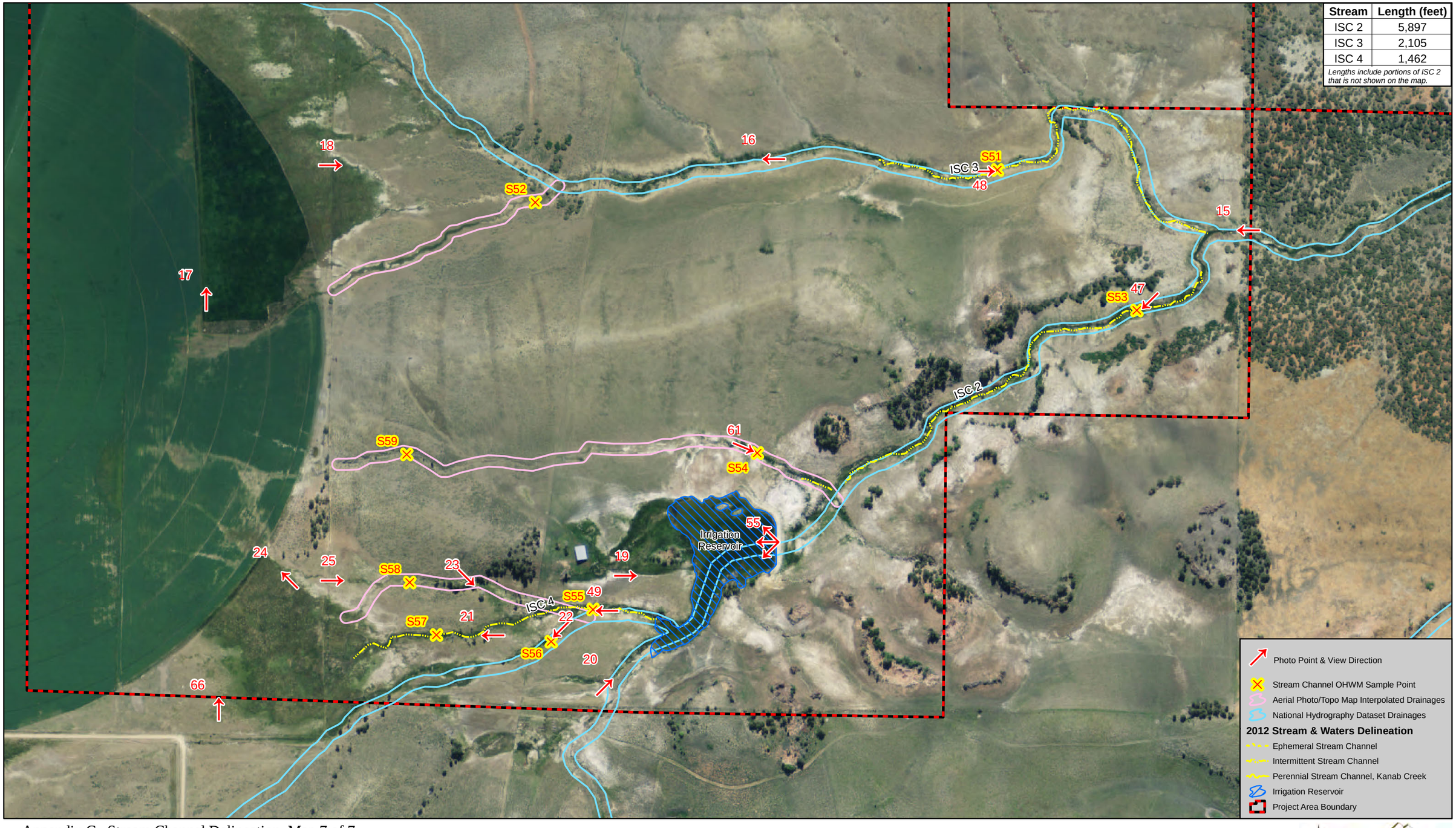
Environmental Consultants
221 N. GATEWAY DRIVE, SUITE B
PROVIDENCE, UT 84332
PHONE (435)-753-9502

Stream	Length (feet)
ISC 2	5,897
ISC 3	2,105
ISC 4	1,462

Lengths include portions of ISC 2 that is not shown on the map.



Appendix C. Stream Channel Delineation, Map 7 of 7.

Basemap true color imagery from 2011 National Agricultural Imagery Program, 1-meter resolution.

Map Date: July 3, 2012
Image Date: June 22, 2011

N

1 inch = 400 feet

0 200 400 800 Feet

FRONTIER CORPORATION USA
Environmental Consultants
221 N. GATEWAY DRIVE, SUITE B
PROVIDENCE, UT 84332
PHONE (435)-753-9502

APPENDIX D

Arid West Ordinary High Water Mark Data Sheets

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Alton Coal
Project Number: 421
Stream: S1
Investigator(s): Jeff Boice, Collin Covington, Dennis Wenger
Date: May 3, 2012 **Time:** 3:15 pm
Town: Alton **State:** Utah
Photo begin file#: 012 **Photo end file#:** 014

Y [X] / N [ ] Do normal circumstances exist on the site?

Y [ ] / N [X] Is the site significantly disturbed?

Location Details: South portion of project area.

Projection: UTM **Datum:** NAD 83
Coordinates: 371194 mE 4137186 mN

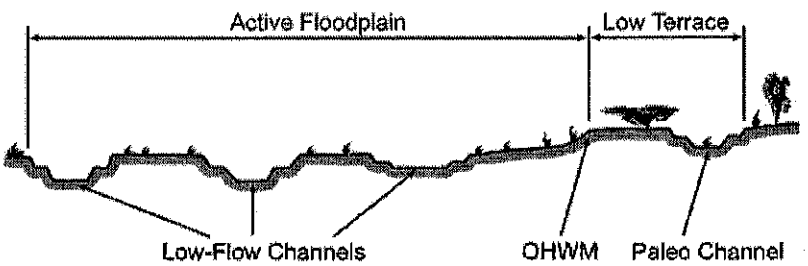
Potential anthropogenic influences on the channel system:
None

Brief site description:
Incised drainage, ~ 10' of vertical entrenchment, Pinyon-Juniper forested landscape with a sagebrush understory

Checklist of resources (if available):

- [X] Aerial photography
  Dates: June 22, 2011
- [X] Topographic maps
- [ ] Geologic maps
- [ ] Vegetation maps
- [ ] Soils maps
- [ ] Rainfall/precipitation maps
- [ ] Existing delineation(s) for site
- [ ] Global positioning system (GPS)
- [ ] Other studies
- [ ] Stream gage data
  Gage number:
  Period of record:
  - [ ] History of recent effective discharges
  - [ ] Results of flood frequency analysis
  - [ ] Most recent shift-adjusted rating
  - [ ] Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units

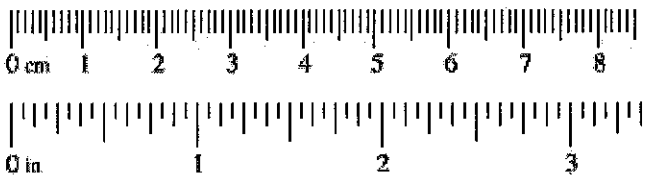


Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - [X] Mapping on aerial photograph
   - [ ] Digitized on computer
   - [X] GPS
   - [ ] Other:

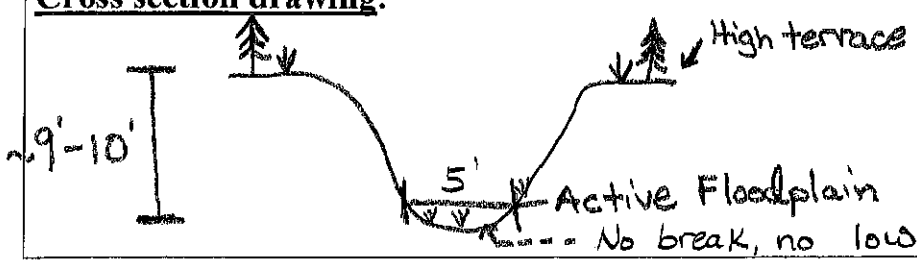
Wentworth Size Classes

Inches (in)	Millimeters (mm)	Wentworth size class	
10.08	256	Boulder	Gravel
2.56	64	Cobble	Gravel
0.157	4	Pebble	Gravel
		Granule	Gravel
0.079	2.00		
0.039	1.00	Very coarse sand	Sand
0.020	0.50	Coarse sand	Sand
1/2 0.0098	0.25	Medium sand	Sand
1/4 0.005	0.125	Fine sand	Sand
1/8 0.0025	0.0625	Very fine sand	Sand
1/16 0.0012	0.031	Coarse silt	Silt
1/32 0.00061	0.0156	Medium silt	Silt
1/64 0.00031	0.0078	Fine silt	Silt
1/128 0.00015	0.0039	Very fine silt	Silt
		Clay	Mud



Project ID: 421 **Cross section ID:** S1 **Date:** 5/3/12 **Time:** 3:15 pm

Cross section drawing:



U-shaped bottom with a ravelling bank.

OHWM

GPS point: See location on front

Indicators:

- ☐ Change in average sediment texture
- ☐ Change in vegetation species
- ☐ Change in vegetation cover
- ☐ Break in bank slope
- ☐ Other: _____
- ☐ Other: _____

Comments:

No OHWM indicators.

U-shaped drainage bottom with western wheatgrass on bottom & on sideslopes.

Floodplain unit:

☐ Low-Flow Channel ☒ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: course angular, gravel / pebble

Total veg cover: 2 % Tree: ____ % Shrub: ____ % Herb: 2 %

Community successional stage:

- ☐ NA
- ☒ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☒ Mudcracks
- ☐ Ripples
- ☒ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Western wheatgrass is the vegetation in the drainage. Drainage has evidence of ephemeral flow, but no OHWM or defined stream channel.

Project ID: **Cross section ID:** **Date:** **Time:**

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____% Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____% Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Alton Coal
Project Number: 421
Stream: S2
Investigator(s): Jeff Boice, Collin Covington, Dennis Wenger

Date: May 3, 2012 **Time:** 4:17 pm
Town: Alton **State:** Utah
Photo begin file#: 019 **Photo end file#:** 022

Y ☒ / N ☐ Do normal circumstances exist on the site?

Y ☐ / N ☒ Is the site significantly disturbed?

Location Details: South portion of project area.

Projection: UTM **Datum:** NAD 83
Coordinates: 371013 mE 4137293 mN

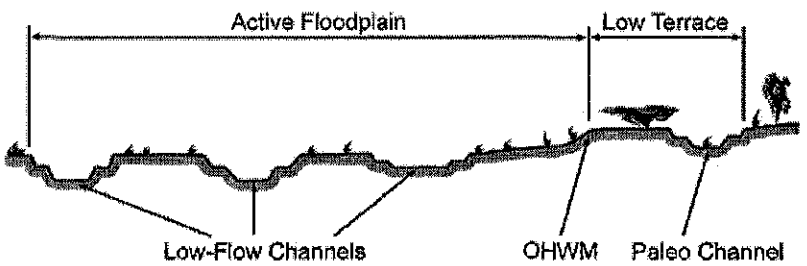
Potential anthropogenic influences on the channel system:
None

Brief site description:
Drainage bordered by a low-sagebrush terrace, east-side ~3' & west-side is sloped.

Checklist of resources (if available):

- ☒ Aerial photography
  Dates: June 22, 2011
- ☒ Topographic maps
- ☐ Geologic maps
- ☐ Vegetation maps
- ☐ Soils maps
- ☐ Rainfall/precipitation maps
- ☐ Existing delineation(s) for site
- ☐ Global positioning system (GPS)
- ☐ Other studies
- ☐ Stream gage data
  Gage number:
  Period of record:
  - ☐ History of recent effective discharges
  - ☐ Results of flood frequency analysis
  - ☐ Most recent shift-adjusted rating
  - ☐ Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units

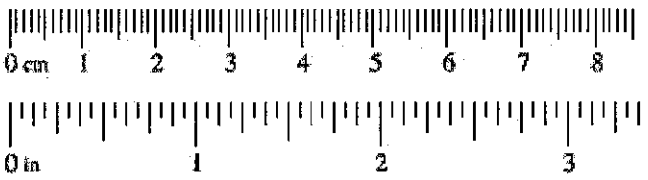


Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - ☒ Mapping on aerial photograph
   - ☐ Digitized on computer
   - ☒ GPS
   - ☐ Other:

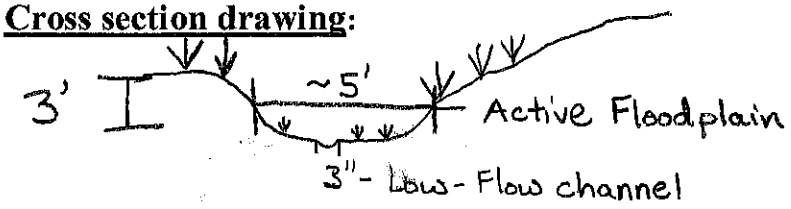
Wentworth Size Classes

Inches (in)	Millimeters (mm)	Wentworth size class	
10.08	256	Boulder	Gravel
2.56	64	Cobble	
0.157	4	Pebble	
		Granule	
0.079	2.00		
0.039	1.00	Very coarse sand	Sand
0.020	0.50	Coarse sand	
1/2 0.0098	0.25	Medium sand	
1/4 0.005	0.125	Fine sand	
		Very fine sand	
1/8 0.0025	0.0625		
1/16 0.0012	0.031	Coarse silt	Silt
1/32 0.00061	0.0156	Medium silt	
1/64 0.00031	0.0078	Fine silt	
		Very fine silt	
1/128 0.00015	0.0039		
		Clay	Mud



Project ID: 421 **Cross section ID:** S2 **Date:** May 3, 2012 **Time:** 4:17 pm

Cross section drawing:



U-shaped bottom of drainage w/ small Low-Flow channel

Vegetation on drainage bottom. Thin layer of salt effervescence.

OHWM

GPS point: See location on front

Indicators:

- ☐ Change in average sediment texture
- ☐ Change in vegetation species
- ☐ Change in vegetation cover
- ☐ Break in bank slope
- ☐ Other: _____
- ☐ Other: _____

Comments:

No OHWM indicators.

Grass on bottom of drainage.

Floodplain unit: ☒ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: Silt

Total veg cover: 0 % Tree: ____% Shrub: ____% Herb: ____%

Community successional stage:

- ☒ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☒ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Channel is ~ 3" wide by ½" deep.

Project ID: 421 **Cross section ID:** S2 **Date:** May 3, 2012 **Time:** 4:17 pm

Floodplain unit: ☐ Low-Flow Channel ☒ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: Course, angular pebble, embedded in high amounts of silt

Total veg cover: ≥ 1 % Tree: ____% Shrub: ____% Herb: ≥ 1 %

Community successional stage:

- ☐ NA
- ☒ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☒ Mudcracks
- ☐ Ripples
- ☒ Drift and/or debris
- ☐ Presence of bed and bank
- ☒ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Drainage has evidence of ephemeral flow, but no OHWM indicators or defined stream channel.

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: ____% Tree: ____% Shrub: ____% Herb: ____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Alton Coal
Project Number: 421
Stream: S3
Date: May 3, 2012 **Time:** 5:33 pm
Town: Alton **State:** Utah
Photo begin file#: 033 **Photo end file#:** 035
Investigator(s): Dennis Wenger, Jeff Boice, Collin Covington

Y ☒ / N ☐ Do normal circumstances exist on the site?

Y ☒ / N ☐ Is the site significantly disturbed?

Location Details: South portion of project area

Projection: UTM **Datum:** NAD 83
Coordinates: 371119 mE 4138054 mN

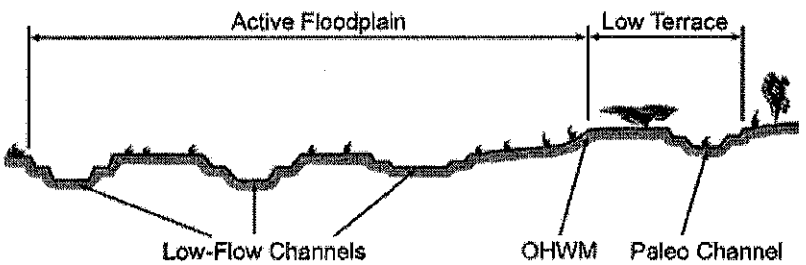
Potential anthropogenic influences on the channel system:
Placement of cleared Juniper in drainage could have a damming effect.

Brief site description:
Sagebrush terrace.

Checklist of resources (if available):

- ☒ Aerial photography
  Dates: June 22, 2011
- ☒ Topographic maps
- ☐ Geologic maps
- ☐ Vegetation maps
- ☐ Soils maps
- ☐ Rainfall/precipitation maps
- ☐ Existing delineation(s) for site
- ☐ Global positioning system (GPS)
- ☐ Other studies
- ☐ Stream gage data
  Gage number:
  Period of record:
  - ☐ History of recent effective discharges
  - ☐ Results of flood frequency analysis
  - ☐ Most recent shift-adjusted rating
  - ☐ Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units

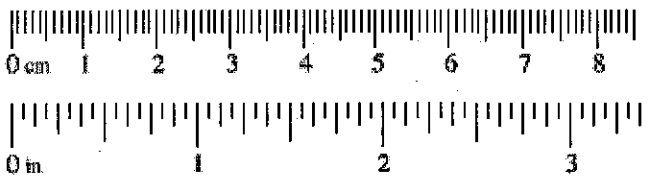


Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - ☒ Mapping on aerial photograph
   - ☐ Digitized on computer
   - ☒ GPS
   - ☐ Other:

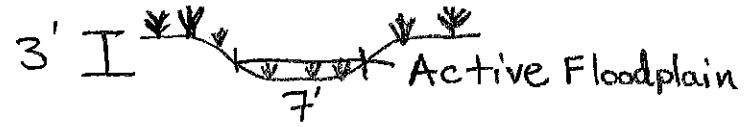
Wentworth Size Classes

Inches (in)	Millimeters (mm)	Wentworth size class	
10.08	256	Boulder	Gravel
2.56	64	Cobble	Gravel
0.157	4	Pebble	Gravel
0.079	2.00	Granule	Gravel
0.039	1.00	Very coarse sand	Sand
0.020	0.50	Coarse sand	Sand
1/2 0.0098	0.25	Medium sand	Sand
1/4 0.005	0.125	Fine sand	Sand
1/8 0.0025	0.0625	Very fine sand	Sand
1/16 0.0012	0.031	Coarse silt	Silt
1/32 0.00061	0.0156	Medium silt	Silt
1/64 0.00031	0.0078	Fine silt	Silt
1/128 0.00015	0.0039	Very fine silt	Silt
		Clay	Mud



Project ID: 421 **Cross section ID:** S3 **Date:** May 3, 2012 **Time:** 5:33 pm

Cross section drawing:



U-shaped drainage bottom. Drainage is vegetated.

OHWM

GPS point: See location on front

Indicators:

- ☐ Change in average sediment texture
- ☐ Change in vegetation species
- ☐ Change in vegetation cover
- ☐ Break in bank slope
- ☐ Other: _____
- ☐ Other: _____

Comments:

No OHWM indicators.

Floodplain unit: ☒ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: 0 % Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- ☒ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

No channel indicators.

Project ID: 421 **Cross section ID:** S3 **Date:** May 3, 2012 **Time:** 5:33 pm

Floodplain unit: ☐ Low-Flow Channel ☒ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: silt

Total veg cover: 6 % Tree: ____ % Shrub: >1 % Herb: ≥5 %

Community successional stage:

- ☐ NA
- ☒ Mid (herbaceous, shrubs, saplings)
- ☐ Early (herbaceous & seedlings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments: (more in bottom comments)

No indicators present. Vegetation is thicker near the damming effect of the juniper in the drainage. Vegetation in drainage includes: Achillea millefolium, Crested Wheatgrass, Astragalus sp., Clover sp.

Floodplain unit: ☐ Low-Flow Channel ☒ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: ____ % Tree: ____ % Shrub: ____ % Herb: ____ %

Community successional stage:

- ☐ NA
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Early (herbaceous & seedlings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Drainage has evidence of ephemeral flow, but no OHWM of defined stream channel.

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Alton Coal | **Date:** May 3, 2012 | **Time:** 5:52 pm
Project Number: 421 | **Town:** Alton | **State:** Utah
Stream: S4 | **Photo begin file#:** 036 | **Photo end file#:** 038
Investigator(s): Jeff Boice, Collin Covington, Dennis Wenger

Y ☒ / N ☐ Do normal circumstances exist on the site?

Y ☐ / N ☒ Is the site significantly disturbed?

Location Details: South portion of project area

Projection: UTM **Datum:** NAD 83
Coordinates: 371255 m E 4137991 m N

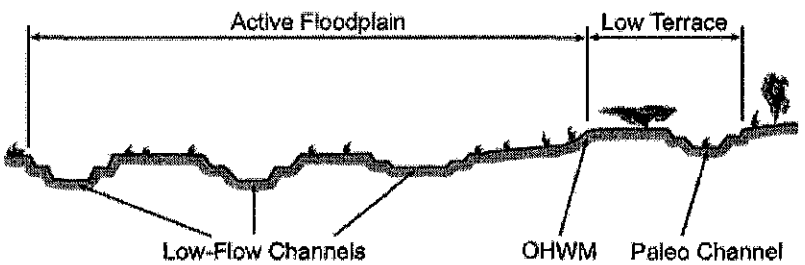
Potential anthropogenic influences on the channel system:
Some juniper trees placed in drainage off of nearby upland, high terrace.

Brief site description:
Sagebrush understory with a juniper tree stratum.

Checklist of resources (if available):

- ☒ Aerial photography
  Dates: June 22, 2011
- ☒ Topographic maps
- ☐ Geologic maps
- ☐ Vegetation maps
- ☐ Soils maps
- ☐ Rainfall/precipitation maps
- ☐ Existing delineation(s) for site
- ☐ Global positioning system (GPS)
- ☐ Other studies
- ☐ Stream gage data
  Gage number:
  Period of record:
  - ☐ History of recent effective discharges
  - ☐ Results of flood frequency analysis
  - ☐ Most recent shift-adjusted rating
  - ☐ Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units

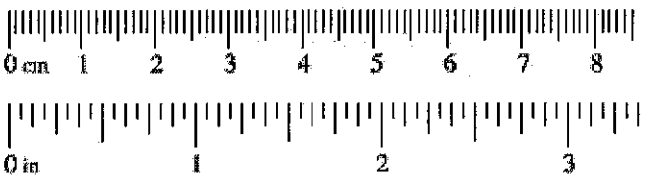


Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - ☒ Mapping on aerial photograph
   - ☐ Digitized on computer
   - ☒ GPS
   - ☐ Other:

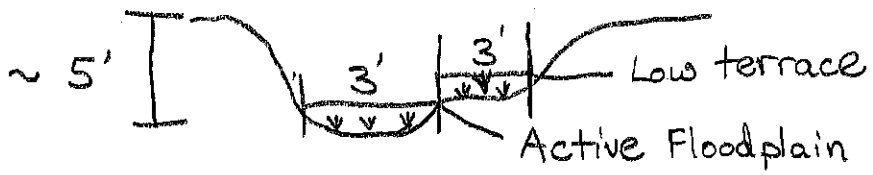
Wentworth Size Classes

Inches (in)	Millimeters (mm)	Wentworth size class	
10.08	256	Boulder	Gravel
2.56	64	Cobble	Gravel
0.157	4	Pebble	Gravel
		Granule	Gravel
0.079	2.00		
0.039	1.00	Very coarse sand	Sand
0.020	0.50	Coarse sand	Sand
1/2 0.0098	0.25	Medium sand	Sand
1/4 0.005	0.125	Fine sand	Sand
		Very fine sand	Sand
1/8 0.0025	0.0625		
1/16 0.0012	0.031	Coarse silt	Silt
1/32 0.00061	0.0156	Medium silt	Silt
1/64 0.00031	0.0078	Fine silt	Silt
		Very fine silt	Silt
1/128 0.00015	0.0039		
		Clay	Mud



Project ID: 421 **Cross section ID:** S4 **Date:** May 3, 2012 **Time:** 5:52 pm

Cross section drawing:



U-shaped drainage.
Drainage is vegetated.
Low terrace present

OHWM

GPS point: See location on front

Indicators:

- ☐ Change in average sediment texture
- ☐ Change in vegetation species
- ☐ Change in vegetation cover
- ☐ Break in bank slope
- ☐ Other: _____
- ☐ Other: _____

Comments:

No OHWM indicators.

Floodplain unit: ☒ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____% Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

No evidence of a Low-Flow Channel.

Project ID: 421 **Cross section ID:** S4 **Date:** May 3, 2012 **Time:** 5:52 pm

Floodplain unit: ☐ Low-Flow Channel ☒ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: Fine silt

Total veg cover: ≥ 5 % Tree: ____ % Shrub: ____ % Herb: ≥ 5 %

Community successional stage:

- ☐ NA
- ☒ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

No indicators present. Vegetation in drainage includes: Cirsium sp., western wheatgrass (found on high terrace) Drainage has evidence of ephemeral flow, but no other indicators or defined stream channel.

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☒ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: Fine silt

Total veg cover: ~15 % Tree: ____ % Shrub: ≥10 % Herb: ≥ 5 %

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☒ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

No indicators present. Vegetation includes Sagebrush, Western wheatgrass, & Cirsium sp.

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Alton Coal
Project Number: 421
Stream: S5
Date: May 4, 2012 **Time:** 9:07 am
Town: Alton **State:** Utah
Photo begin file#: 044 **Photo end file#:** 046
Investigator(s): Jeff Boice, Dennis Wenger, Collin Covington

Y ☒ / N ☐ Do normal circumstances exist on the site?

Y ☐ / N ☒ Is the site significantly disturbed?

Location Details: South portion of project area

Projection: UTM **Datum:** NAD 83
Coordinates: 371510 mE 4138364 m N

Potential anthropogenic influences on the channel system:

None

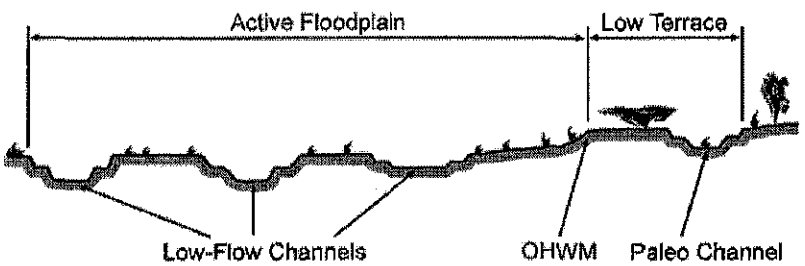
Brief site description:

Broad, u-shaped drainage with meadow on left-side and Pinyon Juniper/ Sagebrush vegetation on the right-side.

Checklist of resources (if available):

- ☒ Aerial photography
  Dates: June 22, 2011
- ☒ Topographic maps
- ☐ Geologic maps
- ☐ Vegetation maps
- ☐ Soils maps
- ☐ Rainfall/precipitation maps
- ☐ Existing delineation(s) for site
- ☐ Global positioning system (GPS)
- ☐ Other studies
- ☐ Stream gage data
  Gage number:
  Period of record:
  - ☐ History of recent effective discharges
  - ☐ Results of flood frequency analysis
  - ☐ Most recent shift-adjusted rating
  - ☐ Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units



Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

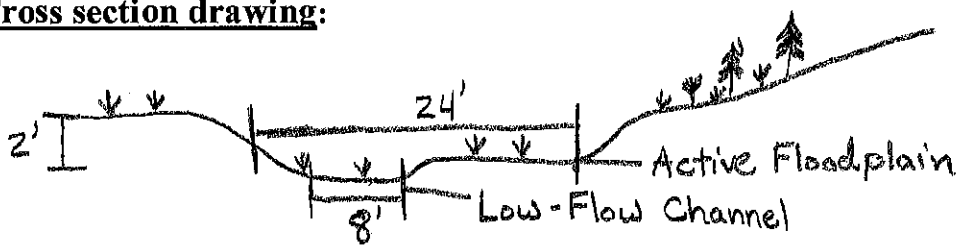
1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - ☒ Mapping on aerial photograph
   - ☐ Digitized on computer
   - ☒ GPS
   - ☐ Other:

Wentworth Size Classes

Inches (in)	Millimeters (mm)	Wentworth size class	
10.08	256	Boulder	
		Cobble	Gravel
2.56	64	Pebble	
0.157	4	Granule	
0.079	2.00	Very coarse sand	
0.039	1.00	Coarse sand	
0.020	0.50	Medium sand	Sand
1/2 0.0098	0.25	Fine sand	
1/4 0.005	0.125	Very fine sand	
1/8 0.0025	0.0625	Coarse silt	
1/16 0.0012	0.031	Medium silt	
1/32 0.00061	0.0156	Fine silt	Silt
1/64 0.00031	0.0078	Very fine silt	
1/128 0.00015	0.0039	Clay	Mud

Project ID: 421 **Cross section ID:** S5 **Date:** May 4, 2012 **Time:** 9:07 am

Cross section drawing:



Heavily vegetated, U-shaped drainage.

OHWM

GPS point: See location on front

Indicators:

- ☐ Change in average sediment texture
- ☐ Change in vegetation species
- ☐ Change in vegetation cover
- ☐ Break in bank slope
- ☐ Other: _____
- ☐ Other: _____

Comments:

No OHWM indicators present.

Floodplain unit: ☒ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: Silt

Total veg cover: 85 % Tree: ____ % Shrub: ____ % Herb: 85 %

Community successional stage:

- ☐ NA
- ☒ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

~ 8' wide drainage that is dominated by wetland indicator species of Carex sp. & Juncus sp. No indicators present

Project ID: 421 **Cross section ID:** S5 **Date:** May 4, 2012 **Time:** 9:07 am

Floodplain unit: ☐ Low-Flow Channel ☒ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: Silt

Total veg cover: 75 % Tree: ____% Shrub: ____% Herb: 75 %

Community successional stage:

- ☐ NA
- ☒ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☒ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☒ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

~ 24' wide, wetland drainage swale that has no OHWM or stream channel.

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: ____% Tree: ____% Shrub: ____% Herb: ____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Alton Coal
Project Number: 421
Stream: S6
Investigator(s): Jeff Boice, Dennis Wenger, Collin Covington

Date: May 4, 2012 **Time:** 10:10 am
Town: Alton **State:** Utah
Photo begin file#: 052 **Photo end file#:** 054

Y [X] / N [ ] Do normal circumstances exist on the site?

Y [ ] / N [X] Is the site significantly disturbed?

Location Details: South side of project area.

Projection: UTM **Datum:** NAD 83
Coordinates: 370469 m E 4137223 m N

Potential anthropogenic influences on the channel system:

None

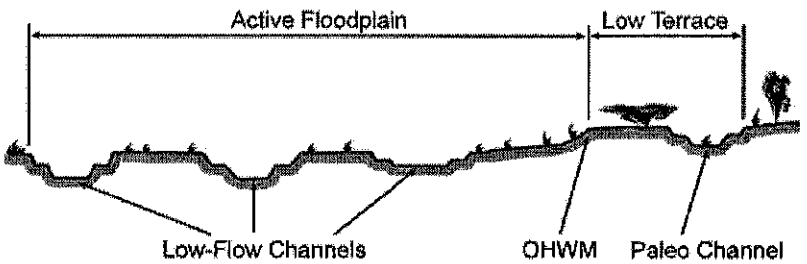
Brief site description:

Pinyon Juniper landscape with sparse understory. Channel is controlled by bedrock.

Checklist of resources (if available):

- [X] Aerial photography
  Dates: June 22, 2011
- [X] Topographic maps
- [ ] Geologic maps
- [ ] Vegetation maps
- [ ] Soils maps
- [ ] Rainfall/precipitation maps
- [ ] Existing delineation(s) for site
- [ ] Global positioning system (GPS)
- [ ] Other studies
- [ ] Stream gage data
  Gage number:
  Period of record:
  - [ ] History of recent effective discharges
  - [ ] Results of flood frequency analysis
  - [ ] Most recent shift-adjusted rating
  - [ ] Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units



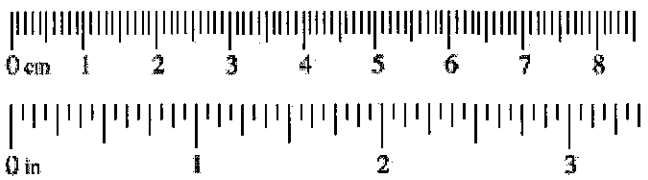
Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - [X] Mapping on aerial photograph
   - [ ] Digitized on computer
   - [X] GPS
   - [ ] Other:

Ephemeral stream channel 1

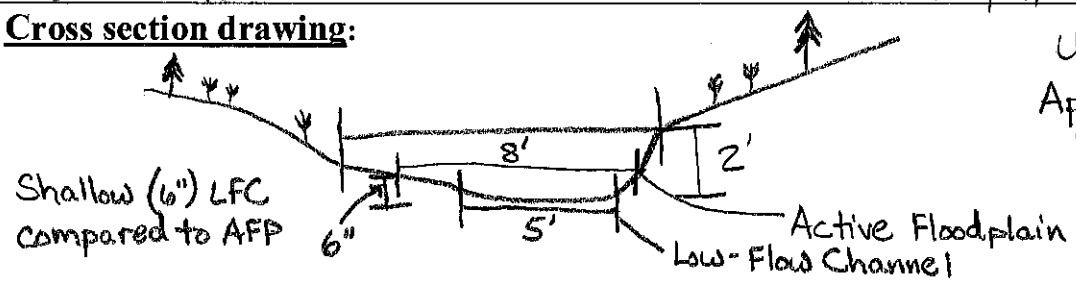
Wentworth Size Classes

Inches (in)	Millimeters (mm)	Wentworth size class	
10.08	256	Boulder	Gravel
2.56	64	Cobble	Gravel
0.157	4	Pebble	Gravel
0.079	2.00	Granule	Gravel
0.039	1.00	Very coarse sand	Sand
0.020	0.50	Coarse sand	Sand
1/2 0.0098	0.25	Medium sand	Sand
1/4 0.005	0.125	Fine sand	Sand
1/8 0.0025	0.0625	Very fine sand	Sand
1/16 0.0012	0.031	Coarse silt	Silt
1/32 0.00061	0.0156	Medium silt	Silt
1/64 0.00031	0.0078	Fine silt	Silt
1/128 0.00015	0.0039	Very fine silt	Silt
		Clay	Mud



Project ID: 421 **Cross section ID:** S6 **Date:** May 4, 2012 **Time:** 10:10 am

Cross section drawing:



U-shaped channel. Appears to be bedrock controlled.

OHWM = Active floodplain = 8' wide

OHWM ESC #1

GPS point: See location on front

Indicators:

- [x] Change in average sediment texture
- [x] Change in vegetation species
- [x] Change in vegetation cover
- [x] Break in bank slope
- [ ] Other: _____
- [ ] Other: _____

Comments:

Evidence of sediment sorting, smoothing of particles. This sorting is indicative of more regular flow events.

Floodplain unit: [x] Low-Flow Channel [ ] Active Floodplain [ ] Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: Cobble, rounding

Total veg cover: TR % Tree: ____% Shrub: ____% Herb: TR %

Community successional stage:

- [x] NA
- [ ] Early (herbaceous & seedlings)
- [ ] Mid (herbaceous, shrubs, saplings)
- [ ] Late (herbaceous, shrubs, mature trees)

Indicators:

- [ ] Mudcracks
- [ ] Ripples
- [x] Drift and/or debris
- [x] Presence of bed and bank
- [x] Benches
- [ ] Soil development
- [x] Surface relief
- [ ] Other: _____
- [ ] Other: _____
- [ ] Other: _____

Comments:

~5' wide by 6" deep.

Project ID: 421 **Cross section ID:** S6 **Date:** May 4, 2012 **Time:** 10:10 am

Floodplain unit: ☐ Low-Flow Channel ☒ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: pebble

Total veg cover: TR % Tree: ____% Shrub: ____% Herb: TR %

Community successional stage:

- ☒ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☒ Drift and/or debris
- ☒ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☒ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Upland vegetation across site. Evidence of particle sorting and rounding.

Ephemeral Stream Channel 1

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: ____% Tree: ____% Shrub: ____% Herb: ____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Alton Coal
Project Number: 421
Stream: S7
Date: May 4, 2012 **Time:** 11:26 am
Town: Alton **State:** Utah
Photo begin file#: 064 **Photo end file#:** 068
Investigator(s): Jeff Boice, Dennis Wenger, Collin Covington

Y ☒ / N ☐ Do normal circumstances exist on the site?

Y ☐ / N ☒ Is the site significantly disturbed?

Location Details: South portion of project area.

Projection: UTM **Datum:** NAD 83
Coordinates: 370321 mE 4137446 mN

Potential anthropogenic influences on the channel system:

None

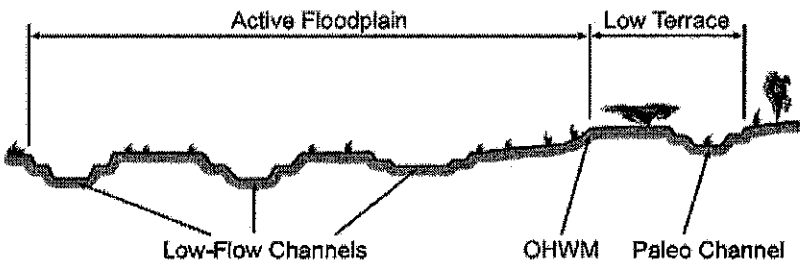
Brief site description:

Slightly incised drainage in a Pinyon-Juniper / Sagebrush / upland herbacious vegetation, (wheatgrass, cheatgrass, Ranunculus testiculatus).

Checklist of resources (if available):

- ☒ Aerial photography
  Dates: June 22, 2011
- ☒ Topographic maps
- ☐ Geologic maps
- ☐ Vegetation maps
- ☐ Soils maps
- ☐ Rainfall/precipitation maps
- ☐ Existing delineation(s) for site
- ☐ Global positioning system (GPS)
- ☐ Other studies
- ☐ Stream gage data
  Gage number:
  Period of record:
  - ☐ History of recent effective discharges
  - ☐ Results of flood frequency analysis
  - ☐ Most recent shift-adjusted rating
  - ☐ Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units



Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - ☒ Mapping on aerial photograph
   - ☐ Digitized on computer
   - ☒ GPS
   - ☐ Other:

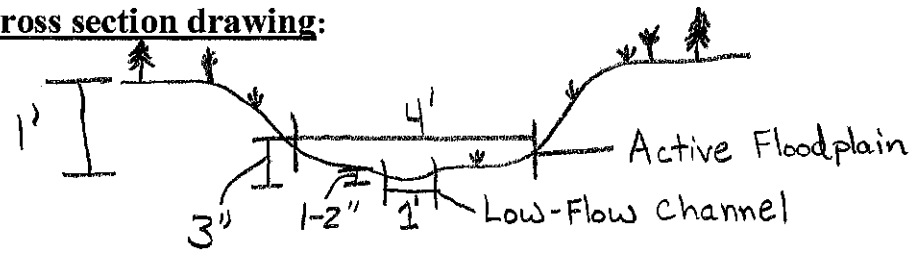
Ephemeral Stream Channel 2

Wentworth Size Classes

Inches (in)	Millimeters (mm)	Wentworth size class	
10.08	256	Boulder	Gravel
2.56	64	Cobble	
0.157	4	Pebble	
		Granule	
0.079	2.00	Very coarse sand	Sand
0.039	1.00	Coarse sand	
0.020	0.50	Medium sand	
1/2 0.0098	0.25	Fine sand	
1/4 0.005	0.125	Very fine sand	
1/8 0.0025	0.0625	Coarse silt	Silt
1/16 0.0012	0.031	Medium silt	
1/32 0.00061	0.0156	Fine silt	
1/64 0.00031	0.0078	Very fine silt	
1/128 0.00015	0.0039	Clay	Mud

Project ID: 421 **Cross section ID:** S7 **Date:** May 4, 2012 **Time:** 11:26 am

Cross section drawing:



U-shaped drainage

OHWM = Active floodplain = 4' wide

OHWM

ESC #2

GPS point: See location on front

Indicators:

- [x] Change in average sediment texture
- [ ] Change in vegetation species
- [ ] Change in vegetation cover
- [x] Break in bank slope
- [ ] Other: _____
- [ ] Other: _____

Comments:

OHWM indicators are very minor.

Floodplain unit: [x] Low-Flow Channel [ ] Active Floodplain [ ] Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: pebble, course angular

Total veg cover: ≥ 1 % Tree: ____% Shrub: ____% Herb: ≥ 1 %

Community successional stage:

- [ ] NA
- [x] Early (herbaceous & seedlings)
- [ ] Mid (herbaceous, shrubs, saplings)
- [ ] Late (herbaceous, shrubs, mature trees)

Indicators:

- [ ] Mudcracks
- [ ] Ripples
- [x] Drift and/or debris
- [ ] Presence of bed and bank
- [x] Benches
- [ ] Soil development
- [x] Surface relief
- [ ] Other: _____
- [ ] Other: _____
- [ ] Other: _____

Comments:

A bed is present but no bank. Ranunculus testiculatus present in LFC.

Project ID: 421 **Cross section ID:** S7 **Date:** May 4, 2012 **Time:** 11:26 am

Floodplain unit: ☐ Low-Flow Channel ☒ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:
Average sediment texture: pebble, course angular
Total veg cover: ≥ 1 % Tree: ____% Shrub: ____% Herb: ≥ 1 %
Community successional stage:
- ☐ NA
- ☒ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:
- ☐ Mudcracks
- ☐ Ripples
- ☒ Drift and/or debris
- ☒ Presence of bed and bank
- ☒ Benches
- ☐ Soil development
- ☒ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:
Bank has a more distinct break. There is mudcracks above the AFP.

Ephemeral Stream Channel 2

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:
Average sediment texture: _____
Total veg cover: ____% Tree: ____% Shrub: ____% Herb: ____%
Community successional stage:
- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:
- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Alton Coal
Project Number: 421
Stream: S 8
Date: May 4, 2012 **Time:** 12:51 pm
Town: Alton **State:** Utah
Photo begin file#: 076 **Photo end file#:** 078
Investigator(s): Jeff Boice, Dennis Wenger, Collin Covington

Y ☒ / N ☐ Do normal circumstances exist on the site?

Y ☐ / N ☒ Is the site significantly disturbed?

Location Details: South portion of project area.

Projection: UTM **Datum:** NAD 83
Coordinates: 370639 mE 4137444 mN

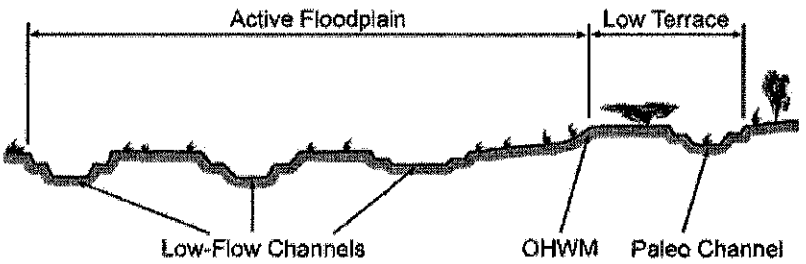
Potential anthropogenic influences on the channel system:
None

Brief site description:
Pinyon-Juniper, sagebrush, & upland herbacious vegetation on high terrace. Incised into landscape. Multiple drainages.

Checklist of resources (if available):

- ☒ Aerial photography
  Dates: June 22, 2011
- ☒ Topographic maps
- ☐ Geologic maps
- ☐ Vegetation maps
- ☐ Soils maps
- ☐ Rainfall/precipitation maps
- ☐ Existing delineation(s) for site
- ☐ Global positioning system (GPS)
- ☐ Other studies
- ☐ Stream gage data
  Gage number:
  Period of record:
- ☐ History of recent effective discharges
- ☐ Results of flood frequency analysis
- ☐ Most recent shift-adjusted rating
- ☐ Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units



Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - ☒ Mapping on aerial photograph
   - ☐ Digitized on computer
   - ☒ GPS
   - ☐ Other:

Ephemeral stream channel 3

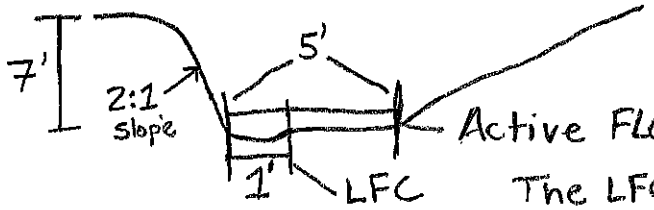
Wentworth Size Classes

Inches (in)	Millimeters (mm)	Wentworth size class	
10.08	256	Boulder	Gravel
2.56	64	Cobble	
0.157	4	Pebble	
		Granule	
0.079	2.00	Very coarse sand	Sand
0.039	1.00	Coarse sand	
0.020	0.50	Medium sand	
1/2 0.0098	0.25	Fine sand	
1/4 0.005	0.125	Very fine sand	
1/8 0.0025	0.0625	Coarse silt	Silt
1/16 0.0012	0.031	Medium silt	
1/32 0.00061	0.0156	Fine silt	
1/64 0.00031	0.0078	Very fine silt	
1/128 0.00015	0.0039	Clay	Mud

Project ID: 421 **Cross section ID:** S8 **Date:** May 4, 2012 **Time:** 12:51 pm

Cross section drawing:

Located on a bend.



OHWM = Active Floodplain = 5' wide

OHWM FSC #3

GPS point: See location on front

Indicators:

- [X] Change in average sediment texture
- [ ] Change in vegetation species
- [X] Change in vegetation cover
- [X] Break in bank slope
- [ ] Other: _____
- [ ] Other: _____

Comments:

Trace vegetation in channel.

Minimal OHWM presence.

Floodplain unit: [X] Low-Flow Channel [ ] Active Floodplain [ ] Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: pebble, course angular

Total veg cover: ≥ 1 % Tree: ____% Shrub: ____% Herb: ≥1 %

Community successional stage:

- [ ] NA
- [X] Early (herbaceous & seedlings)
- [ ] Mid (herbaceous, shrubs, saplings)
- [ ] Late (herbaceous, shrubs, mature trees)

Indicators:

- [ ] Mudcracks
- [ ] Ripples
- [X] Drift and/or debris
- [X] Presence of bed and bank
- [X] Benches
- [ ] Soil development
- [X] Surface relief
- [ ] Other: _____
- [ ] Other: _____
- [ ] Other: _____

Comments:

~ 1' wide by 1-2" deep

Project ID: 421 **Cross section ID:** S8 **Date:** May 4, 2012 **Time:** 12:51 pm

Floodplain unit: ☐ Low-Flow Channel ☒ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: pebble, course angular

Total veg cover: ≥ 1 % Tree: ____% Shrub: ____% Herb: ≥ 1 %

Community successional stage:

- ☐ NA
- ☒ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☒ Drift and/or debris
- ☒ Presence of bed and bank
- ☒ Benches
- ☐ Soil development
- ☒ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

~5' wide with patches of silt deposition & upland plant species.

Ephemeral Stream Channel 3

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: ____% Tree: ____% Shrub: ____% Herb: ____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Alton Coal
Project Number: 421
Stream: S9
Investigator(s): Jeff Boice, Dennis Wenger, Collin Covington
Date: May 4, 2012 **Time:** 2:19 pm
Town: Alton **State:** Utah
Photo begiu file#: 090 **Photo end file#:** 092

Y [X] / N [ ] Do normal circumstances exist on the site?

Y [ ] / N [X] Is the site significantly disturbed?

Location Details: South portion of project area.

Projection: UTM **Datum:** NAD 83
Coordinates: 370061 m E 4138235 m N

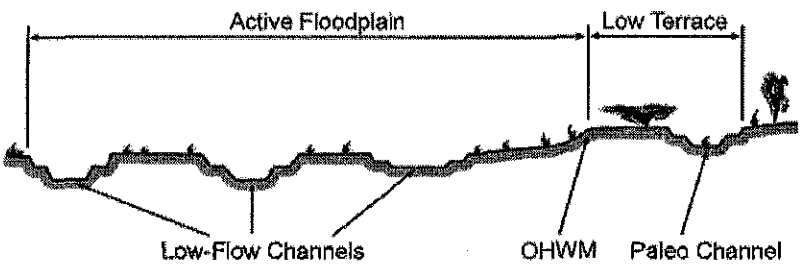
Potential anthropogenic influences on the channel system:
None

Brief site description:
Pinyon-Juniper, sagebrush, upland herbacious vegetation on the high terrace. Drainage incised ~6'.

Checklist of resources (if available):

- [X] Aerial photography
  Dates: June 22, 2011
- [X] Topographic maps
- [ ] Geologic maps
- [ ] Vegetation maps
- [ ] Soils maps
- [ ] Rainfall/precipitation maps
- [ ] Existing delineation(s) for site
- [ ] Global positioning system (GPS)
- [ ] Other studies
- [ ] Stream gage data
  Gage number:
  Period of record:
- [ ] History of recent effective discharges
- [ ] Results of flood frequency analysis
- [ ] Most recent shift-adjusted rating
- [ ] Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units

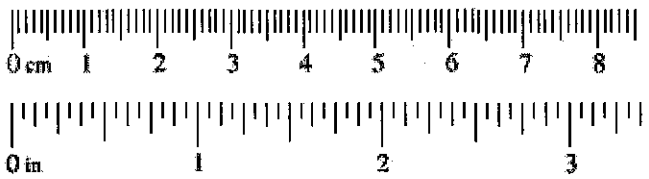


Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - [X] Mapping on aerial photograph
   - [ ] Digitized on computer
   - [X] GPS
   - [ ] Other:

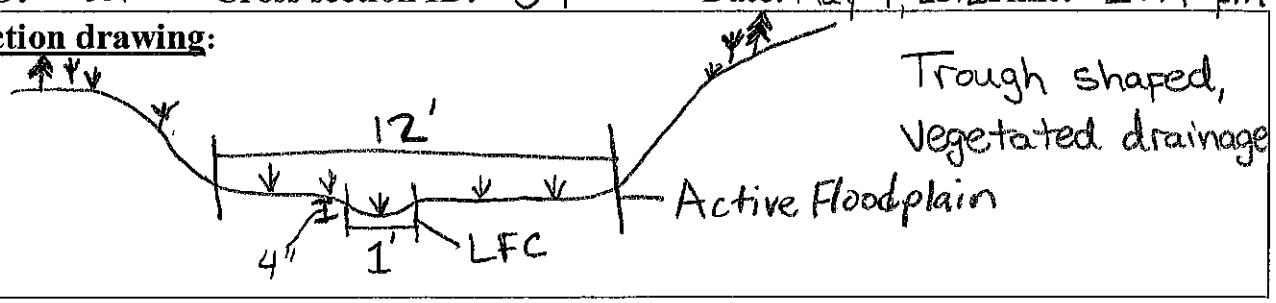
Wentworth Size Classes

Inches (in)	Millimeters (mm)	Wentworth size class	
10.08	256	Boulder	
		Cobble	Gravel
2.56	64		
0.157	4	Pebble	
		Granule	
0.079	2.00		
0.039	1.00	Very coarse sand	
		Coarse sand	
0.020	0.50		Sand
1/2 0.0098	0.25	Medium sand	
1/4 0.005	0.125	Fine sand	
1/8 0.0025	0.0625	Very fine sand	
1/16 0.0012	0.031	Coarse silt	
		Medium silt	
1/32 0.00061	0.0156		Silt
1/64 0.00031	0.0078	Fine silt	
1/128 0.00015	0.0039	Very fine silt	
		Clay	Mud



Project ID: 421 **Cross section ID:** S9 **Date:** May 4, 2012 **Time:** 2:19 pm

Cross section drawing:



OHWM

GPS point: See location on front

Indicators:

- ☐ Change in average sediment texture
- ☐ Change in vegetation species
- ☐ Change in vegetation cover
- ☐ Break in bank slope
- ☐ Other: _____
- ☐ Other: _____

Comments:

No OHWM indicators

Floodplain unit: ☒ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: silt

Total veg cover: 85 % Tree: ____% Shrub: ____% Herb: 85 %

Community successional stage:

- ☐ NA
- ☒ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☒ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

~ 1' wide & 4" deep

Project ID: 421 **Cross section ID:** S9 **Date:** May 4, 2012 **Time:** 2:19 pm

Floodplain unit: ☐ Low-Flow Channel ☒ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: Silt

Total veg cover: 90 % Tree: ____% Shrub: ____% Herb: 90 %

Community successional stage:

- ☐ NA
- ☒ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☒ Benches
- ☒ Soil development
- ☒ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

~12' wide, No OHWM indicators, but there is evidence of ephemeral flow. Vegetation in drainage: Western wheatgrass 70%
Poa sp. & forbs 10%
Vegetated upland drainage swale. Juncus sp. 10%

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: ____% Tree: ____% Shrub: ____% Herb: ____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Alton Coal
Project Number: 421
Stream: S10
Investigator(s): Jeff Boice, Dennis Wenger, Collin Covington

Date: May 4, 2012 **Time:** 2:45 pm
Town: Alton **State:** Utah
Photo begin file#: 096 **Photo end file#:** 098

Y ☒ / N ☐ Do normal circumstances exist on the site?

Y ☐ / N ☒ Is the site significantly disturbed?

Location Details: South portion of project area.

Projection: UTM **Datum:** NAD 83
Coordinates: 370181 mE 4138355 mN

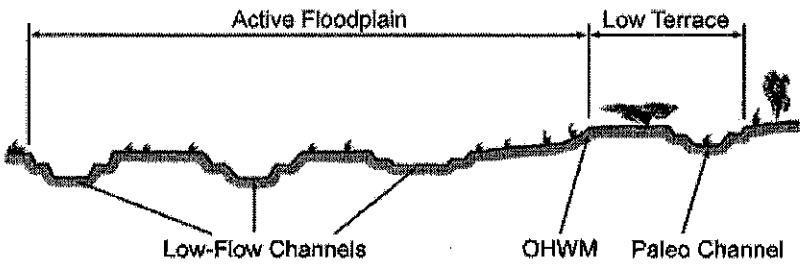
Potential anthropogenic influences on the channel system:
None

Brief site description:
Drainage incised ~5' with a Pinyon-Juniper, Sagebrush & upland vegetation herbacious layer.

Checklist of resources (if available):

- ☒ Aerial photography
  Dates: June 22, 2011
- ☒ Topographic maps
- ☐ Geologic maps
- ☐ Vegetation maps
- ☐ Soils maps
- ☐ Rainfall/precipitation maps
- ☐ Existing delineation(s) for site
- ☐ Global positioning system (GPS)
- ☐ Other studies
- ☐ Stream gage data
  Gage number:
  Period of record:
  - ☐ History of recent effective discharges
  - ☐ Results of flood frequency analysis
  - ☐ Most recent shift-adjusted rating
  - ☐ Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units

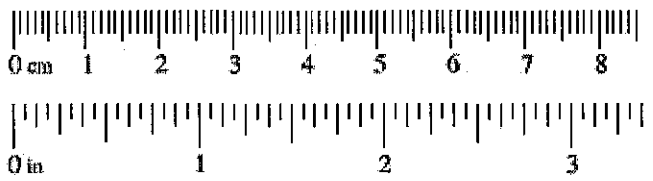


Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - ☒ Mapping on aerial photograph
   - ☐ Digitized on computer
   - ☒ GPS
   - ☐ Other:

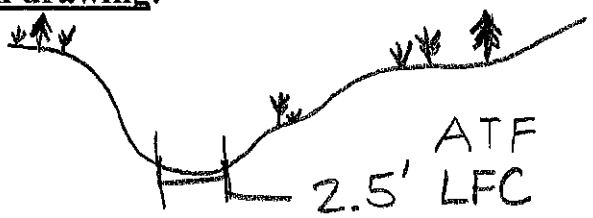
Wentworth Size Classes

Inches (in)		Millimeters (mm)	Wentworth size class	
	10.08	256	Boulder	
			Cobble	Gravel
	2.56	64		
	0.157	4	Pebble	
			Granule	
	0.079	2.00	Very coarse sand	
	0.039	1.00	Coarse sand	
	0.020	0.50	Medium sand	Sand
1/2	0.0098	0.25	Fine sand	
1/4	0.005	0.125	Very fine sand	
1/8	0.0025	0.0625	Coarse silt	
1/16	0.0012	0.031	Medium silt	
1/32	0.00061	0.0156	Fine silt	Silt
1/64	0.00031	0.0078	Very fine silt	
1/128	0.00015	0.0039		
			Clay	Mud



Project ID: 421 **Cross section ID:** S10 **Date:** May 4, 2012 **Time:** 2:45 pm

Cross section drawing:



The Low-Flow Channel comprises the entire drainage bottom. Active Floodplain is confined WITHIN LOW FLOW channel

OHWM

GPS point: See location on front

Indicators:

- ☐ Change in average sediment texture
- ☐ Change in vegetation species
- ☐ Change in vegetation cover
- ☐ Break in bank slope
- ☐ Other: _____
- ☐ Other: _____

Comments:

No OHWM indicators.

Floodplain unit: ☒ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: pebble, course angular

Total veg cover: (0) % Tree: ____% Shrub: ____% Herb: ____%

Community successional stage:

- ☒ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

No indicators present. Ephemeral drainage. Terrace present in mid-drainage.

Project ID: **Cross section ID:** **Date:** **Time:**

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____ % Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____ % Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Alton Coal
Project Number: 421
Stream: S11, Kanab Creek
Investigator(s): Jeff Boice, Dennis Wenger, Collin Covington

Date: May 4, 2012 **Time:** 3:43 pm
Town: Alton **State:** Utah
Photo begin file#: 099 **Photo end file#:** 102

Y ☒ / N ☐ Do normal circumstances exist on the site?

Y ☐ / N ☒ Is the site significantly disturbed?

Location Details: Central portion of project area. Kanab Creek

Projection: UTM **Datum:** NAD83
Coordinates: 369804 mE 4141519 mN

Potential anthropogenic influences on the channel system:

None

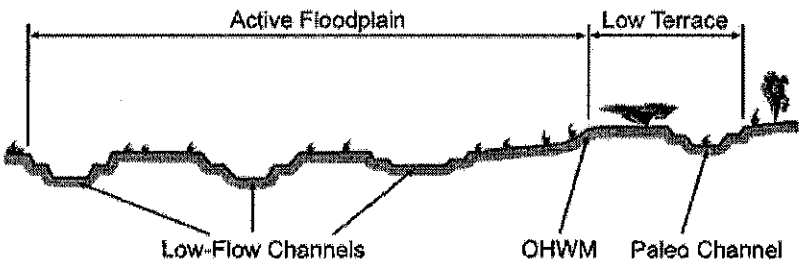
Brief site description:

Kanab Creek floodplain within upland high terraces covered with Pinyon-Juniper and Sagebrush.

Checklist of resources (if available):

- ☒ Aerial photography
  Dates: June 22, 2011
- ☒ Topographic maps
- ☐ Geologic maps
- ☐ Vegetation maps
- ☐ Soils maps
- ☐ Rainfall/precipitation maps
- ☐ Existing delineation(s) for site
- ☐ Global positioning system (GPS)
- ☐ Other studies
- ☐ Stream gage data
  Gage number:
  Period of record:
  - ☐ History of recent effective discharges
  - ☐ Results of flood frequency analysis
  - ☐ Most recent shift-adjusted rating
  - ☐ Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units



Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - ☒ Mapping on aerial photograph
   - ☐ Digitized on computer
   - ☒ GPS
   - ☐ Other:

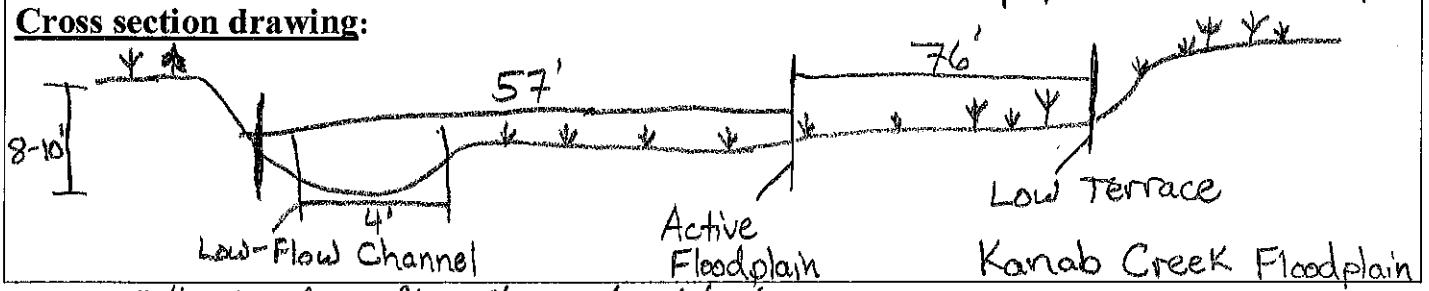
Perenial stream channel / Kanab Creek

Wentworth Size Classes

Inches (in)	Millimeters (mm)	Wentworth size class	
10.08	256	Boulder	Gravel
2.56	64	Cobble	
0.157	4	Pebble	
		Granule	
0.079	2.00		
0.039	1.00	Very coarse sand	Sand
0.020	0.50	Coarse sand	
1/2 0.0098	0.25	Medium sand	
1/4 0.005	0.125	Fine sand	
1/8 0.0025	0.0625	Very fine sand	
1/16 0.0012	0.031	Coarse silt	Silt
1/32 0.00061	0.0156	Medium silt	
1/64 0.00031	0.0078	Fine silt	
1/128 0.00015	0.0039	Very fine silt	
		Clay	Mud

Project ID: 421 **Cross section ID:** S11 **Date:** May 4, 2012 **Time:** 3:43 pm

Cross section drawing:



OHWM = Low-flow channel = 4' wide

OHWM

PSC #1

GPS point: See location on front

Indicators:

- ☒ Change in average sediment texture
- ☒ Change in vegetation species
- ☒ Change in vegetation cover
- ☐ Break in bank slope
- ☐ Other: _____
- ☐ Other: _____

Comments:

OHWM is present. Fine material in the bed with banks densely vegetated with Juncus sp. Active flood plain is vegetated OHWM IS WITHIN "LOW FLOW CHANNEL".

Floodplain unit: ☒ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: pebble, rounding

Total veg cover: Ø % Tree: ____% Shrub: ____% Herb: ____%

Community successional stage:

- ☒ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☒ Drift and/or debris
- ☒ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☒ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Perennial Stream Channel of Kanab Creek

Project ID: 421 **Cross section ID:** S11 **Date:** May 4, 2012 **Time:** 3:43 pm

Floodplain unit: ☐ Low-Flow Channel ☒ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: Silt

Total veg cover: 70 % Tree: ____ % Shrub: ____ % Herb: 70 %

Community successional stage:

- ☐ NA
- ☒ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☒ Ripples
- ☒ Drift and/or debris
- ☐ Presence of bed and bank
- ☒ Benches
- ☒ Soil development
- ☒ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Evidence of recent flooding, vegetation is bent over facing downstream. Vegetation is dominated by Juncus sp.

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☒ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: Soil

Total veg cover: 90 % Tree: ____ % Shrub: 21 % Herb: 95 %

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☒ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☒ Soil development
- ☒ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Terrace is dominated by upland vegetation which is adjacent to Active Floodplain dominated by wetland vegetation.

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Alton Coal
Project Number: 421
Stream: S12, Kanab Creek
Investigator(s): Jeff Boice, Dennis Wenger, Collin Covington

Date: May 4, 2012 **Time:** 4:26 pm
Town: Alton **State:** Utah
Photo begin file#: 103 **Photo end file#:** 106

Y ☒ / N ☐ Do normal circumstances exist on the site?

Y ☒ / N ☐ Is the site significantly disturbed?

Location Details: Central portion of Kanab Creek. project area

Projection: UTM **Datum:** NAD83
Coordinates: 369577 mE 4140762 mN

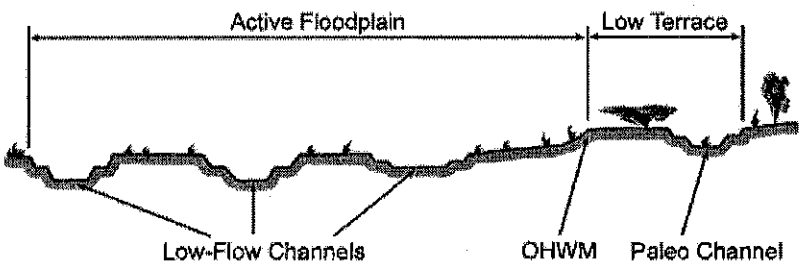
Potential anthropogenic influences on the channel system:
Valley floodplain worked with heavy machinery upstream.

Brief site description:
Perennial stream channel of Kanab Creek with high terraces vegetated with Pinyon-Juniper, Sagebrush, & upland herb vegetation

Checklist of resources (if available):

- ☒ Aerial photography
  Dates: June 22, 2011
- ☒ Topographic maps
- ☐ Geologic maps
- ☐ Vegetation maps
- ☐ Soils maps
- ☐ Rainfall/precipitation maps
- ☐ Existing delineation(s) for site
- ☐ Global positioning system (GPS)
- ☐ Other studies
- ☐ Stream gage data
  Gage number:
  Period of record:
  - ☐ History of recent effective discharges
  - ☐ Results of flood frequency analysis
  - ☐ Most recent shift-adjusted rating
  - ☐ Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units



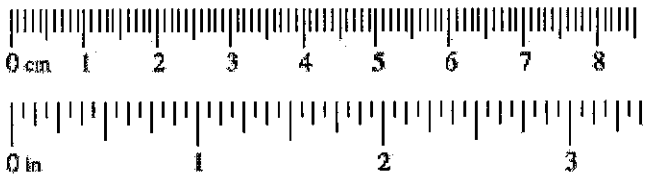
Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - ☒ Mapping on aerial photograph
   - ☐ Digitized on computer
   - ☒ GPS
   - ☐ Other:

Perenial stream channel |
Kanab Creek

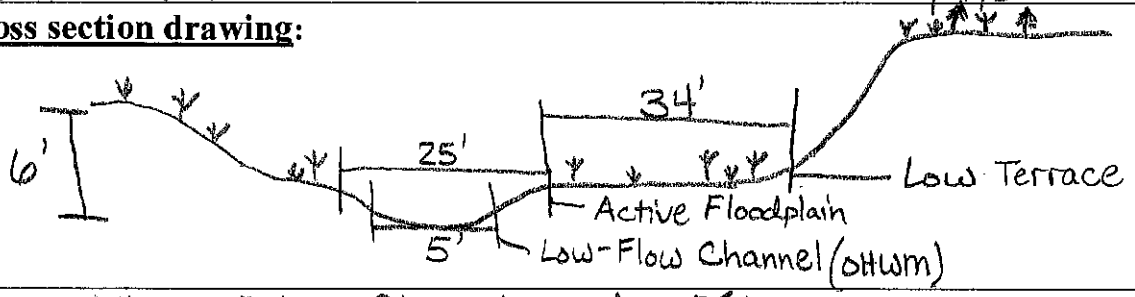
Wentworth Size Classes

Inches (in)	Millimeters (mm)	Wentworth size class	
10.08	256	Boulder	Gravel
2.56	64	Cobble	
0.157	4	Pebble	
		Granule	
0.079	2.00	Very coarse sand	Sand
0.039	1.00	Coarse sand	
0.020	0.50	Medium sand	
1/2 0.0098	0.25	Fine sand	
1/4 0.005	0.125	Very fine sand	
1/8 0.0025	0.0625	Coarse silt	Silt
1/16 0.0012	0.031	Medium silt	
1/32 0.00061	0.0156	Fine silt	
1/64 0.00031	0.0078	Very fine silt	
1/128 0.00015	0.0039	Clay	Mud



Project ID: 421 **Cross section ID:** S12 **Date:** May 4, 2012 **Time:** 4:26 pm

Cross section drawing:



OHWM = Low-flow channel = 5' wide

OHWM

PSC #1

GPS point: See location on front

Indicators:

- ☐ Change in average sediment texture
- ☒ Change in vegetation species
- ☒ Change in vegetation cover
- ☒ Break in bank slope
- ☐ Other: _____
- ☐ Other: _____

Comments:

OHWM is confined to the "Low-Flow Channel", Perennial Stream Channel. Active floodplain is vegetated.

Floodplain unit: ☒ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: pebble, rounded

Total veg cover: ≥ 1 % Tree: ____% Shrub: ≥ 1 % Herb: ____%

Community successional stage:

- ☒ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☒ Drift and/or debris
- ☒ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☒ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Perennial Stream Channel of Kanab Creek.

Project ID: 421 **Cross section ID:** S12 **Date:** May 4, 2012 **Time:** 4:26 pm

Floodplain unit: ☐ Low-Flow Channel ☒ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: pebble, rounded

Total veg cover: 12 % Tree: ____ % Shrub: 10 % Herb: 2 %

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☒ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☒ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☒ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Gradual slope to high terrace, no bank present but only the bed.

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☒ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: silt

Total veg cover: 18 % Tree: ____ % Shrub: 15 % Herb: 3 %

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☒ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☒ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☒ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Terrace is vegetated with Salix exigua & sagebrush closer to the slope. There is a relict side channel near the slope on the right.

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Alton Coal
Project Number: 421
Stream: S13, Kanab Creek
Investigator(s): Jeff Boice, Dennis Wenger, Collin Covington

Date: May 4, 2012 **Time:** 5:15 pm
Town: Alton **State:** Utah
Photo begin file#: 116 **Photo end file#:** 118

Y ☒ / N ☐ Do normal circumstances exist on the site?

Y ☐ / N ☒ Is the site significantly disturbed?

Location Details: Northern portion of Kanab Creek project area.

Projection: UTM **Datum:** NAD 83
Coordinates: 370084 mE 4142268 mN

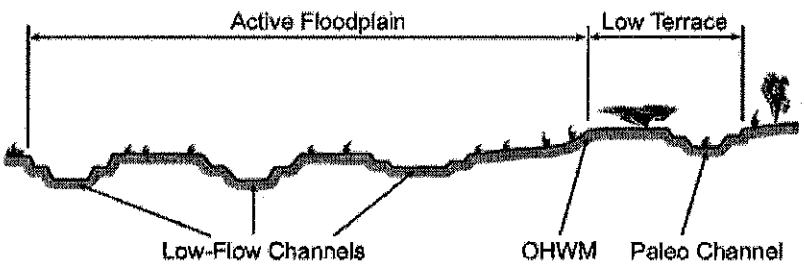
Potential anthropogenic influences on the channel system:
None

Brief site description:
Kanab Creek floodplain within upland high terraces covered with Pinyon-Juniper & Sagebrush ~ 25' above low-terrace & 29' above active floodplain

Checklist of resources (if available):

- ☒ Aerial photography
  Dates: June 22, 2011
- ☒ Topographic maps
- ☐ Geologic maps
- ☐ Vegetation maps
- ☐ Soils maps
- ☐ Rainfall/precipitation maps
- ☐ Existing delineation(s) for site
- ☐ Global positioning system (GPS)
- ☐ Other studies
- ☐ Stream gage data
  Gage number:
  Period of record:
- ☐ History of recent effective discharges
- ☐ Results of flood frequency analysis
- ☐ Most recent shift-adjusted rating
- ☐ Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units



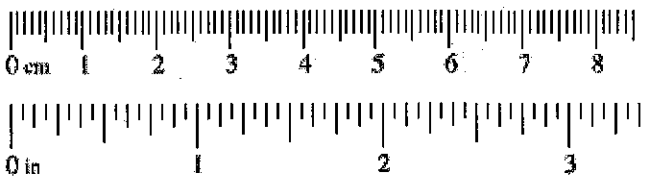
Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - ☒ Mapping on aerial photograph
   - ☐ Digitized on computer
   - ☒ GPS
   - ☐ Other:

Perenial Stream Channel 1
Kanab Creek

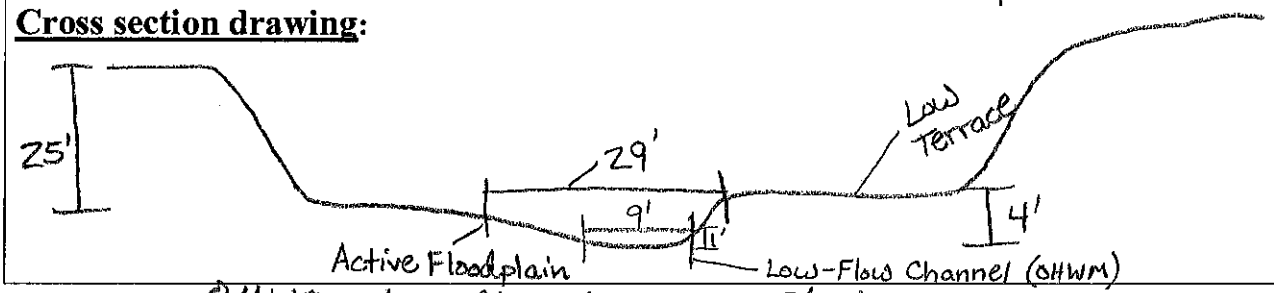
Wentworth Size Classes

Inches (in)	Millimeters (mm)	Wentworth size class	
10.08	256	Boulder	
		Cobble	Gravel
2.56	64		
0.157	4	Pebble	
		Granule	
0.079	2.00		
0.039	1.00	Very coarse sand	
		Coarse sand	
0.020	0.50		Sand
1/2 0.0098	0.25	Medium sand	
		Fine sand	
1/4 0.005	0.125		
		Very fine sand	
1/8 0.0025	0.0625		
1/16 0.0012	0.031	Coarse silt	
		Medium silt	
1/32 0.00061	0.0156		Silt
1/64 0.00031	0.0078	Fine silt	
		Very fine silt	
1/128 0.00015	0.0039		
		Clay	Mud



Project ID: 421 **Cross section ID:** S13 **Date:** May 5, 2012 **Time:** 5:15 pm

Cross section drawing:



OHWM = Low flow channel = 9' wide

OHWM

PSC #1

GPS point: See location on front

Indicators:

- [x] Change in average sediment texture
- [x] Change in vegetation species
- [x] Change in vegetation cover
- [ ] Break in bank slope
- [ ] Other: _____
- [ ] Other: _____

Comments:

No vegetation beneath the OHWM. The OHWM is restricted to the Low-Flow channel. Active floodplain is vegetated.

Floodplain unit: [x] Low-Flow Channel [ ] Active Floodplain [ ] Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: pebble, rounded

Total veg cover: 0 % Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- [x] NA
- [ ] Early (herbaceous & seedlings)
- [ ] Mid (herbaceous, shrubs, saplings)
- [ ] Late (herbaceous, shrubs, mature trees)

Indicators:

- [ ] Mudcracks
- [ ] Ripples
- [x] Drift and/or debris
- [x] Presence of bed and bank
- [ ] Benches
- [ ] Soil development
- [x] Surface relief
- [ ] Other: _____
- [ ] Other: _____
- [ ] Other: _____

Comments:

Perennial stream channel of Kanab Creek.

Project ID: 421 **Cross section ID:** S13 **Date:** May 4, 2012 **Time:** 5:15 pm

Floodplain unit: ☐ Low-Flow Channel ☒ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: pebble, smooth & rounded

Total veg cover: Ø % Tree: ____% Shrub: ____% Herb: ____%

Community successional stage:

- ☒ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☒ Mudcracks
- ☐ Ripples
- ☒ Drift and/or debris
- ☒ Presence of bed and bank
- ☒ Benches
- ☐ Soil development
- ☒ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Silt deposits from recent floodplain activity. Bed is present, the bank has a gradual slope.

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☒ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: pebble

Total veg cover: 7 % Tree: ____% Shrub: 2 % Herb: 5 %

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☒ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

No recent flooding activity.

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Alton Coal
Project Number: 421
Stream: S14
Investigator(s): Jeff Boice, Collin Covington

Date: May 5, 2012 **Time:** 10:19 am
Town: Alton **State:** Utah
Photo begin file#: 132 **Photo end file#:** 134

Y [X] / N [ ] Do normal circumstances exist on the site?

Y [ ] / N [X] Is the site significantly disturbed?

Location Details: Central portion of project area.

Projection: UTM **Datum:** NAD83
Coordinates: 369521 mE 4139320 mN

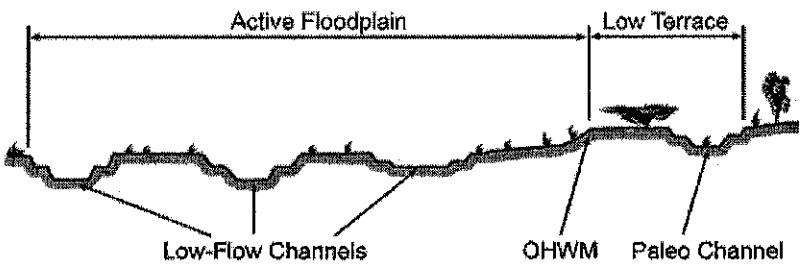
Potential anthropogenic influences on the channel system:
None

Brief site description:
Pinyon-Juniper dominated landscape with very minimal herbacious understory. There is an 8-10% drainage slope.

Checklist of resources (if available):

- [X] Aerial photography
  Dates: June 22, 2011
- [X] Topographic maps
- [ ] Geologic maps
- [ ] Vegetation maps
- [ ] Soils maps
- [ ] Rainfall/precipitation maps
- [ ] Existing delineation(s) for site
- [ ] Global positioning system (GPS)
- [ ] Other studies
- [ ] Stream gage data
  Gage number:
  Period of record:
  - [ ] History of recent effective discharges
  - [ ] Results of flood frequency analysis
  - [ ] Most recent shift-adjusted rating
  - [ ] Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units



Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

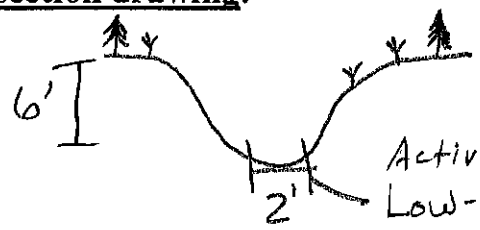
1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - [X] Mapping on aerial photograph
   - [ ] Digitized on computer
   - [X] GPS
   - [ ] Other:

Wentworth Size Classes

Inches (in)	Millimeters (mm)	Wentworth size class	
10.08	256	Boulder	Gravel
2.56	64	Cobble	Gravel
0.157	4	Pebble	Gravel
0.079	2.00	Granule	Gravel
0.039	1.00	Very coarse sand	Sand
0.020	0.50	Coarse sand	Sand
1/2 0.0098	0.25	Medium sand	Sand
1/4 0.005	0.125	Fine sand	Sand
1/8 0.0025	0.0625	Very fine sand	Sand
1/16 0.0012	0.031	Coarse silt	Silt
1/32 0.00061	0.0156	Medium silt	Silt
1/64 0.00031	0.0078	Fine silt	Silt
1/128 0.00015	0.0039	Very fine silt	Silt
		Clay	Mud

Project ID: 421 **Cross section ID:** S14 **Date:** May 5, 2012 **Time:** 10:19 am

Cross section drawing:



Low-Flow Channel Covers the entire Active Floodplain V-shaped drainage

OHWM

GPS point: See location on front

Indicators:

- ☐ Change in average sediment texture
- ☐ Change in vegetation species
- ☐ Change in vegetation cover
- ☐ Break in bank slope
- ☐ Other: _____
- ☐ Other: _____

Comments:

No OHWM indicators.

Floodplain unit: ☒ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: pebble, platy & angular

Total veg cover: Ø % Tree: ____% Shrub: ____% Herb: ____%

Community successional stage:

- ☒ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☒ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☒ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Ephemeral drainage swale on an erosional landscape.

Project ID: **Cross section ID:** **Date:** **Time:**

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____% Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____% Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Alton Coal
Project Number: 421
Stream: S15
Investigator(s): Jeff Boice, Collin Covington
Date: May 5, 2012 **Time:** 10:47 am
Town: Alton **State:** Utah
Photo begin file#: 140 **Photo end file#:** 142

Y [X] / N [ ] Do normal circumstances exist on the site?

Y [ ] / N [X] Is the site significantly disturbed?

Location Details: Central portion of project area

Projection: UTM **Datum:** NAD83
Coordinates: 369289 mE 4139162m N

Potential anthropogenic influences on the channel system:

None

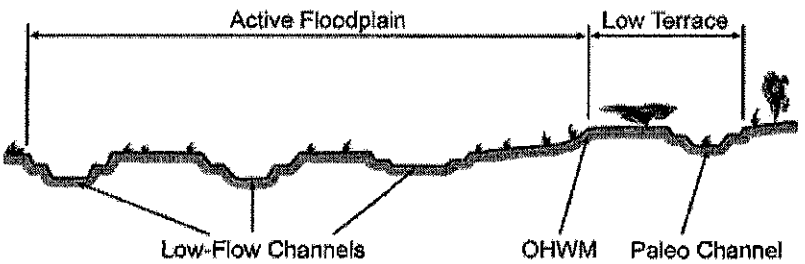
Brief site description:

Channel in a Pinyon-Juniper & Gamble Oak dominated high terrace landscape. Lots of boulders/ cobbles from bedrock in channel.

Checklist of resources (if available):

- [X] Aerial photography
  Dates: June 22, 2011
- [X] Topographic maps
- [ ] Geologic maps
- [ ] Vegetation maps
- [ ] Soils maps
- [ ] Rainfall/precipitation maps
- [ ] Existing delineation(s) for site
- [ ] Global positioning system (GPS)
- [ ] Other studies
- [ ] Stream gage data
  Gage number:
  Period of record:
- [ ] History of recent effective discharges
- [ ] Results of flood frequency analysis
- [ ] Most recent shift-adjusted rating
- [ ] Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units



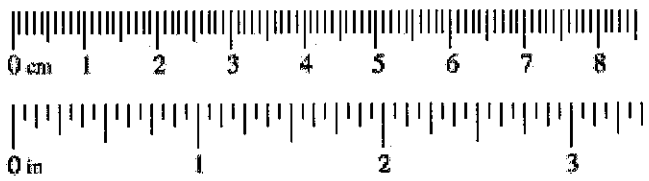
Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - [X] Mapping on aerial photograph
   - [ ] Digitized on computer
   - [X] GPS
   - [ ] Other:

Ephemeral Stream Channel 4

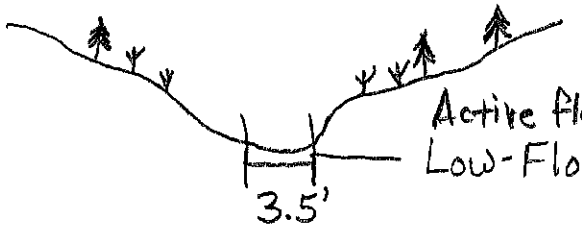
Wentworth Size Classes

Inches (in)	Millimeters (mm)	Wentworth size class	
10.08	256	Boulder	Gravel
2.56	64	Cobble	
0.157	4	Pebble	
		Granule	
0.079	2.00		
0.039	1.00	Very coarse sand	Sand
0.020	0.50	Coarse sand	
1/2 0.0098	0.25	Medium sand	
1/4 0.005	0.125	Fine sand	
		Very fine sand	
1/8 0.0025	0.0625		
1/16 0.0012	0.031	Coarse silt	Silt
1/32 0.00061	0.0156	Medium silt	
1/64 0.00031	0.0078	Fine silt	
		Very fine silt	
1/128 0.00015	0.0039		
		Clay	Mud



Project ID: 421 **Cross section ID:** S15 **Date:** May 5, 2012 **Time:** 10:47 am

Cross section drawing:



Low-Flow Channel covers entire Active Floodplain.

U-shaped channel

OHWM = 3.5' wide

OHWM

ESC #4

GPS point: See location on front

Indicators:

- [x] Change in average sediment texture
- [ ] Change in vegetation species
- [ ] Change in vegetation cover
- [x] Break in bank slope
- [x] Other: wracking
- [ ] Other: _____

Comments:

OHWM indicators are not very distinct. Channel has a step-pool form.

Floodplain unit:

- [x] Low-Flow Channel
- [ ] Active Floodplain
- [ ] Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: Cobble, minimal rounding of angular/ platy sandstone

Total veg cover: Ø % Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- [x] NA
- [ ] Early (herbaceous & seedlings)
- [ ] Mid (herbaceous, shrubs, saplings)
- [ ] Late (herbaceous, shrubs, mature trees)

Indicators:

- [ ] Mudcracks
- [ ] Ripples
- [x] Drift and/or debris
- [x] Presence of bed and bank
- [ ] Benches
- [ ] Soil development
- [x] Surface relief
- [ ] Other: _____
- [ ] Other: _____
- [ ] Other: _____

Comments:

Channel is dominated by bedrock (platy sandstone) that is mostly colluvial material transported minimally.

Ephemeral Stream Channel 4

Project ID: **Cross section ID:** **Date:** **Time:**

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____ % Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____ % Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Alton Coal | **Date:** May 5, 2012 | **Time:** 11:20 am
Project Number: 421 | **Town:** Alton | **State:** Utah
Stream: S16 | **Photo begin file#:** 145 | **Photo end file#:** 147
Investigator(s): Jeff Boice, Collin Covington

Y ☒ / N ☐ Do normal circumstances exist on the site?

Y ☐ / N ☒ Is the site significantly disturbed?

Location Details: central portion of project area.

Projection: UTM **Datum:** NAD83
Coordinates: 369786 m E 4139190 m N

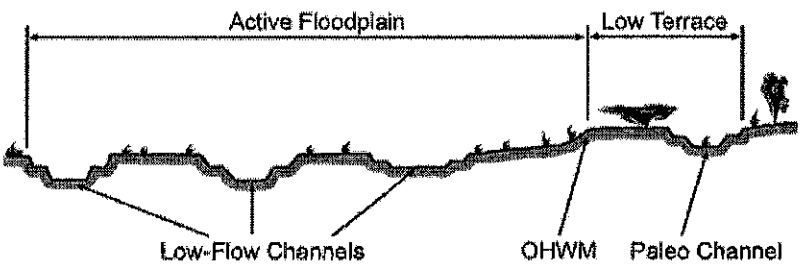
Potential anthropogenic influences on the channel system:
None

Brief site description:
Sagebrush & upland herbacious vegetation on the high terrace. Open landscape.

Checklist of resources (if available):

- ☒ Aerial photography
  Dates: June 22, 2011
- ☒ Topographic maps
- ☐ Geologic maps
- ☐ Vegetation maps
- ☐ Soils maps
- ☐ Rainfall/precipitation maps
- ☐ Existing delineation(s) for site
- ☐ Global positioning system (GPS)
- ☐ Other studies
- ☐ Stream gage data
  Gage number:
  Period of record:
  - ☐ History of recent effective discharges
  - ☐ Results of flood frequency analysis
  - ☐ Most recent shift-adjusted rating
  - ☐ Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units



Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

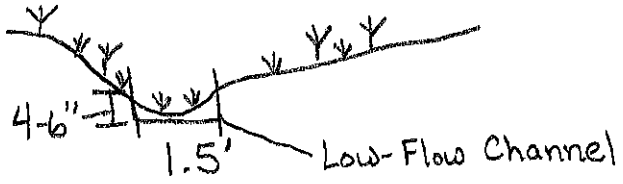
1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - ☒ Mapping on aerial photograph
   - ☐ Digitized on computer
   - ☒ GPS
   - ☐ Other:

Wentworth Size Classes

Inches (in)	Millimeters (mm)	Wentworth size class	
10.08	256	Boulder	Gravel
2.56	64	Cobble	Gravel
0.157	4	Pebble	Gravel
		Granule	Gravel
0.079	2.00		
0.039	1.00	Very coarse sand	Sand
0.020	0.50	Coarse sand	Sand
1/2 0.0098	0.25	Medium sand	Sand
1/4 0.005	0.125	Fine sand	Sand
		Very fine sand	Sand
1/8 0.0025	0.0625		
1/16 0.0012	0.031	Coarse silt	Silt
1/32 0.00061	0.0156	Medium silt	Silt
1/64 0.00031	0.0078	Fine silt	Silt
		Very fine silt	Silt
1/128 0.00015	0.0039		
		Clay	Mud

Project ID: 421 **Cross section ID:** S16 **Date:** May 5, 2012 **Time:** 11:20 am

Cross section drawing:



Low-Flow Channel covers entire Active Floodplain.
U-shaped drainage.

OHWM

GPS point: See location on front

Indicators:

- ☐ Change in average sediment texture
- ☐ Change in vegetation species
- ☐ Change in vegetation cover
- ☐ Break in bank slope
- ☐ Other: _____
- ☐ Other: _____

Comments:

No OHWM indicators. Very minimal break in slope, no abrupt change. No evidence of recent flow.

Floodplain unit: ☒ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: granule, angular course
Total veg cover: ≥ 1 % Tree: ____ % Shrub: ____ % Herb: ≥ 1 %
Community successional stage:

- ☐ NA
- ☒ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☒ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☒ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Very poor definition of bed and bank, no abrupt change.

Ephemeral upland swale.

Project ID: **Cross section ID:** **Date:** **Time:**

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____ % Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____ % Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Alton Coal
Project Number: 421
Stream: S17
Investigator(s): Jeff Boice, Collin Covington
Date: May 5, 2012 **Time:** 12:20 pm
Town: Alton **State:** Utah
Photo begin file#: 153 **Photo end file#:** 155

Y [X] / N [ ] Do normal circumstances exist on the site?

Y [ ] / N [X] Is the site significantly disturbed?

Location Details: South portion of project area

Projection: UTM **Datum:** NAD83
Coordinates: 369531 mE 4138498 mN

Potential anthropogenic influences on the channel system:

None

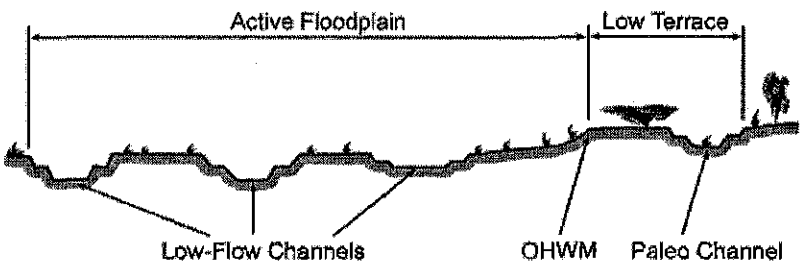
Brief site description:

Deeply incised, V-shaped drainage in a Pinyon-Juniper dominated landscape. Erosional landscape.

Checklist of resources (if available):

- [X] Aerial photography
  Dates: June 22, 2011
- [X] Topographic maps
- [ ] Geologic maps
- [ ] Vegetation maps
- [ ] Soils maps
- [ ] Rainfall/precipitation maps
- [ ] Existing delineation(s) for site
- [ ] Global positioning system (GPS)
- [ ] Other studies
- [ ] Stream gage data
  Gage number:
  Period of record:
  - [ ] History of recent effective discharges
  - [ ] Results of flood frequency analysis
  - [ ] Most recent shift-adjusted rating
  - [ ] Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units



Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

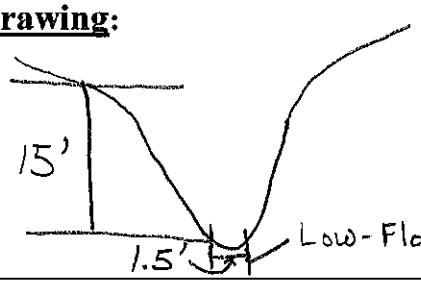
1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - [X] Mapping on aerial photograph
   - [ ] Digitized on computer
   - [X] GPS
   - [ ] Other:

Wentworth Size Classes

Inches (in)	Millimeters (mm)	Wentworth size class	
10.08	256	Boulder	Gravel
2.56	64	Cobble	
0.157	4	Pebble	
		Granule	
0.079	2.00	Very coarse sand	Sand
0.039	1.00	Coarse sand	
0.020	0.50	Medium sand	
1/2 0.0098	0.25	Fine sand	
1/4 0.005	0.125	Very fine sand	
1/8 0.0025	0.0625	Coarse silt	Silt
1/16 0.0012	0.031	Medium silt	
1/32 0.00061	0.0156	Fine silt	
1/64 0.00031	0.0078	Very fine silt	
1/128 0.00015	0.0039	Clay	Mud

Project ID: 421 **Cross section ID:** S17 **Date:** May 5, 2012 **Time:** 12:20 pm

Cross section drawing:



V-shaped channel
Low-Flow Channel covers the entire Active Floodplain

OHWM

GPS point: See location on front

Indicators:

- ☐ Change in average sediment texture
- ☐ Change in vegetation species
- ☐ Change in vegetation cover
- ☐ Break in bank slope
- ☐ Other: _____
- ☐ Other: _____

Comments:

No OHWM indicators.

Floodplain unit: ☒ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: Sand

Total veg cover: Ø % Tree: ____% Shrub: ____% Herb: ____%

Community successional stage:

- ☒ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☒ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Erosional sideslopes, pedestalling happening.

Upland drainage swale in erosional landscape.

Project ID: **Cross section ID:** **Date:** **Time:**

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____% Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____% Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Alton Coal
Project Number: 421
Stream: S18
Investigator(s): Jeff Boice, Collin Covington
Date: May 5, 2012 **Time:** 12:51 pm
Town: Alton **State:** Utah
Photo begin file#: 165 **Photo end file#:** 167

Y ☒ / N ☐ Do normal circumstances exist on the site?

Y ☐ / N ☒ Is the site significantly disturbed?

Location Details: South portion of project area.

Projection: UTM **Datum:** NAD83
Coordinates: 369249 mE 4138496 mN

Potential anthropogenic influences on the channel system:

None

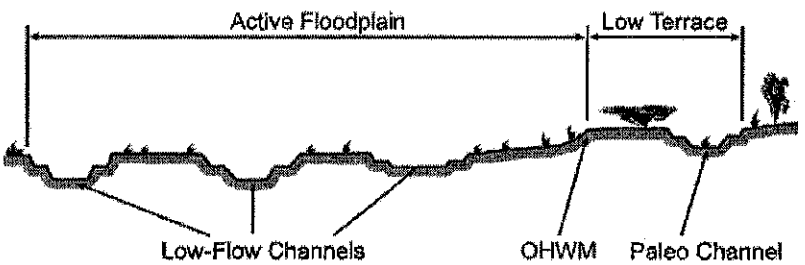
Brief site description:

Pinyon-Juniper, sagebrush, & upland herbacious vegetation on high terrace. Erosional landscape Ephemeral Channel w/ seeps & wetlands in lower portion.

Checklist of resources (if available):

- ☒ Aerial photography
  Dates: June 22, 2011
- ☒ Topographic maps
- ☐ Geologic maps
- ☐ Vegetation maps
- ☐ Soils maps
- ☐ Rainfall/precipitation maps
- ☐ Existing delineation(s) for site
- ☐ Global positioning system (GPS)
- ☐ Other studies
- ☐ Stream gage data
  Gage number:
  Period of record:
  - ☐ History of recent effective discharges
  - ☐ Results of flood frequency analysis
  - ☐ Most recent shift-adjusted rating
  - ☐ Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units



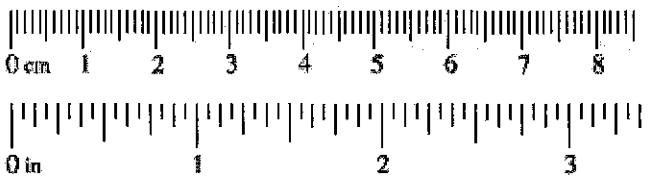
Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - ☒ Mapping on aerial photograph
   - ☐ Digitized on computer
   - ☒ GPS
   - ☐ Other:

Ephemeral stream channel 14

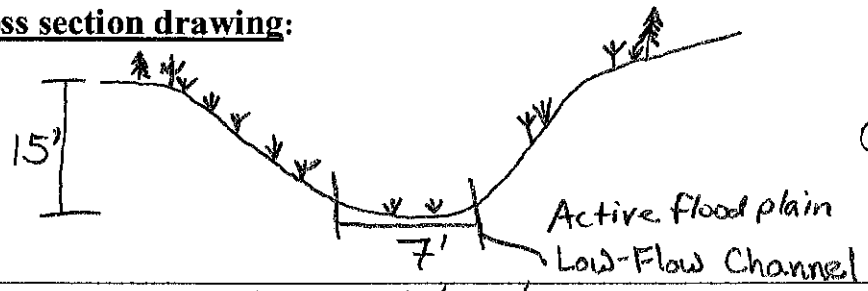
Wentworth Size Classes

Inches (in)	Millimeters (mm)	Wentworth size class	
10.08	256	Boulder	Gravel
2.56	64	Cobble	
0.157	4	Pebble	
		Granule	
0.079	2.00		
0.039	1.00	Very coarse sand	Sand
0.020	0.50	Coarse sand	
1/2 0.0098	0.25	Medium sand	
1/4 0.005	0.125	Fine sand	
1/8 0.0025	0.0625	Very fine sand	
1/16 0.0012	0.031	Coarse silt	Silt
1/32 0.00061	0.0156	Medium silt	
1/64 0.00031	0.0078	Fine silt	
1/128 0.00015	0.0039	Very fine silt	
		Clay	Mud



Project ID: 421 **Cross section ID:** S18 **Date:** May 5, 2012 **Time:** 12:51 pm

Cross section drawing:



Trough shaped channel, entrenched. Low-Flow Channel covers entire Active Floodplain. No distinct breaks.

OHWM = 7' wide

OHWM

ESC #14

GPS point: See location on front.

Indicators:

- [X] Change in average sediment texture
- [X] Change in vegetation species
- [X] Change in vegetation cover
- [X] Break in bank slope
- [ ] Other: _____
- [ ] Other: _____

Comments:

OHWM is in an entrenched channel and is width of active floodflain and low-flow channel

Floodplain unit: [X] Low-Flow Channel [ ] Active Floodplain [ ] Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: cobble, platy w/ rounding

Total veg cover: 10 % Tree: _____ % Shrub: 5 % Herb: ≥ 1 %

Community successional stage:

- [ ] NA
- [ ] Early (herbaceous & seedlings)
- [X] Mid (herbaceous, shrubs, saplings)
- [ ] Late (herbaceous, shrubs, mature trees)

Indicators:

- [ ] Mudcracks
- [ ] Ripples
- [X] Drift and/or debris
- [X] Presence of bed and bank
- [ ] Benches
- [ ] Soil development
- [ ] Surface relief
- [ ] Other: _____
- [ ] Other: _____
- [ ] Other: _____

Comments:

Ephemeral Stream Channel 14. Soil was moist that had evidence of salt wicking, salt on the surfaces of all particles.

Project ID: **Cross section ID:** **Date:** **Time:**

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____% Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____% Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Alton Coal
Project Number: 421
Stream: S19
Investigator(s): Jeff Boice, Collin Covington

Date: May 5, 2012 **Time:** 3:02 pm
Town: Alton **State:** Utah
Photo begin file#: 181 **Photo end file#:** 183

Y ☒ / N ☐ Do normal circumstances exist on the site?

Y ☐ / N ☒ Is the site significantly disturbed?

Location Details: Central portion of project area

Projection: UTM **Datum:** NAD83
Coordinates: 369808 mE 4139583 mN

Potential anthropogenic influences on the channel system:

None

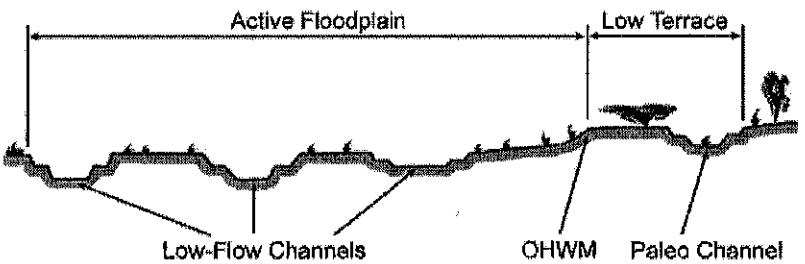
Brief site description:

Pinyon-Juniper with upland herbaceous understory, located in an incised hillslope drainage. Rock layers visible.

Checklist of resources (if available):

- ☒ Aerial photography
  Dates: June 22, 2011
- ☒ Topographic maps
- ☐ Geologic maps
- ☐ Vegetation maps
- ☐ Soils maps
- ☐ Rainfall/precipitation maps
- ☐ Existing delineation(s) for site
- ☐ Global positioning system (GPS)
- ☐ Other studies
- ☐ Stream gage data
  Gage number:
  Period of record:
  - ☐ History of recent effective discharges
  - ☐ Results of flood frequency analysis
  - ☐ Most recent shift-adjusted rating
  - ☐ Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units

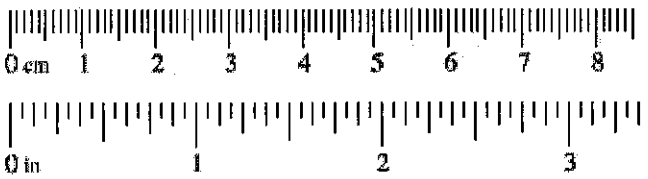


Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - ☒ Mapping on aerial photograph
   - ☐ Digitized on computer
   - ☒ GPS
   - ☐ Other:

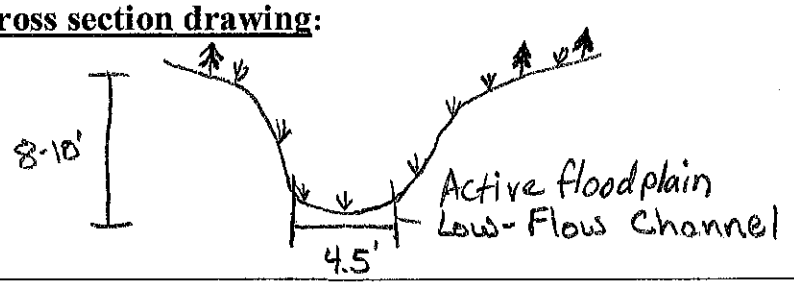
Wentworth Size Classes

Inches (in)	Millimeters (mm)	Wentworth size class	
10.08	256	Boulder	Gravel
2.56	64	Cobble	
0.157	4	Pebble	
		Granule	
0.079	2.00		
0.039	1.00	Very coarse sand	Sand
0.020	0.50	Coarse sand	
1/2 0.0098	0.25	Medium sand	
1/4 0.005	0.125	Fine sand	
		Very fine sand	
1/8 0.0025	0.0625		
1/16 0.0012	0.031	Coarse silt	Silt
1/32 0.00061	0.0156	Medium silt	
1/64 0.00031	0.0078	Fine silt	
		Very fine silt	
1/128 0.00015	0.0039		
		Clay	Mud



Project ID: 421 **Cross section ID:** S19 **Date:** May 5, 2012 **Time:** 3:02 pm

Cross section drawing:



U-shaped drainage of colluvial material

Low-Flow Channel is the Active Floodplain

OHWM

GPS point: See location on front

Indicators:

- ☐ Change in average sediment texture
- ☐ Change in vegetation species
- ☐ Change in vegetation cover
- ☐ Break in bank slope
- ☐ Other: _____
- ☐ Other: _____

Comments:

No OHWM indicators.

Floodplain unit: ☒ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: gravel, angular/platy

Total veg cover: ≥1 % Tree: ____ % Shrub: ____ % Herb: ≥1 %

Community successional stage:

- ☐ NA
- ☒ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☒ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Most of the material in the drainage is colluvial from the sides. Material isn't transported. No evidence of recent flow. Upland drainage swale.

Project ID: **Cross section ID:** **Date:** **Time:**

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____% Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____% Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Alton Coal
Project Number: 421
Stream: S20
Investigator(s): Jeff Boice, Collin Covington

Date: May 5, 2012 **Time:** 3:34 pm
Town: Alton **State:** Utah
Photo begin file#: 186 **Photo end file#:** 188

Y ☒ / N ☐ Do normal circumstances exist on the site?

Y ☐ / N ☒ Is the site significantly disturbed?

Location Details: Central portion of project area

Projection: UTM **Datum:** NAD83
Coordinates: 369773 mE 4139772 mN

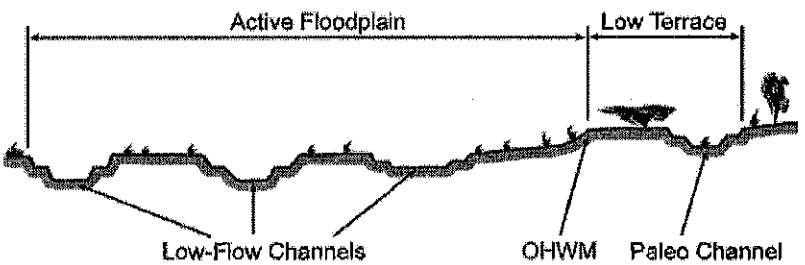
Potential anthropogenic influences on the channel system:
Newly constructed county road to the south is potentially adding increased runoff to the system.

Brief site description:
Sagebrush high terrace with a deeply incised Ephemeral Stream Channel 5.

Checklist of resources (if available):

- ☒ Aerial photography
  Dates: June 22, 2011
- ☒ Topographic maps
- ☐ Geologic maps
- ☐ Vegetation maps
- ☐ Soils maps
- ☐ Rainfall/precipitation maps
- ☐ Existing delineation(s) for site
- ☐ Global positioning system (GPS)
- ☐ Other studies
- ☐ Stream gage data
  Gage number:
  Period of record:
  - ☐ History of recent effective discharges
  - ☐ Results of flood frequency analysis
  - ☐ Most recent shift-adjusted rating
  - ☐ Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units



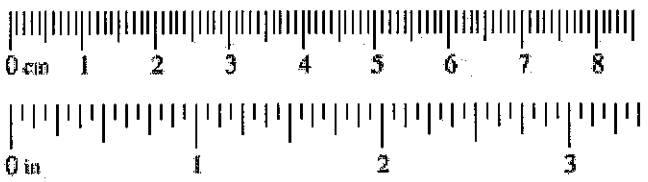
Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - ☒ Mapping on aerial photograph
   - ☐ Digitized on computer
   - ☒ GPS
   - ☐ Other:

Ephemeral Stream Channel 5

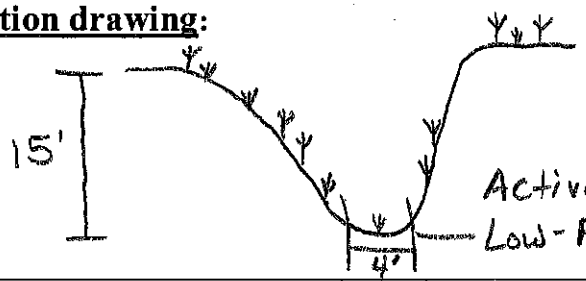
Wentworth Size Classes

Inches (in)	Millimeters (mm)	Wentworth size class	
10.08	256	Boulder	
		Cobble	Gravel
2.56	64		
0.157	4	Pebble	
		Granule	
0.079	2.00		
0.039	1.00	Very coarse sand	
		Coarse sand	
0.020	0.50		Sand
1/2 0.0098	0.25	Medium sand	
1/4 0.005	0.125	Fine sand	
1/8 0.0025	0.0625	Very fine sand	
1/16 0.0012	0.031	Coarse silt	
1/32 0.00061	0.0156	Medium silt	Silt
1/64 0.00031	0.0078	Fine silt	
1/128 0.00015	0.0039	Very fine silt	
		Clay	Mud



Project ID: 421 **Cross section ID:** S20 **Date:** May 5, 2012 **Time:** 3:34 pm

Cross section drawing:



V-shaped drainage entrenched in an upland meadow. Low-Flow channel covers entire Active Floodplain

OHWM = 4' wide

OHWM

ESC #5

GPS point: See location on front

Indicators:

- ☐ Change in average sediment texture
- ☒ Change in vegetation species
- ☒ Change in vegetation cover
- ☒ Break in bank slope
- ☐ Other: _____
- ☐ Other: _____

Comments:

Etching observed on sandy channel bottom from recent flow events.

Floodplain unit:

☒ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: Sand, 100%

Total veg cover: >1 % Tree: _____ % Shrub: _____ % Herb: >1 %

Community successional stage:

- ☐ NA
- ☒ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☒ Mudcracks
- ☐ Ripples
- ☒ Drift and/or debris
- ☒ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☒ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Vegetation is a Poa sp. Evidence of recent flow with surface etching in sand.

Ephemeral Stream Channel 5

Project ID: **Cross section ID:** **Date:** **Time:**

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____% Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____% Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Alton Coal
Project Number: 421
Stream: S21, Lower Robinson Creek
Investigator(s): Jeff Boice, Collin Covington
Date: May 5, 2012 **Time:** 3:50 pm
Town: Alton **State:** Utah
Photo begin file#: 189 **Photo end file#:** 191

Y ☒ / N ☐ Do normal circumstances exist on the site?

Y ☐ / N ☒ Is the site significantly disturbed?

Location Details: Central portion of project area. Lower Robinson Creek.

Projection: UTM **Datum:** NAD 83
Coordinates: 369802 mE 4139856 mN

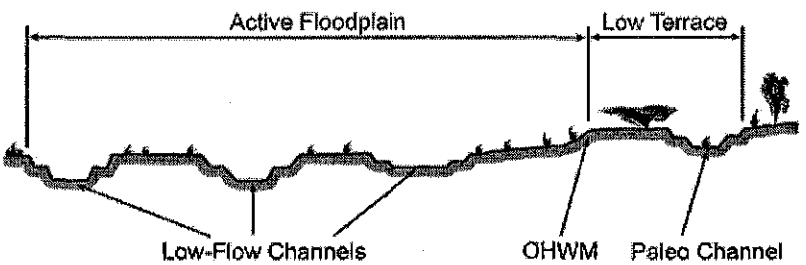
Potential anthropogenic influences on the channel system:
None

Brief site description:
Sagebrush high terrace meadow that drops into Lower Robinson Creek, entrenched Intermittent Stream Channel 1, w/ floodplain widening.

Checklist of resources (if available):

- ☒ Aerial photography
  Dates: June 22, 2011
- ☒ Topographic maps
- ☐ Geologic maps
- ☐ Vegetation maps
- ☐ Soils maps
- ☐ Rainfall/precipitation maps
- ☐ Existing delineation(s) for site
- ☐ Global positioning system (GPS)
- ☐ Other studies
- ☐ Stream gage data
  Gage number:
  Period of record:
  - ☐ History of recent effective discharges
  - ☐ Results of flood frequency analysis
  - ☐ Most recent shift-adjusted rating
  - ☐ Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units



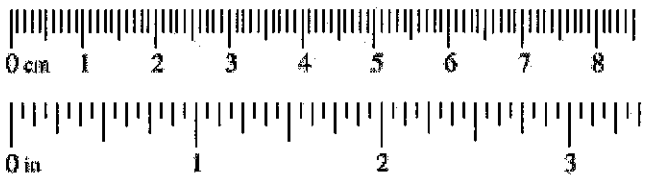
Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - ☒ Mapping on aerial photograph
   - ☐ Digitized on computer
   - ☒ GPS
   - ☐ Other:

Intermittent Stream Channel 1
Lower Robinson Creek

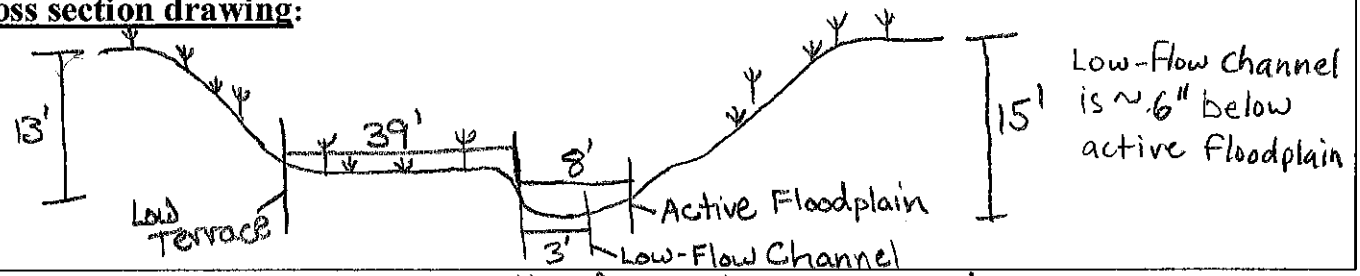
Wentworth Size Classes

Inches (in)	Millimeters (mm)	Wentworth size class	
10.08	256	Boulder	
2.56	64	Cobble	Gravel
0.157	4	Pebble	
0.079	2.00	Granule	
0.039	1.00	Very coarse sand	
0.020	0.50	Coarse sand	
1/2 0.0098	0.25	Medium sand	Sand
1/4 0.005	0.125	Fine sand	
1/8 0.0025	0.0625	Very fine sand	
1/16 0.0012	0.031	Coarse silt	
1/32 0.00061	0.0158	Medium silt	Silt
1/64 0.00031	0.0078	Fine silt	
1/128 0.00015	0.0039	Very fine silt	
		Clay	Mud



Project ID: 421 **Cross section ID:** S21 **Date:** May 5, 2012 **Time:** 3:50 pm

Cross section drawing:



OHWM = active floodplain = 8-feet wide

OHWM

ISC #1

GPS point: See location on front

Indicators:

- [x] Change in average sediment texture
- [x] Change in vegetation species
- [x] Change in vegetation cover
- [x] Break in bank slope
- [ ] Other: _____
- [ ] Other: _____

Comments:

Channel bed saturated across Active Floodplain, salt deposits left on all sediment. Fine material is burying pebbles in Intermittent Stream Channel...

Floodplain unit: [x] Low-Flow Channel [ ] Active Floodplain [ ] Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: pebble, rounded

Total veg cover: Ø % Tree: ____% Shrub: ____% Herb: ____%

Community successional stage:

- [x] NA
- [ ] Early (herbaceous & seedlings)
- [ ] Mid (herbaceous, shrubs, saplings)
- [ ] Late (herbaceous, shrubs, mature trees)

Indicators:

- [ ] Mudcracks
- [x] Ripples
- [x] Drift and/or debris
- [x] Presence of bed and bank
- [x] Benches
- [ ] Soil development
- [x] Surface relief
- [ ] Other: _____
- [ ] Other: _____
- [ ] Other: _____

Comments:

Buried pebbles in the fine material.

Project ID: 421 **Cross section ID:** S21 **Date:** May 5, 2012 **Time:** 3:50 pm

Floodplain unit: ☐ Low-Flow Channel ☒ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: pebble, rounded buried in fine material

Total veg cover: ≥1 % Tree: ____% Shrub: ____% Herb: ≥1 %

Community successional stage:

- ☒ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☒ Mudcracks
- ☐ Ripples
- ☒ Drift and/or debris
- ☒ Presence of bed and bank
- ☒ Benches
- ☐ Soil development
- ☒ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Salt crusting on outcrops. Moist to nearly saturated.

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☒ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: silt

Total veg cover: 80 % Tree: ____% Shrub: 30 % Herb: 50 %

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☒ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☒ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

~ 2' above bottom of channel. No OHWM indicators.

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Alton Coal
Project Number: 421
Stream: S22
Investigator(s): Jeff Boice, Collin Covington
Date: May 6, 2012 **Time:** 9:10 am
Town: Alton **State:** Utah
Photo begin file#: 202 **Photo end file#:** 204

Y [X] / N [ ] Do normal circumstances exist on the site?

Y [ ] / N [X] Is the site significantly disturbed?

Location Details: Central portion of project area.

Projection: UTM **Datum:** NAD 83
Coordinates: 369710 mE 4140092 mN

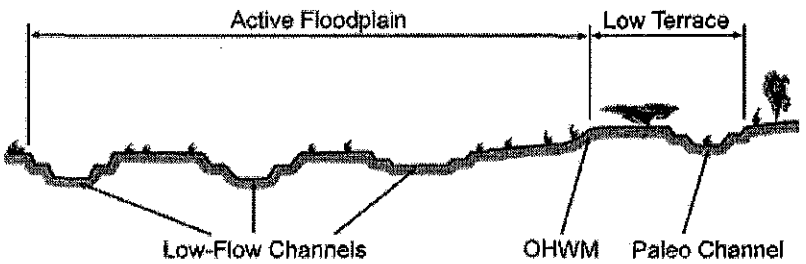
Potential anthropogenic influences on the channel system:
None

Brief site description:
~20% hillslope in a Pinyon-Juniper, scrub/shrub landscape. Eroded form to show bedrock. The drainage drops into alluvial fan & terminates to overland flow.

Checklist of resources (if available):

- [X] Aerial photography
  Dates: June 22, 2011
- [X] Topographic maps
- [ ] Geologic maps
- [ ] Vegetation maps
- [ ] Soils maps
- [ ] Rainfall/precipitation maps
- [ ] Existing delineation(s) for site
- [ ] Global positioning system (GPS)
- [ ] Other studies
- [ ] Stream gage data
  Gage number:
  Period of record:
  - [ ] History of recent effective discharges
  - [ ] Results of flood frequency analysis
  - [ ] Most recent shift-adjusted rating
  - [ ] Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units



Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

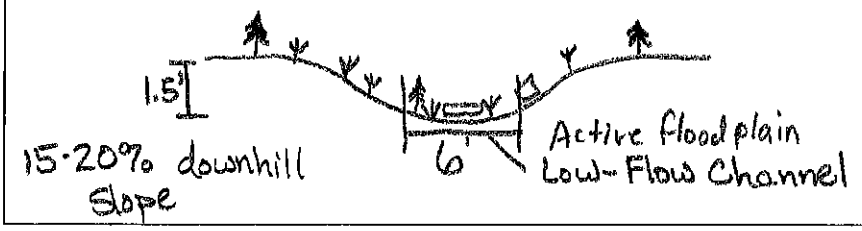
1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - [X] Mapping on aerial photograph
   - [ ] Digitized on computer
   - [X] GPS
   - [ ] Other:

Wentworth Size Classes

Inches (in)	Millimeters (mm)	Wentworth size class	
10.08	256	Boulder	
		Cobble	Gravel
2.56	64		
0.157	4	Pebble	
		Granule	
0.079	2.00		
0.039	1.00	Very coarse sand	
0.020	0.50	Coarse sand	
1/2 0.0098	0.25	Medium sand	Sand
1/4 0.005	0.125	Fine sand	
1/8 0.0025	0.0625	Very fine sand	
1/16 0.0012	0.031	Coarse silt	
1/32 0.00061	0.0156	Medium silt	Silt
1/64 0.00031	0.0078	Fine silt	
1/128 0.00015	0.0039	Very fine silt	
		Clay	Mud

Project ID: 421 **Cross section ID:** S22 **Date:** May 6, 2012 **Time:** 9:10 am

Cross section drawing:



U-shaped drainage.
Low-Flow Channel encompasses entire Active Floodplain.

OHWM

GPS point: See location on front

Indicators:

- ☐ Change in average sediment texture
- ☐ Change in vegetation species
- ☐ Change in vegetation cover
- ☐ Break in bank slope
- ☐ Other: _____
- ☐ Other: _____

Comments:

No OHWM indicators.

Floodplain unit: ☒ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: pebble, course angular

Total veg cover: 14 % Tree: 10 % Shrub: 2 % Herb: 2 %

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☒ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☒ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Drainage is not distinct from overall slope. No OHWM Steep, upland drainage swale. Large boulders present in channel.

Project ID: **Cross section ID:** **Date:** **Time:**

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____ % Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____ % Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Alton Coal | **Date:** May 6, 2012 | **Time:** 9:59 am
Project Number: 421 | **Town:** Alton | **State:** Utah
Stream: S23 | **Photo begin file#:** 223 | **Photo end file#:** 225
Investigator(s): Jeff Boice, Collin Covington

Y ☒ / N ☐ Do normal circumstances exist on the site?

Y ☒ / N ☐ Is the site significantly disturbed?

Location Details: Central portion of project area.

Projection: UTM **Datum:** NAD 83
Coordinates: 369913 m E 4140059 m N

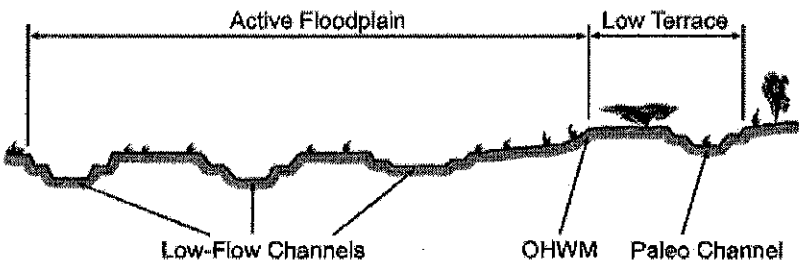
Potential anthropogenic influences on the channel system:
County road has potentially increased fine sediments and concentrated flows.

Brief site description:
Pinyon-Juniper and Sagebrush landscape. Upper portion above culvert is sagebrush & lower end is entrenched, V-shaped channel in sagebrush.

Checklist of resources (if available):

- ☒ Aerial photography
  Dates: June 22, 2011
- ☒ Topographic maps
- ☐ Geologic maps
- ☐ Vegetation maps
- ☐ Soils maps
- ☐ Rainfall/precipitation maps
- ☐ Existing delineation(s) for site
- ☐ Global positioning system (GPS)
- ☐ Other studies
- ☐ Stream gage data
  Gage number:
  Period of record:
- ☐ History of recent effective discharges
- ☐ Results of flood frequency analysis
- ☐ Most recent shift-adjusted rating
- ☐ Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units



Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

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2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
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   a) Record the floodplain unit and GPS position.
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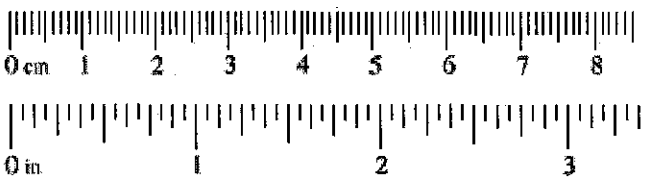
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - ☒ Mapping on aerial photograph
   - ☐ Digitized on computer
   - ☒ GPS
   - ☐ Other:

Ephemeral stream channel 6

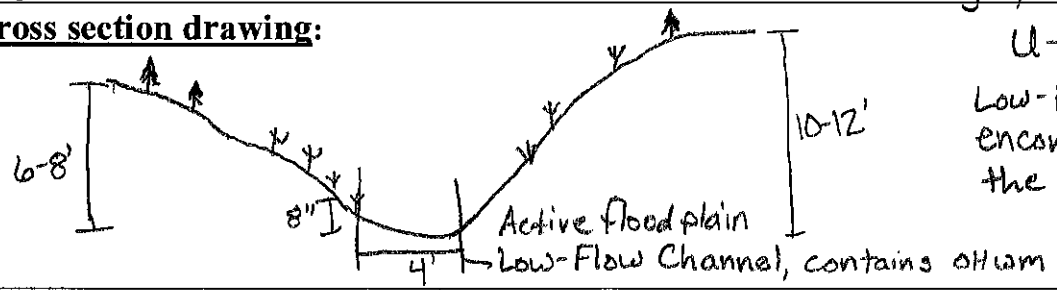
Wentworth Size Classes

Inches (in)	Millimeters (mm)	Wentworth size class	
10.08	256	Boulder	Gravel
2.56	64	Cobble	
0.157	4	Pebble	
		Granule	
0.079	2.00	Very coarse sand	Sand
0.039	1.00	Coarse sand	
0.020	0.50	Medium sand	
1/2 0.0098	0.25	Fine sand	
1/4 0.005	0.125	Very fine sand	
1/8 0.0025	0.0625	Coarse silt	Silt
1/16 0.0012	0.031	Medium silt	
1/32 0.00061	0.0156	Fine silt	
1/64 0.00031	0.0078	Very fine silt	
1/128 0.00015	0.0039	Clay	Mud



Project ID: 421 **Cross section ID:** S23 **Date:** May 6, 2012 **Time:** 9:59 am

Cross section drawing:



U-shaped channel
Low-Flow Channel encompasses all of the Active Floodplain

OHWM = 4' WIDE

OHWM

ESC #6

GPS point: See location on front

Indicators:

- [X] Change in average sediment texture
- [ ] Change in vegetation species
- [X] Change in vegetation cover
- [X] Break in bank slope
- [ ] Other: _____
- [ ] Other: _____

Comments:

Sidewalls are finer than what's in the channel. Particle size & sorting is minimal.

Ephemeral Stream Channel (p

Floodplain unit:

- [X] Low-Flow Channel
- [ ] Active Floodplain
- [ ] Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: pebble, platy & angular

Total veg cover: Ø % Tree: ____% Shrub: ____% Herb: ____%

Community successional stage:

- [X] NA
- [ ] Early (herbaceous & seedlings)
- [ ] Mid (herbaceous, shrubs, saplings)
- [ ] Late (herbaceous, shrubs, mature trees)

Indicators:

- [X] Mudcracks
- [ ] Ripples
- [X] Drift and/or debris
- [X] Presence of bed and bank
- [ ] Benches
- [ ] Soil development
- [X] Surface relief
- [ ] Other: _____
- [ ] Other: _____
- [ ] Other: _____

Comments:

Fine sandy material deposits behind obstructions. Thin veneers of fine material on top of cobble. Portions of channel the soil is moist.

Project ID: **Cross section ID:** **Date:** **Time:**

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____ % Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____ % Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Alton Coal
Project Number: 421
Stream: S24
Investigator(s): Jeff Boice, Collin Covington

Date: May 6, 2012 **Time:** 11:10 am
Town: Alton **State:** Utah
Photo begin file#: 237 **Photo end file#:** 239

Y [X] / N [ ] Do normal circumstances exist on the site?

Y [ ] / N [X] Is the site significantly disturbed?

Location Details: Central portion of project area.

Projection: UTM **Datum:** NAD83
Coordinates: 370410 mE 4140277m N

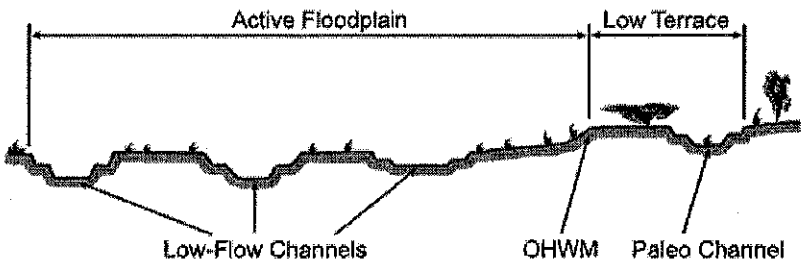
Potential anthropogenic influences on the channel system:
None

Brief site description: Sagebrush high terrace & slopes, deeply incised & actively eroding channel. ~20-25' deep, dissected country with many gully drainages entering channel, no OHWM indicators in those.

Checklist of resources (if available):

- [X] Aerial photography
  Dates: June 22, 2011
- [X] Topographic maps
- [ ] Geologic maps
- [ ] Vegetation maps
- [ ] Soils maps
- [ ] Rainfall/precipitation maps
- [ ] Existing delineation(s) for site
- [ ] Global positioning system (GPS)
- [ ] Other studies
- [ ] Stream gage data
  Gage number:
  Period of record:
  - [ ] History of recent effective discharges
  - [ ] Results of flood frequency analysis
  - [ ] Most recent shift-adjusted rating
  - [ ] Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units



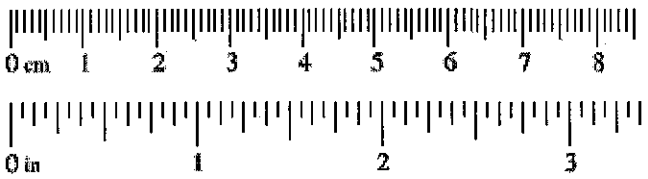
Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - [X] Mapping on aerial photograph
   - [ ] Digitized on computer
   - [X] GPS
   - [ ] Other:

Ephemeral Stream channel 7

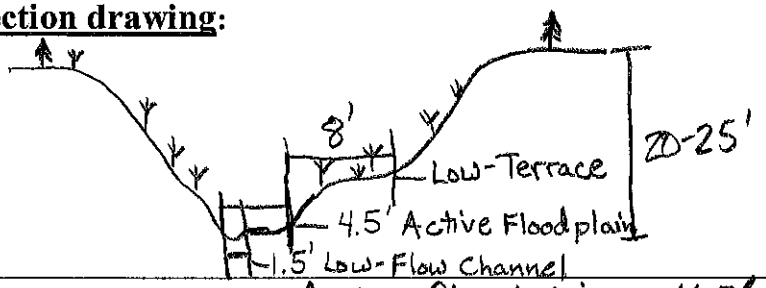
Wentworth Size Classes

Inches (in)	Millimeters (mm)	Wentworth size class	
10.08	256	Boulder	Gravel
2.56	64	Cobble	Gravel
0.157	4	Pebble	Gravel
		Granule	Gravel
0.079	2.00		
0.039	1.00	Very coarse sand	Sand
0.020	0.50	Coarse sand	Sand
1/2 0.0098	0.25	Medium sand	Sand
1/4 0.005	0.125	Fine sand	Sand
		Very fine sand	Sand
1/8 0.0025	0.0625		
1/16 0.0012	0.031	Coarse silt	Silt
1/32 0.00061	0.0156	Medium silt	Silt
1/64 0.00031	0.0078	Fine silt	Silt
		Very fine silt	Silt
1/128 0.00015	0.0039		
		Clay	Mud



Project ID: 421 **Cross section ID:** S24 **Date:** May 6, 2012 **Time:** 11:10 am

Cross section drawing:



OHWM = Active floodplain = 4.5'

OHWM

ESC #7

GPS point: See location on front

Indicators:

- [x] Change in average sediment texture
- [x] Change in vegetation species
- [x] Change in vegetation cover
  - Minimal
- [x] Break in bank slope
- [ ] Other: _____
- [ ] Other: _____

Comments:

Rapid weathering off slopes.

OHWM is present.

Floodplain unit: [x] Low-Flow Channel [ ] Active Floodplain [ ] Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: Sand

Total veg cover: ≥ 1 % Tree: ____% Shrub: ____% Herb: ≥ 1 %

Community successional stage:

- [ ] NA
- [x] Early (herbaceous & seedlings)
- [ ] Mid (herbaceous, shrubs, saplings)
- [ ] Late (herbaceous, shrubs, mature trees)

Indicators:

- [x] Mudcracks
- [x] Ripples
- [x] Drift and/or debris
- [x] Presence of bed and bank
- [ ] Benches
- [ ] Soil development
- [x] Surface relief
- [ ] Other: _____
- [ ] Other: _____
- [ ] Other: _____

Comments:

—

Project ID: 421 **Cross section ID:** S24 **Date:** May 6, 2012 **Time:** 11:10 am

Floodplain unit: ☐ Low-Flow Channel ☒ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: pebble, course, angular platy

Total veg cover: ≥ 1 % Tree: ____ % Shrub: ____ % Herb: ≥ 1 %

Community successional stage:

- ☐ NA
- ☒ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☒ Drift and/or debris
- ☒ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☒ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Rapid erosion.

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☒ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: silt

Total veg cover: 70 % Tree: ____ % Shrub: 70 % Herb: ____ %

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☒ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

—

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Alton Coal
Project Number: 421
Stream: S25
Investigator(s): Jeff Boice, Collin Covington

Date: May 6, 2012 **Time:** 12:10 pm
Town: Alton **State:** Utah
Photo begin file#: 257 **Photo end file#:** 259

Y [X] / N [ ] Do normal circumstances exist on the site?

Y [ ] / N [X] Is the site significantly disturbed?

Location Details: Central portion of project area.

Projection: UTM **Datum:** NAD 83
Coordinates: 370736 mE 4141033 mN

Potential anthropogenic influences on the channel system:

None

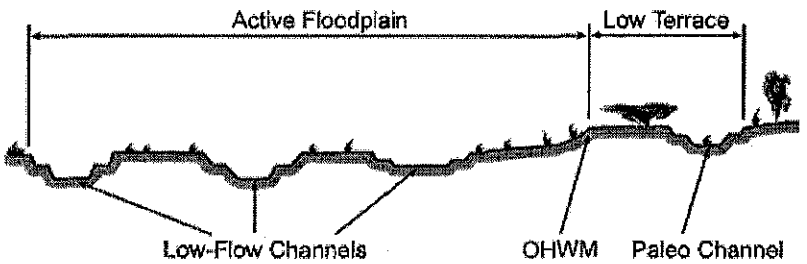
Brief site description:

Pinyon-Juniper & sagebrush high terrace landscape that continues down drainage hillslope.

Checklist of resources (if available):

- [X] Aerial photography
  Dates: June 22, 2011
- [X] Topographic maps
- [ ] Geologic maps
- [ ] Vegetation maps
- [ ] Soils maps
- [ ] Rainfall/precipitation maps
- [ ] Existing delineation(s) for site
- [ ] Global positioning system (GPS)
- [ ] Other studies
- [ ] Stream gage data
  Gage number:
  Period of record:
  - [ ] History of recent effective discharges
  - [ ] Results of flood frequency analysis
  - [ ] Most recent shift-adjusted rating
  - [ ] Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units

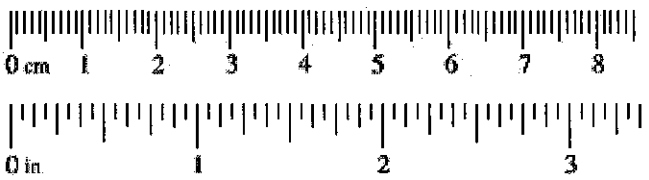


Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - [X] Mapping on aerial photograph
   - [ ] Digitized on computer
   - [X] GPS
   - [ ] Other:

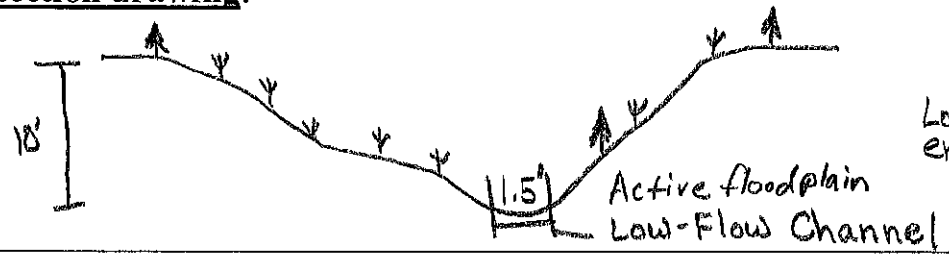
Wentworth Size Classes

Inches (in)	Millimeters (mm)	Wentworth size class	
10.08	256	Boulder	Gravel
2.56	64	Cobble	
0.157	4	Pebble	
		Granule	
0.079	2.00		
0.039	1.00	Very coarse sand	Sand
0.020	0.50	Coarse sand	
1/2 0.0098	0.25	Medium sand	
1/4 0.005	0.125	Fine sand	
		Very fine sand	
1/8 0.0025	0.0625		
1/16 0.0012	0.031	Coarse silt	Silt
1/32 0.00061	0.0156	Medium silt	
1/64 0.00031	0.0078	Fine silt	
		Very fine silt	
1/128 0.00015	0.0039		
		Clay	Mud



Project ID: 421 **Cross section ID:** S25 **Date:** May 6, 2012 **Time:** 12:10 pm

Cross section drawing:



U-shaped drainage.
Low-Flow Channel encompasses entire Active Floodplain

OHWM

GPS point: See location on front

Indicators:

- ☐ Change in average sediment texture
- ☐ Change in vegetation species
- ☐ Change in vegetation cover
- ☐ Break in bank slope
- ☐ Other: _____
- ☐ Other: _____

Comments:

No OHWM indicators

Floodplain unit: ☒ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: silt

Total veg cover: ≥1 % Tree: ____% Shrub: ____% Herb: ≥1 %

Community successional stage:

- ☐ NA
- ☒ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☒ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☒ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

No evidence of etching from Low-Flows. Loose, unconsolidated sediment. Upland drainage swale.

Project ID: **Cross section ID:** **Date:** **Time:**

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____ % Tree: _____ % Shrub: _____ % Herb: _____ %

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____ % Tree: _____ % Shrub: _____ % Herb: _____ %

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Alton Coal
Project Number: 421
Stream: S26
Investigator(s): Jeff Boice, Collin Covington

Date: May 6, 2012 **Time:** 12:55 pm
Town: Alton **State:** Utah
Photo begin file#: 268 **Photo end file#:** 270

Y [X] / N [ ] Do normal circumstances exist on the site?

Y [ ] / N [X] Is the site significantly disturbed?

Location Details: Central portion of project area.

Projection: UTM **Datum:** NAD 83
Coordinates: 370637 mE 4140556 mN

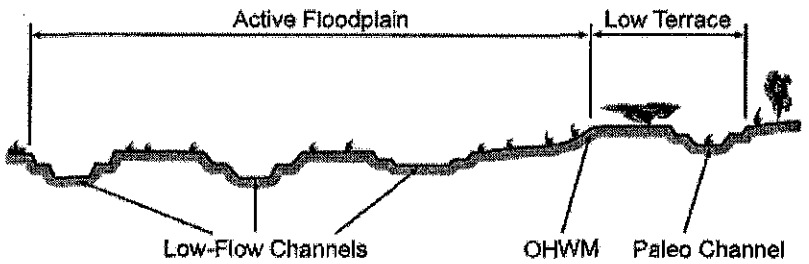
Potential anthropogenic influences on the channel system:
None

Brief site description:
Sagebrush & upland herbacious vegetation landscape. Multiple flow paths across landscape without OHWM that converge to this central drainage.

Checklist of resources (if available):

- [X] Aerial photography
  Dates: June 22, 2011
- [X] Topographic maps
- [ ] Geologic maps
- [ ] Vegetation maps
- [ ] Soils maps
- [ ] Rainfall/precipitation maps
- [ ] Existing delineation(s) for site
- [ ] Global positioning system (GPS)
- [ ] Other studies
- [ ] Stream gage data
  Gage number:
  Period of record:
  - [ ] History of recent effective discharges
  - [ ] Results of flood frequency analysis
  - [ ] Most recent shift-adjusted rating
  - [ ] Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units

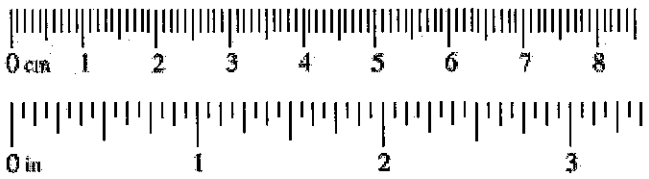


Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

1. Walk the channel and floodplain within the study area to get an inpression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - [X] Mapping on aerial photograph
   - [ ] Digitized on computer
   - [X] GPS
   - [ ] Other:

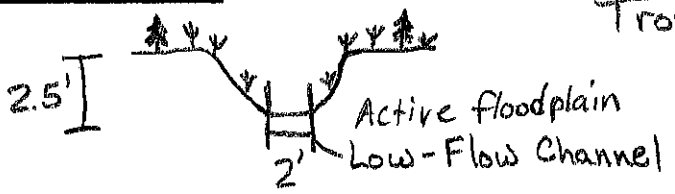
Wentworth Size Classes

Inches (in)	Millimeters (mm)	Wentworth size class	
10.08	256	Boulder	Gravel
2.56	64	Cobble	
0.157	4	Pebble	
		Granule	
0.079	2.00	Very coarse sand	Sand
0.039	1.00	Coarse sand	
0.020	0.50	Medium sand	
1/2 0.0098	0.25	Fine sand	
1/4 0.005	0.125	Very fine sand	
1/8 0.0025	0.0625	Coarse silt	Silt
1/16 0.0012	0.031	Medium silt	
1/32 0.00061	0.0156	Fine silt	
1/64 0.00031	0.0078	Very fine silt	
1/128 0.00015	0.0039	Clay	Mud



Project ID: 421 **Cross section ID:** S26 **Date:** May 6, 2012 **Time:** 12:55 pm

Cross section drawing:



Trough shaped drainage.
Low-Flow Channel encompasses the Active Floodplain

OHWM

GPS point: See location on front

Indicators:

- ☐ Change in average sediment texture
- ☐ Change in vegetation species
- ☐ Change in vegetation cover
- ☐ Break in bank slope
- ☐ Other: _____
- ☐ Other: _____

Comments:

No OHWM indicators. Vegetated hillslope with shrubs.

Floodplain unit: ☒ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: silt

Total veg cover: Ø % Tree: ____% Shrub: ____% Herb: ____%

Community successional stage:

- ☒ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☒ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☒ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

No evidence of recent flow. Drainage floor is flat, no etching. Upland drainage swale.

Project ID: **Cross section ID:** **Date:** **Time:**

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____ % Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____ % Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Alton Coal
Project Number: 421
Stream: S27
Investigator(s): Jeff Boice, Collin Covington

Date: May 6, 2012 **Time:** 1:23 pm
Town: Alton **State:** Utah
Photo begin file#: 278 **Photo end file#:** 280

Y [X] / N [ ] Do normal circumstances exist on the site?

Y [ ] / N [X] Is the site significantly disturbed?

Location Details: Central portion of project area.

Projection: UTM **Datum:** NAD83
Coordinates: 370525 mE 4140344 mN

Potential anthropogenic influences on the channel system:

None

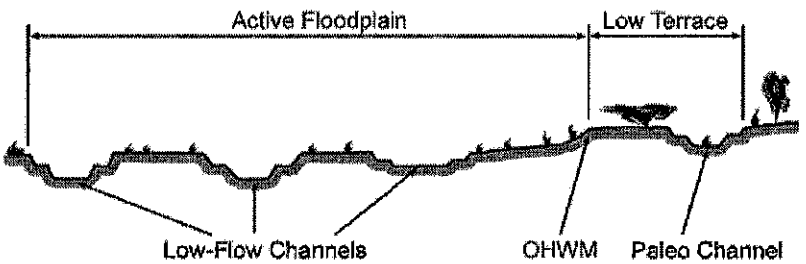
Brief site description:

Juniper, sagebrush, & upland grasses/forbs across the landscape. Entrenched, Ephemeral Stream Channel 8.

Checklist of resources (if available):

- [X] Aerial photography
  Dates: June 22, 2011
- [X] Topographic maps
- [ ] Geologic maps
- [ ] Vegetation maps
- [ ] Soils maps
- [ ] Rainfall/precipitation maps
- [ ] Existing delineation(s) for site
- [ ] Global positioning system (GPS)
- [ ] Other studies
- [ ] Stream gage data
  Gage number:
  Period of record:
  - [ ] History of recent effective discharges
  - [ ] Results of flood frequency analysis
  - [ ] Most recent shift-adjusted rating
  - [ ] Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units



Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - [X] Mapping on aerial photograph
   - [ ] Digitized on computer
   - [X] GPS
   - [ ] Other:

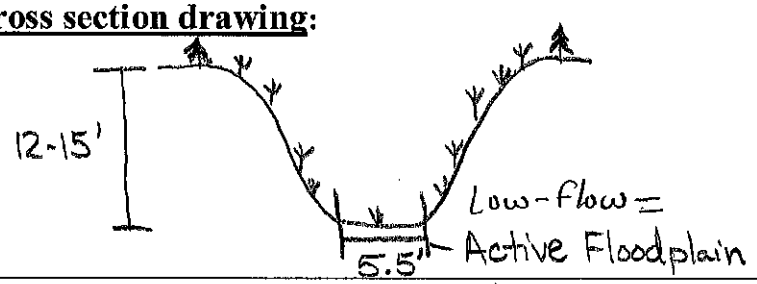
Ephemeral Stream Channel 8

Wentworth Size Classes

Inches (in)	Millimeters (mm)	Wentworth size class	
10.08	256	Boulder	Gravel
2.56	64	Cobble	
0.157	4	Pebble	
		Granule	
0.079	2.00	Very coarse sand	Sand
0.039	1.00	Coarse sand	
0.020	0.50	Medium sand	
1/2 0.0098	0.25	Fine sand	
1/4 0.005	0.125	Very fine sand	
1/8 0.0025	0.0625	Coarse silt	Silt
1/16 0.0012	0.031	Medium silt	
1/32 0.00061	0.0156	Fine silt	
1/64 0.00031	0.0078	Very fine silt	
1/128 0.00015	0.0039	Clay	Mud

Project ID: 421 **Cross section ID:** S27 **Date:** May 6, 2012 **Time:** 1:23 pm

Cross section drawing:



OHWM = 5.5' wide

U-shaped drainage. Trough shaped channel. Salt effervescence across the channel, soil is moist.

OHWM

ESC #8

GPS point: See location on front

Indicators:

- [x] Change in average sediment texture
- [ ] Change in vegetation species
- [x] Change in vegetation cover
- [x] Break in bank slope
- [ ] Other: _____
- [ ] Other: _____

Comments:

OHWM is marginal.

Floodplain unit: [ ] Low-Flow Channel [x] Active Floodplain [ ] Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: Cobble, angular & platy

Total veg cover: 2 % Tree: ____% Shrub: ____% Herb: 2 %

Community successional stage:

- [ ] NA
- [x] Early (herbaceous & seedlings)
- [ ] Mid (herbaceous, shrubs, saplings)
- [ ] Late (herbaceous, shrubs, mature trees)

Indicators:

- [x] Mudcracks
- [ ] Ripples
- [x] Drift and/or debris
- [x] Presence of bed and bank
- [ ] Benches
- [ ] Soil development
- [ ] Surface relief
- [ ] Other: _____
- [ ] Other: _____
- [ ] Other: _____

Comments:

Marginal channel.

Ephemeral Stream Channel 8

Project ID: **Cross section ID:** **Date:** **Time:**

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____ % Tree: _____ % Shrub: _____ % Herb: _____ %

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____ % Tree: _____ % Shrub: _____ % Herb: _____ %

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Alton Coal
Project Number: 421
Stream: S28
Investigator(s): Jeff Boice, Collin Covington
Date: May 6, 2012 **Time:** 3:22 pm
Town: Alton **State:** Utah
Photo begin file#: 292 **Photo end file#:** 294

Y [X] / N [ ] Do normal circumstances exist on the site?

Y [ ] / N [X] Is the site significantly disturbed?

Location Details: Western portion of project area.

Projection: UTM **Datum:** NAD83
Coordinates: 368891 m E 4140661 m N

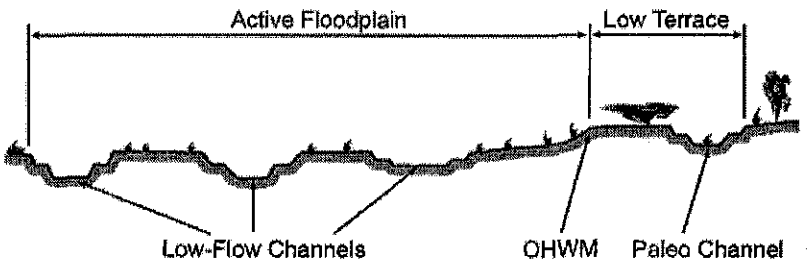
Potential anthropogenic influences on the channel system:
None

Brief site description:
10% hillslope in a Pinyon-Juniper / Gamble Oak landscape. Drainage is not very prevalent.

Checklist of resources (if available):

- [X] Aerial photography
  Dates: June 22, 2011
- [X] Topographic maps
- [ ] Geologic maps
- [ ] Vegetation maps
- [ ] Soils maps
- [ ] Rainfall/precipitation maps
- [ ] Existing delineation(s) for site
- [ ] Global positioning system (GPS)
- [ ] Other studies
- [ ] Stream gage data
  Gage number:
  Period of record:
  - [ ] History of recent effective discharges
  - [ ] Results of flood frequency analysis
  - [ ] Most recent shift-adjusted rating
  - [ ] Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units



Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

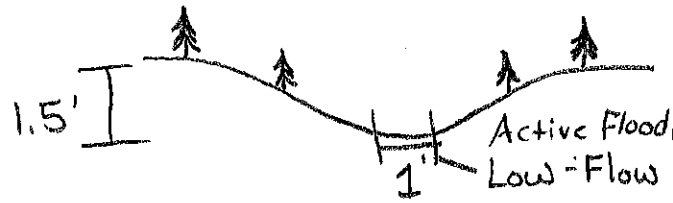
1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - [X] Mapping on aerial photograph
   - [ ] Digitized on computer
   - [X] GPS
   - [ ] Other:

Wentworth Size Classes

Inches (in)	Millimeters (mm)	Wentworth size class	
10.08	256	Boulder	Gravel
2.56	64	Cobble	
0.157	4	Pebble	
		Granule	
0.079	2.00	Very coarse sand	Sand
0.039	1.00	Coarse sand	
0.020	0.50	Medium sand	
1/2 0.0098	0.25	Fine sand	
1/4 0.005	0.125	Very fine sand	
1/8 0.0025	0.0625	Coarse silt	Silt
1/16 0.0012	0.031	Medium silt	
1/32 0.00061	0.0156	Fine silt	
1/64 0.00031	0.0078	Very fine silt	
1/128 0.00015	0.0039	Clay	Mud

Project ID: 421 **Cross section ID:** S28 **Date:** May 6, 2012 **Time:** 3:22 pm

Cross section drawing:



U-shaped drainage. Low-Flow channel encompasses the Active Floodplain

OHWM

GPS point: See location on front

Indicators:

- ☐ Change in average sediment texture
- ☐ Change in vegetation species
- ☐ Change in vegetation cover
- ☐ Break in bank slope
- ☐ Other: _____
- ☐ Other: _____

Comments:

No OHWM indicators.

Floodplain unit: ☒ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: pebble, course angular colluvium

Total veg cover: ~0 % Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- ☒ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

No indicators, Upland Drainage Swale. Crenulation in topography creates a path for periodic surface water to flow.

Project ID: **Cross section ID:** **Date:** **Time:**

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____ % Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____ % Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Alton Coal
Project Number: 421
Stream: S29
Investigator(s): Jeff Boice, Collin Covington

Date: May 6, 2012 **Time:** 3:49 pm
Town: Alton **State:** Utah
Photo begin file#: 301 **Photo end file#:** 303

Y [X] / N [ ] Do normal circumstances exist on the site?

Y [ ] / N [X] Is the site significantly disturbed?

Location Details: Western portion of project area.

Projection: UTM **Datum:** NAD83
Coordinates: 368905 m E 4140239 m N

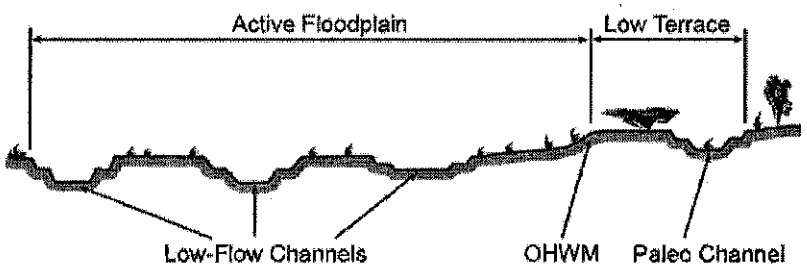
Potential anthropogenic influences on the channel system:
None

Brief site description: Pinyon-Juniper, Sagebrush, Gambel Oak landscape with the incised channel. Sandstone bedrock throughout channel, farther up-channel the particle size includes boulders. Ephemeral Stream Channel 9.

Checklist of resources (if available):

- [X] Aerial photography
  Dates: June 22, 2011
- [X] Topographic maps
- [ ] Geologic maps
- [ ] Vegetation maps
- [ ] Soils maps
- [ ] Rainfall/precipitation maps
- [ ] Existing delineation(s) for site
- [ ] Global positioning system (GPS)
- [ ] Other studies
- [ ] Stream gage data
  Gage number:
  Period of record:
  - [ ] History of recent effective discharges
  - [ ] Results of flood frequency analysis
  - [ ] Most recent shift-adjusted rating
  - [ ] Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units



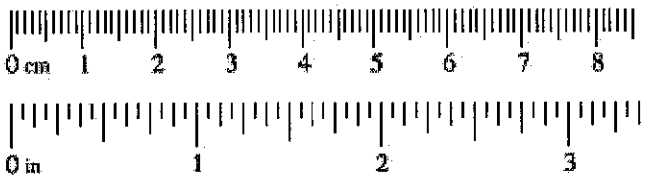
Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - [X] Mapping on aerial photograph
   - [ ] Digitized on computer
   - [X] GPS
   - [ ] Other:

Ephemeral Stream Channel 9

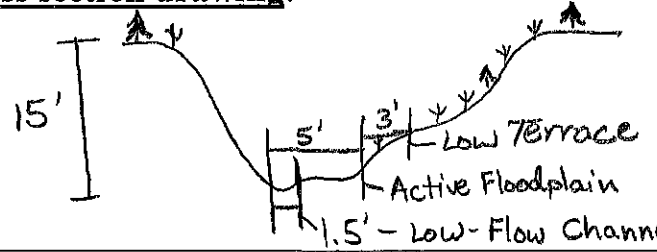
Wentworth Size Classes

Inches (in)	Millimeters (mm)	Wentworth size class	
10.08	256	Boulder	Gravel
2.56	64	Cobble	
0.157	4	Pebble	
		Granule	
0.079	2.00	Very coarse sand	Sand
0.039	1.00	Coarse sand	
0.020	0.50	Medium sand	
1/2 0.0098	0.25	Fine sand	
1/4 0.005	0.125	Very fine sand	
1/8 0.0025	0.0625	Coarse silt	Silt
1/16 0.0012	0.031	Medium silt	
1/32 0.00061	0.0156	Fine silt	
1/64 0.00031	0.0078	Very fine silt	
1/128 0.00015	0.0039	Clay	Mud



Project ID: 421 **Cross section ID:** S29 **Date:** May 6, 2012 **Time:** 3:49 pm

Cross section drawing:



Trough shaped channel. Deeply incised. Ephemeral Stream Channel 9

OHWM = Active floodplain = 5' wide

OHWM

ESC #9

GPS point: See location on front

Indicators:

- [X] Change in average sediment texture
- [X] Change in vegetation species
- [X] Change in vegetation cover
- [X] Break in bank slope, distinct
- [ ] Other: _____
- [ ] Other: _____

Comments:

Ephemeral channel with OHWM present

Floodplain unit: [X] Low-Flow Channel [ ] Active Floodplain [ ] Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: pebble, course angular

Total veg cover: Ø % Tree: ____% Shrub: ____% Herb: ____%

Community successional stage:

- [X] NA
- [ ] Early (herbaceous & seedlings)
- [ ] Mid (herbaceous, shrubs, saplings)
- [ ] Late (herbaceous, shrubs, mature trees)

Indicators:

- [X] Mudcracks
- [ ] Ripples
- [X] Drift and/or debris
- [X] Presence of bed and bank
- [ ] Benches
- [ ] Soil development
- [X] Surface relief
- [ ] Other: _____
- [ ] Other: _____
- [ ] Other: _____

Commeuts:

Meanders in & out of larger cobble & boulder sized material.

Project ID: 421 **Cross section ID:** S29 **Date:** May 6, 2012 **Time:** 3:49 pm

Floodplain unit: ☐ Low-Flow Channel ☒ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: Cobble, course angular

Total veg cover: ≥ 1 % Tree: _____ % Shrub: _____ % Herb: ≥ 1 %

Community successional stage:

- ☐ NA
- ☒ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☒ Drift and/or debris
- ☒ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☒ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Particle size ranges from boulder to gravel is not well sorted.

Ephemeral Stream Channel 9

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☒ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: pebble, course angular

Total veg cover: 80 % Tree: _____ % Shrub: 40 % Herb: 40 %

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☒ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

No indicators. Minor feature in this system.

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Alton Coal
Project Number: 421
Stream: S30
Investigator(s): Jeff Boice, Collin Covington

Date: May 6, 2012 **Time:** 4:09 pm
Town: Alton **State:** Utah
Photo begin file#: 304 **Photo end file#:** 307

Y ☒ / N ☐ Do normal circumstances exist on the site?

Y ☐ / N ☒ Is the site significantly disturbed?

Location Details: Western portion of project area.

Projection: UTM **Datum:** NAD83
Coordinates: 368940 mE 4140161 m N

Potential anthropogenic influences on the channel system:

None

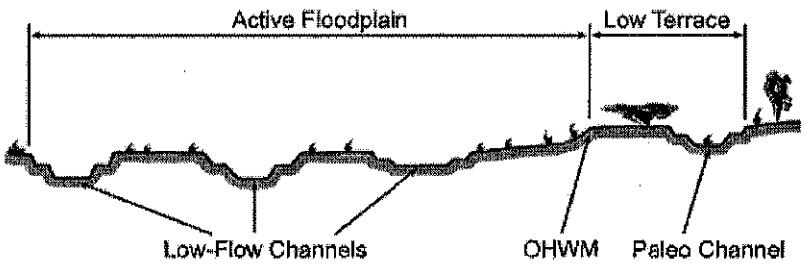
Brief site description:

Pinyon-Juniper, Sagebrush, Gambel oak, minimal upland herbacious vegetation. Incised channel. Ephemeral stream channel 15.

Checklist of resources (if available):

- ☒ Aerial photography
  Dates: June 22, 2011
- ☒ Topographic maps
- ☐ Geologic maps
- ☐ Vegetation maps
- ☐ Soils maps
- ☐ Rainfall/precipitation maps
- ☐ Existing delineation(s) for site
- ☐ Global positioning system (GPS)
- ☐ Other studies
- ☐ Stream gage data
  Gage number:
  Period of record:
  - ☐ History of recent effective discharges
  - ☐ Results of flood frequency analysis
  - ☐ Most recent shift-adjusted rating
  - ☐ Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units



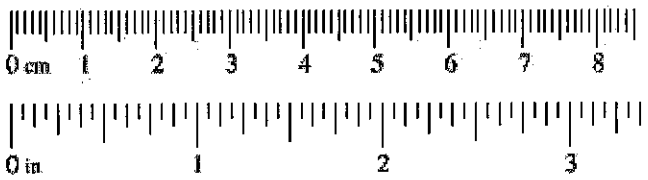
Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - ☒ Mapping on aerial photograph
   - ☐ Digitized on computer
   - ☒ GPS
   - ☐ Other:

Ephemeral Stream channel 15

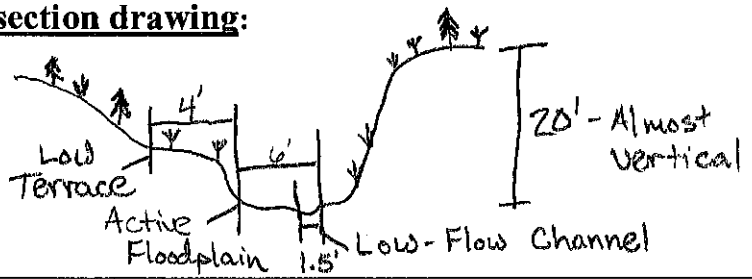
Wentworth Size Classes

Inches (in)	Millimeters (mm)	Wentworth size class	
10.08	256	Boulder	Gravel
2.56	64	Cobble	
0.157	4	Pebble	
		Granule	
0.079	2.00		
0.039	1.00	Very coarse sand	Sand
0.020	0.50	Coarse sand	
1/2 0.0098	0.25	Medium sand	
1/4 0.005	0.125	Fine sand	
1/8 0.0025	0.0625	Very fine sand	
1/16 0.0012	0.031	Coarse silt	Silt
1/32 0.00061	0.0156	Medium silt	
1/64 0.00031	0.0078	Fine silt	
1/128 0.00015	0.0039	Very fine silt	
		Clay	Mud



Project ID: 421 **Cross section ID:** S30 **Date:** May 6, 2012 **Time:** 4:09 pm

Cross section drawing:



Trough shaped channel.

Ephemeral Stream Channel 15

OHWM = Active floodplain = 6' wide

OHWM

ESC #15

GPS point: See location on front

Indicators:

- [x] Change in average sediment texture
- [ ] Change in vegetation species
- [ ] Change in vegetation cover
- [x] Break in bank slope
- [ ] Other: _____
- [ ] Other: _____

Comments:

Both banks have ravelling with the change in slope masked by it. Ephemeral flow regime.

Floodplain unit: [x] Low-Flow Channel [ ] Active Floodplain [ ] Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: pebble, rounded, veneer on large pieces

Total veg cover: Ø % Tree: ____% Shrub: ____% Herb: ____%

Community successional stage:

- [x] NA
- [ ] Early (herbaceous & seedlings)
- [ ] Mid (herbaceous, shrubs, saplings)
- [ ] Late (herbaceous, shrubs, mature trees)

Indicators:

- [x] Mudcracks
- [x] Ripples
- [x] Drift and/or debris
- [ ] Presence of bed and bank
- [ ] Benches
- [ ] Soil development
- [x] Surface relief
- [ ] Other: _____
- [ ] Other: _____
- [ ] Other: _____

Comments:

Very subtle break from Active Floodplain. Etched with cobble & gravel material.

Project ID: 421 **Cross section ID:** S30 **Date:** May 6, 2012 **Time:** 4:09 pm

Floodplain unit: ☐ Low-Flow Channel ☒ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: pebble, rounded platy

Total veg cover: 0 % Tree: ____% Shrub: ____% Herb: ____%

Community successional stage:

- ☒ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☒ Mudcracks
- ☒ Ripples
- ☒ Drift and/or debris
- ☒ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☒ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Evidence of channel imbrication.

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☒ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: course, gravel pavement

Total veg cover: 7 % Tree: ____% Shrub: 2 % Herb: 5 %

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☒ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

No indicators

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Alton Coal
Project Number: 421
Stream: S31
Investigator(s): Jeff Boice, Collin Covington

Date: May 7, 2012 **Time:** 10:21 am
Town: Alton **State:** Utah
Photo begin file#: 326 **Photo end file#:** 328

Y [X] / N [ ] Do normal circumstances exist on the site?

Y [ ] / N [X] Is the site significantly disturbed?

Location Details: Eastern portion of project area.

Projection: UTM **Datum:** NAD83
Coordinates: 371701 mE 4141097 mN

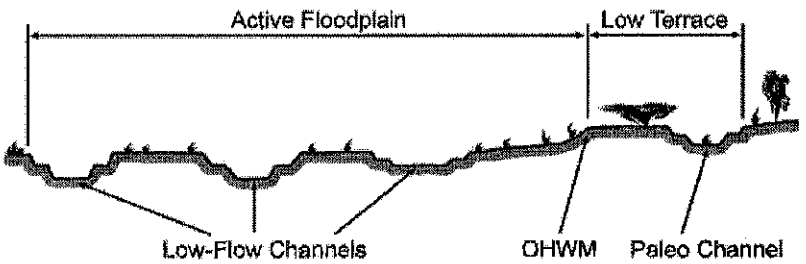
Potential anthropogenic influences on the channel system:
None

Brief site description:
Pinyon-Juniper, Sagebrush, Mahogany, scrub/shrub erosional landscape. Upland drainage swale.

Checklist of resources (if available):

- [X] Aerial photography
  Dates: June 22, 2011
- [X] Topographic maps
- [ ] Geologic maps
- [ ] Vegetation maps
- [ ] Soils maps
- [ ] Rainfall/precipitation maps
- [ ] Existing delineation(s) for site
- [ ] Global positioning system (GPS)
- [ ] Other studies
- [ ] Stream gage data
  Gage number:
  Period of record:
  - [ ] History of recent effective discharges
  - [ ] Results of flood frequency analysis
  - [ ] Most recent shift-adjusted rating
  - [ ] Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units

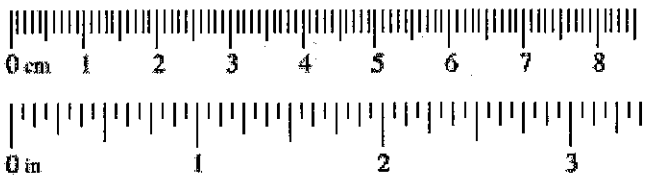


Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - [X] Mapping on aerial photograph
   - [ ] Digitized on computer
   - [X] GPS
   - [ ] Other:

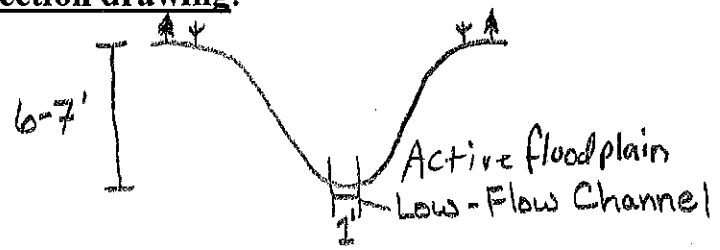
Wentworth Size Classes

Inches (in)	Millimeters (mm)	Wentworth size class	
10.08	256	Boulder	Gravel
2.56	64	Cobble	
0.157	4	Pebble	
		Granule	
0.079	2.00	Very coarse sand	Sand
0.039	1.00	Coarse sand	
0.020	0.50	Medium sand	
1/2 0.0098	0.25	Fine sand	
1/4 0.005	0.125	Very fine sand	
1/8 0.0025	0.0625	Coarse silt	Silt
1/16 0.0012	0.031	Medium silt	
1/32 0.00061	0.0156	Fine silt	
1/64 0.00031	0.0078	Very fine silt	
1/128 0.00015	0.0039	Clay	Mud



Project ID: 421 **Cross section ID:** S31 **Date:** May 7, 2012 **Time:** 10:21 am

Cross section drawing:



V-shaped drainage
Low-Flow Channel encompasses entire Active Floodplain

OHWM

GPS point: see location on front.

Indicators:

- ☐ Change in average sediment texture
- ☐ Change in vegetation species
- ☐ Change in vegetation cover
- ☐ Break in bank slope
- ☐ Other: _____
- ☐ Other: _____

Comments:

No OHWM indicators.

Floodplain unit: ☒ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: pebble, course angular platy

Total veg cover: ≥1 % Tree: ____% Shrub: ____% Herb: ≥1 %

Community successional stage:

- ☐ NA
- ☒ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☒ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☒ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Upland drainage swale, drainage has numerous headcuts indicating active entrenchment. Upper portion of drainage is more vegetated with upland species.

Project ID: **Cross section ID:** **Date:** **Time:**

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____% Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____% Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Alton Coal
Project Number: 421
Stream: S32
Investigator(s): Jeff Boice, Collin Covington

Date: May 7, 2012 **Time:** 11:02 am
Town: Alton **State:** Utah
Photo begin file#: 336 **Photo end file#:** 338

Y ☒ / N ☐ Do normal circumstances exist on the site?

Y ☐ / N ☒ Is the site significantly disturbed?

Location Details: Eastern portion of project area.

Projection: UTM **Datum:** NAD83
Coordinates: 371881 mE 4141088 m N

Potential anthropogenic influences on the channel system:

None

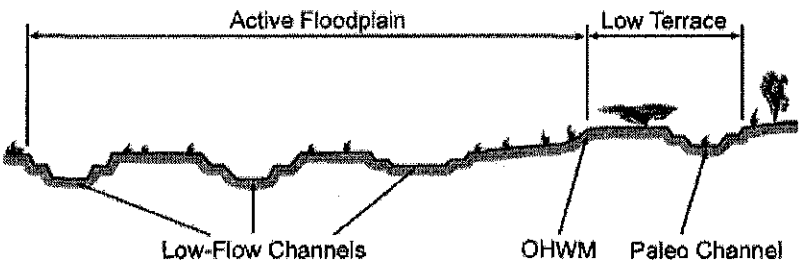
Brief site description:

Pinyon-Juniper, scrub/shrub landscape with a deeply incised upland drainage swale with evidence of mass failures shown in tension cracks.

Checklist of resources (if available):

- ☒ Aerial photography
  Dates: June 22, 2011
- ☒ Topographic maps
- ☐ Geologic maps
- ☐ Vegetation maps
- ☐ Soils maps
- ☐ Rainfall/precipitation maps
- ☐ Existing delineation(s) for site
- ☐ Global positioning system (GPS)
- ☐ Other studies
- ☐ Stream gage data
  Gage number:
  Period of record:
  - ☐ History of recent effective discharges
  - ☐ Results of flood frequency analysis
  - ☐ Most recent shift-adjusted rating
  - ☐ Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units

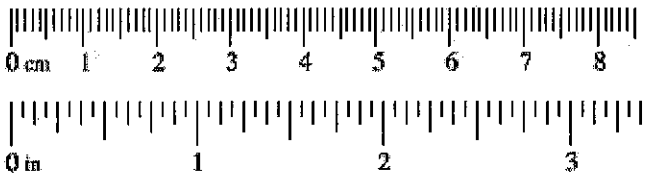


Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - ☒ Mapping on aerial photograph
   - ☐ Digitized on computer
   - ☒ GPS
   - ☐ Other:

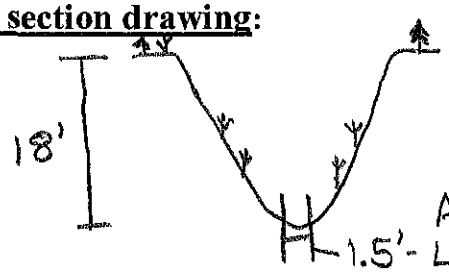
Wentworth Size Classes

Inches (in)	Millimeters (mm)	Wentworth size class	
10.08	256	Boulder	
		Cobble	Gravel
2.56	64		
		Pebble	
0.157	4		
		Granule	
0.079	2.00		
0.039	1.00	Very coarse sand	
0.020	0.50	Coarse sand	
1/2 0.0098	0.25	Medium sand	Sand
1/4 0.005	0.125	Fine sand	
1/8 0.0025	0.0625	Very fine sand	
1/16 0.0012	0.031	Coarse silt	
1/32 0.00061	0.0156	Medium silt	Silt
1/64 0.00031	0.0078	Fine silt	
1/128 0.00015	0.0039	Very fine silt	
		Clay	Mud



Project ID: 421 **Cross section ID:** S32 **Date:** May 7, 2012 **Time:** 11:02 am

Cross section drawing:



V-shaped drainage. Deep ravelling banks. Low-Flow Channel encompasses entire Active Floodplain.

OHWM

GPS point: see location on front

Indicators:

- ☐ Change in average sediment texture
- ☐ Change in vegetation species
- ☐ Change in vegetation cover
- ☐ Break in bank slope
- ☐ Other: _____
- ☐ Other: _____

Comments:

No OHWM indicators

Floodplain unit: ☒ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: Sand, same sediment as hillslope

Total veg cover: ≥1 % Tree: ____% Shrub: ____% Herb: ≥1 %

Community successional stage:

- ☐ NA
- ☒ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☒ Mudcracks
- ☐ Ripples
- ☒ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Recent flow indicated by minimal scouring. No indications of more frequent flow. Upland drainage swale.

Project ID: **Cross section ID:** **Date:** **Time:**

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____ % Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____ % Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Alton Coal
Project Number: 421
Stream: S33, Lower Robinson Creek
Investigator(s): Jeff Boice, Collin Covington

Date: May 7, 2012 **Time:** 12:07 pm
Town: Alton **State:** Utah
Photo begin file#: 348 **Photo end file#:** 350

Y ☒ / N ☐ Do normal circumstances exist on the site?

Y ☐ / N ☒ Is the site significantly disturbed?

Location Details: Eastern portion of project area. Lower Robinson Creek

Projection: UTM **Datum:** NAD83
Coordinates: 371806 m E 4140701 m N

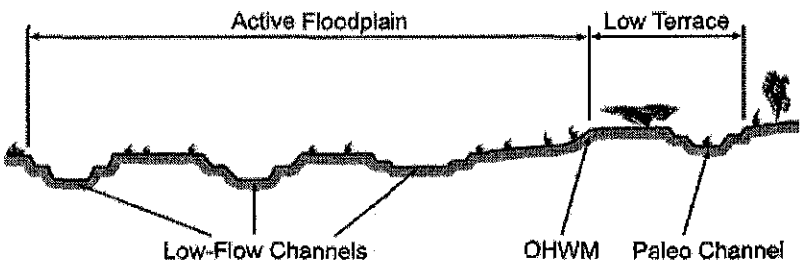
Potential anthropogenic influences on the channel system:
None

Brief site description:
Pinyon-Juniper, sagebrush, upland herbacious vegetated landscape. Deeply entrenched ~40', mass slumping along creek. Intermittent Stream Channel 1 upper portion

Checklist of resources (if available):

- ☒ Aerial photography
  Dates: June 22, 2011
- ☒ Topographic maps
- ☐ Geologic maps
- ☐ Vegetation maps
- ☐ Soils maps
- ☐ Rainfall/precipitation maps
- ☐ Existing delineation(s) for site
- ☐ Global positioning system (GPS)
- ☐ Other studies
- ☐ Stream gage data
  Gage number:
  Period of record:
- ☐ History of recent effective discharges
- ☐ Results of flood frequency analysis
- ☐ Most recent shift-adjusted rating
- ☐ Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units



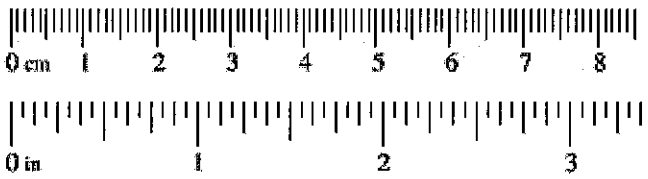
Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - ☒ Mapping on aerial photograph
   - ☐ Digitized on computer
   - ☒ GPS
   - ☐ Other:

Intermittent Stream Channel 1
Lower Robinson Creek

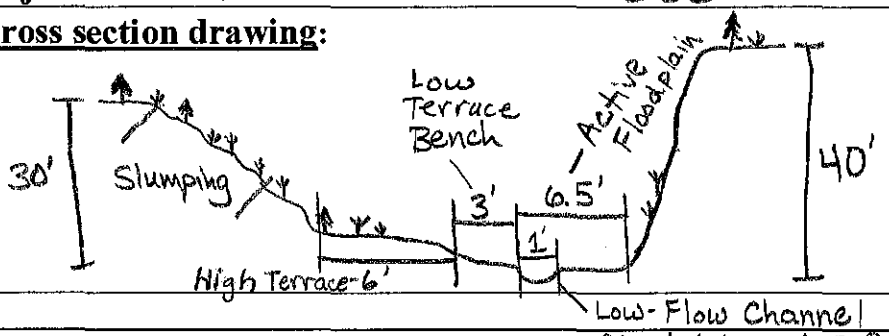
Wentworth Size Classes

Inches (in)	Millimeters (mm)	Wentworth size class	
10.08	256	Boulder	
		Cobble	Gravel
2.56	64		
0.157	4	Pebble	
		Granule	
0.079	2.00	Very coarse sand	
0.039	1.00	Coarse sand	
0.020	0.50	Medium sand	Sand
1/2 0.0098	0.25	Fine sand	
1/4 0.005	0.125	Very fine sand	
1/8 0.0025	0.0625	Coarse silt	
1/16 0.0012	0.031	Medium silt	Silt
1/32 0.00061	0.0156	Fine silt	
1/64 0.00031	0.0078	Very fine silt	
1/128 0.00015	0.0039	Clay	Mud



Project ID: 421 **Cross section ID:** S33 **Date:** May 7, 2012 **Time:** 12:07 pm

Cross section drawing:



Low-Flow Channel is ~2" below the Active Floodplain.

Salt effervescence on on the soil & rocks in the channel.

OHWM

OHWM = active floodplain = 6.5 feet wide

GPS point: See location on front

Indicators:

- [x] Change in average sediment texture
- [ ] Change in vegetation species
- [x] Change in vegetation cover
- [x] Break in bank slope
- [ ] Other: _____
- [ ] Other: _____

Comments:

OHWM present. Channel is located in the Intermittent Stream Channel 1.

Floodplain unit:

- [x] Low-Flow Channel
- [ ] Active Floodplain
- [ ] Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: granule, rounded

Total veg cover: ≥ 1 % Tree: ____ % Shrub: ____ % Herb: ≥ 1 %

Community successional stage:

- [ ] NA
- [ ] Early (herbaceous & seedlings)
- [ ] Mid (herbaceous, shrubs, saplings)
- [ ] Late (herbaceous, shrubs, mature trees)

Indicators:

- [ ] Mudcracks
- [ ] Ripples
- [x] Drift and/or debris
- [x] Presence of bed and bank
- [x] Benches
- [ ] Soil development
- [x] Surface relief
- [ ] Other: _____
- [ ] Other: _____
- [ ] Other: _____

Comments:

Excess of sediment buries the courser material. Sediment is saturated.

Project ID: 421 **Cross section ID:** S33 **Date:** May 7, 2012 **Time:** 12:07 pm

Floodplain unit: ☐ Low-Flow Channel ☒ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: pebble, course angular

Total veg cover: Ø % Tree: ____% Shrub: ____% Herb: ____%

Community successional stage:

- ☒ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☒ Mudcracks
- ☐ Ripples
- ☒ Drift and/or debris
- ☒ Presence of bed and bank
- ☒ Benches
- ☐ Soil development
- ☒ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Fine material (sand) is saturated.

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☒ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: sand

Total veg cover: 33 % Tree: ____% Shrub: 30 % Herb: 3 %

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☒ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☒ Mudcracks
- ☐ Ripples
- ☒ Drift and/or debris on edge w/ AFP
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☒ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Depositional sand, transient terrace.

Ephemeral stream channel 10

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Alton Coal
Project Number: 421
Stream: S34
Investigator(s): Jeff Boice, Collin Covington
Date: May 7, 2012 **Time:** 2:17 pm
Town: Alton **State:** Utah
Photo begin file#: 376 **Photo end file#:** 378

Y ☒ / N ☐ Do normal circumstances exist on the site?

Y ☐ / N ☒ Is the site significantly disturbed?

Location Details: Eastern portion of project area.

Projection: UTM **Datum:** NAD83
Coordinates: 371244 m E 4141808 m N

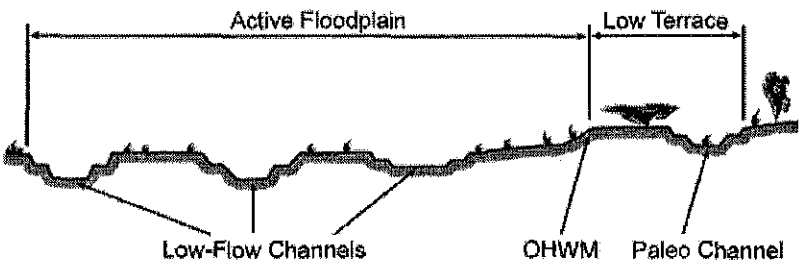
Potential anthropogenic influences on the channel system:
None

Brief site description:
Pinyon-Juniper, scrub/shrub, sagebrush, upland herbacious landscape with multiple drainages lacking OHWM's feeding NHD. Ephemeral stream Channel 10

Checklist of resources (if available):

- ☒ Aerial photography
  Dates: June 22, 2011
- ☒ Topographic maps
- ☐ Geologic maps
- ☐ Vegetation maps
- ☐ Soils maps
- ☐ Rainfall/precipitation maps
- ☐ Existing delineation(s) for site
- ☐ Global positioning system (GPS)
- ☐ Other studies
- ☐ Stream gage data
  Gage number:
  Period of record:
  - ☐ History of recent effective discharges
  - ☐ Results of flood frequency analysis
  - ☐ Most recent shift-adjusted rating
  - ☐ Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units



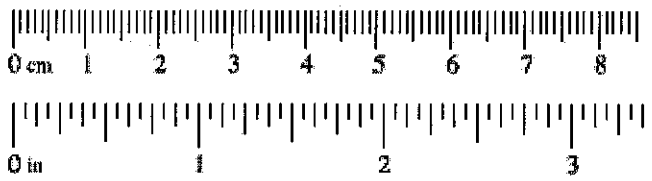
Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - ☒ Mapping on aerial photograph
   - ☐ Digitized on computer
   - ☒ GPS
   - ☐ Other:

Ephemeral Stream channel 10

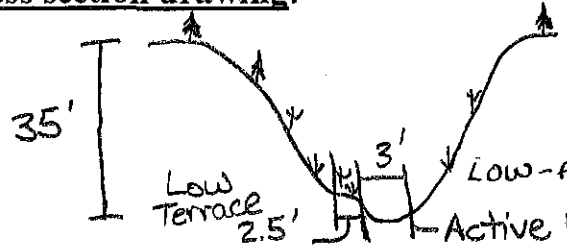
Wentworth Size Classes

Inches (in)	Millimeters (mm)	Wentworth size class	
10.08	256	Boulder	
2.56	64	Cobble	Gravel
0.157	4	Pebble	
0.079	2.00	Granule	
0.039	1.00	Very coarse sand	
0.020	0.50	Coarse sand	
1/2 0.0098	0.25	Medium sand	Sand
1/4 0.005	0.125	Fine sand	
1/8 0.0025	0.0625	Very fine sand	
1/16 0.0012	0.031	Coarse silt	
1/32 0.00061	0.0156	Medium silt	Silt
1/64 0.00031	0.0078	Fine silt	
1/128 0.00015	0.0039	Very fine silt	
		Clay	Mud



Project ID: 421 **Cross section ID:** S34 **Date:** May 7, 2012 **Time:** 2:17 pm

Cross section drawing:



OHWM = 3' wide

V-shaped drainage

Salt effervescence across bottom of channel.

Moist soils in the bottom

OHWM

ESC #10

GPS point: See location on front

Indicators:

- [x] Change in average sediment texture
- [ ] Change in vegetation species
- [x] Change in vegetation cover
- [x] Break in bank slope
- [ ] Other: _____
- [ ] Other: _____

Comments:

Minimal Indicators of an OHWM

Floodplain unit:

- [ ] Low-Flow Channel
- [x] Active Floodplain
- [ ] Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: Fine Sand

Total veg cover: Ø % Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- [x] NA
- [ ] Early (herbaceous & seedlings)
- [ ] Mid (herbaceous, shrubs, saplings)
- [ ] Late (herbaceous, shrubs, mature trees)

Indicators:

- [x] Mudcracks
- [ ] Ripples
- [ ] Drift and/or debris
- [x] Presence of bed and bank
- [ ] Benches
- [ ] Soil development
- [x] Surface relief
- [ ] Other: _____
- [ ] Other: _____
- [ ] Other: _____

Comments:

No change in particle size across the landscape, bottom, slopes, & terrace.

Ephemeral Stream Channel 10

Project ID: **Cross section ID:** **Date:** **Time:**

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____% Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____% Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Alton Coal
Project Number: 421
Stream: S35
Investigator(s): Jeff Boice, Collin Covington
Date: May 7, 2012 **Time:** 3:40 pm
Town: Alton **State:** Utah
Photo begin file#: 404 **Photo end file#:** 406

Y [X] / N [ ] Do normal circumstances exist on the site?

Y [ ] / N [X] Is the site significantly disturbed?

Location Details: Central portion of project area.

Projection: UTM **Datum:** NAD 83
Coordinates: 370684 m E 4141791 m N

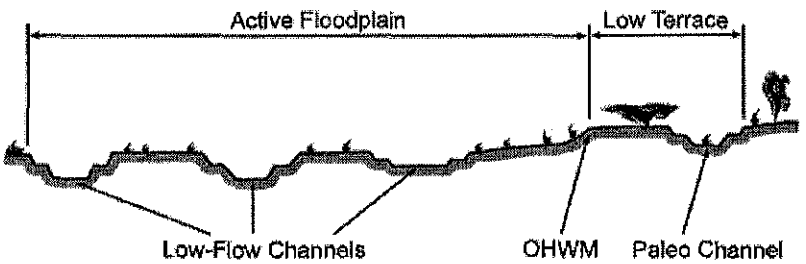
Potential anthropogenic influences on the channel system:
Road is a potential influence blocking the drainage from the upper portion of the system (no culvert under road)

Brief site description:
Alfalfa, Bromus inermis, & Sagebrush meadow with a gentle depression. Early stages of entrenchment. Upland drainage swale.

Checklist of resources (if available):

- [X] Aerial photography
  Dates: June 22, 2011
- [X] Topographic maps
- [ ] Geologic maps
- [ ] Vegetation maps
- [ ] Soils maps
- [ ] Rainfall/precipitation maps
- [ ] Existing delineation(s) for site
- [ ] Global positioning system (GPS)
- [ ] Other studies
- [ ] Stream gage data
  Gage number:
  Period of record:
  - [ ] History of recent effective discharges
  - [ ] Results of flood frequency analysis
  - [ ] Most recent shift-adjusted rating
  - [ ] Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units

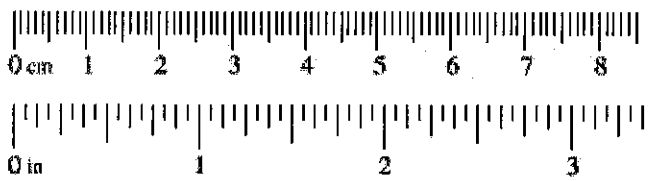


Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - [X] Mapping on aerial photograph
   - [ ] Digitized on computer
   - [X] GPS
   - [ ] Other:

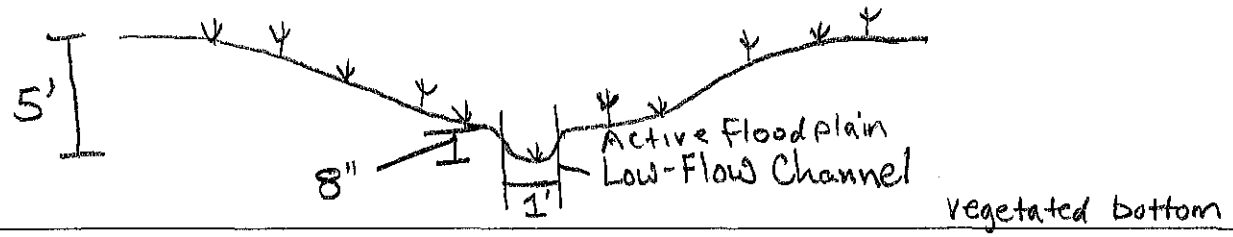
Wentworth Size Classes

Inches (in)		Millimeters (mm)	Wentworth size class	
	10.08	256	Boulder	Gravel
	2.56	64	Cobble	
	0.157	4	Pebble	
			Granule	
	0.079	2.00		
	0.039	1.00	Very coarse sand	Sand
	0.020	0.50	Coarse sand	
1/2	0.0098	0.25	Medium sand	
1/4	0.005	0.125	Fine sand	
1/8	0.0025	0.0625	Very fine sand	
1/16	0.0012	0.031	Coarse silt	Silt
1/32	0.00061	0.0156	Medium silt	
1/64	0.00031	0.0078	Fine silt	
1/128	0.00015	0.0039	Very fine silt	
			Clay	Mud



Project ID: 421 **Cross section ID:** S35 **Date:** May 7, 2012 **Time:** 3:40 pm

Cross section drawing:



OHWM

GPS point: See location on front

Indicators:

- ☐ Change in average sediment texture
- ☐ Change in vegetation species
- ☐ Change in vegetation cover
- ☐ Break in bank slope
- ☐ Other: _____
- ☐ Other: _____

Comments:

No OHWM indicators.

Floodplain unit: ☒ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: sand

Total veg cover: 1 % Tree: ____% Shrub: ____% Herb: 1 %

Community successional stage:

- ☐ NA
- ☒ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Low-Flow Channel is not distinct. Flow is marginal and sporadic. Drainage is small & cut off from upper portion by road. Upland drainage swale.

Project ID: **Cross section ID:** **Date:** **Time:**

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____% Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____% Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Alton Coal
Project Number: 421
Stream: S36
Investigator(s): Jeff Boice, Collin Covington
Date: May 7, 2012 **Time:** 4:36 pm
Town: Alton **State:** Utah
Photo begin file#: 417 **Photo end file#:** 419

Y ☒ / N ☐ Do normal circumstances exist on the site?

Y ☐ / N ☒ Is the site significantly disturbed?

Location Details: Central portion of project area.

Projection: UTM **Datum:** NAD83
Coordinates: 370280 mE 4141804 mN

Potential anthropogenic influences on the channel system:

None

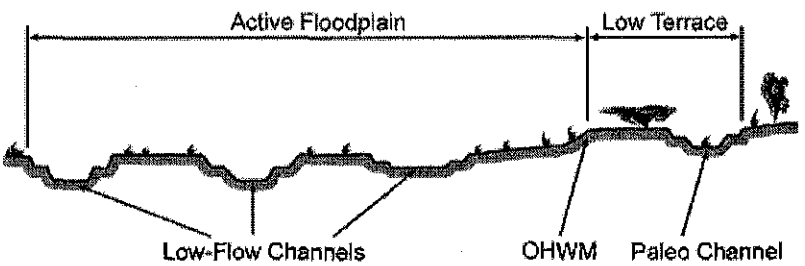
Brief site description:

Deeply entrenched channel in an alfalfa, sagebrush, & Juniper meadow. Ephemeral Stream Channel 11

Checklist of resources (if available):

- ☒ Aerial photography
  Dates: June 22, 2011
- ☒ Topographic maps
- ☐ Geologic maps
- ☐ Vegetation maps
- ☐ Soils maps
- ☐ Rainfall/precipitation maps
- ☐ Existing delineation(s) for site
- ☐ Global positioning system (GPS)
- ☐ Other studies
- ☐ Stream gage data
  Gage number:
  Period of record:
  - ☐ History of recent effective discharges
  - ☐ Results of flood frequency analysis
  - ☐ Most recent shift-adjusted rating
  - ☐ Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units



Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
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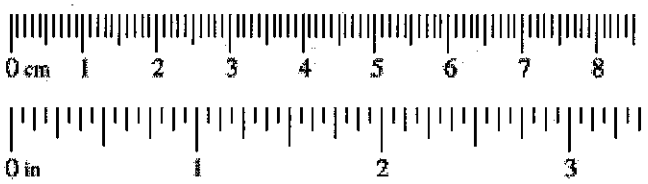
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - ☒ Mapping on aerial photograph
   - ☐ Digitized on computer
   - ☒ GPS
   - ☐ Other:

Ephemeral Stream Channel 11

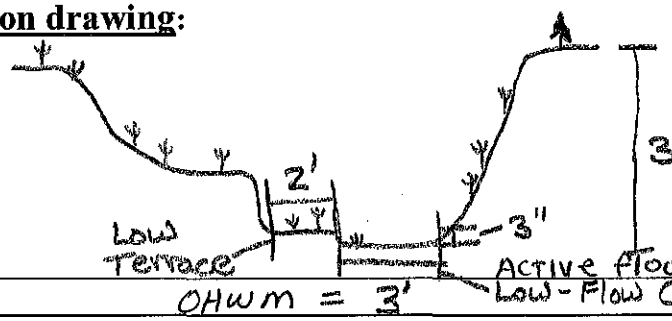
Wentworth Size Classes

Inches (in)	Millimeters (mm)	Wentworth size class	
10.08	256	Boulder	
		Cobble	Gravel
2.56	64	Pebble	
0.157	4	Granule	
0.079	2.00	Very coarse sand	
0.039	1.00	Coarse sand	
0.020	0.50	Medium sand	Sand
1/2 0.0098	0.25	Fine sand	
1/4 0.005	0.125	Very fine sand	
1/8 0.0025	0.0625	Coarse silt	
1/16 0.0012	0.031	Medium silt	
1/32 0.00061	0.0156	Fine silt	Silt
1/64 0.00031	0.0078	Very fine silt	
1/128 0.00015	0.0039	Clay	Mud



Project ID: 421 **Cross section ID:** S36 **Date:** May 7, 2012 **Time:** 4:36 pm

Cross section drawing:



Trough shaped channel.
Low-Flow Channel encompasses entire Active Floodplain.

OHWM

ESC #11

GPS point: See location on front

Indicators:

- ☐ Change in average sediment texture
- ☐ Change in vegetation species
- ☒ Change in vegetation cover
- ☒ Break in bank slope
- ☐ Other: _____
- ☐ Other: _____

Comments:

Sediment similar across the landscape. Erosional area. Etched with distinct cuts for OHWM on banks.

Floodplain unit: ☒ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: Silt

Total veg cover: ≥1 % Tree: ____ % Shrub: ____ % Herb: ≥1 %

Community successional stage:

- ☐ NA
- ☒ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☒ Mudcracks
- ☐ Ripples
- ☒ Drift and/or debris
- ☒ Presence of bed and bank
- ☒ Benches
- ☐ Soil development
- ☒ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Alkaline bottom, salt effervescence present. Fine material (silt) contains multiple narrow channels.

Ephemeral Stream Channel 11

Project ID: **Cross section ID:** **Date:** **Time:**

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____ % Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____ % Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

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- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Alton Coal
Project Number: 421
Stream: S37
Investigator(s): Jeff Boice, Covington

Date: May 8, 2012 **Time:** 10:12 am
Town: Alton **State:** Utah
Photo begin file#: 446 **Photo end file#:** 448

Y ☒ / N ☐ Do normal circumstances exist on the site?

Y ☐ / N ☒ Is the site significantly disturbed?

Location Details: Eastern portion of project area.

Projection: UTM **Datum:** NAD 83
Coordinates: 371602 m E 4142351 m N

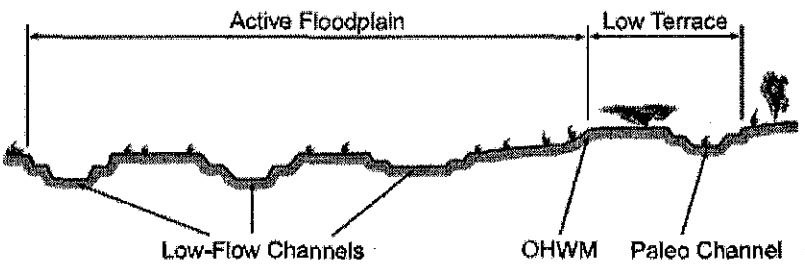
Potential anthropogenic influences on the channel system:
None

Brief site description:
Pinyon-Juniper & Mahogany dominated hillslope with a slope of ~ 30%. Deeply incised, ravelling on both walls. Upland drainage swale.

Checklist of resources (if available):

- ☒ Aerial photography
  Dates: June 22, 2011
- ☒ Topographic maps
- ☐ Geologic maps
- ☐ Vegetation maps
- ☐ Soils maps
- ☐ Rainfall/precipitation maps
- ☐ Existing delineation(s) for site
- ☐ Global positioning system (GPS)
- ☐ Other studies
- ☐ Stream gage data
  Gage number:
  Period of record:
  - ☐ History of recent effective discharges
  - ☐ Results of flood frequency analysis
  - ☐ Most recent shift-adjusted rating
  - ☐ Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units



Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
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   c) Identify any indicators present at the location.
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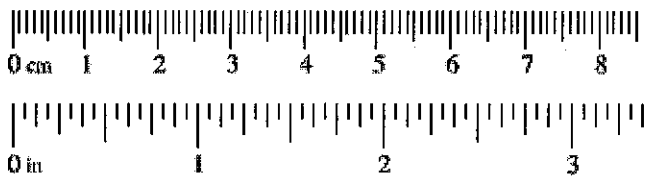
   - ☒ Mapping on aerial photograph
   - ☐ Digitized on computer
   - ☒ GPS
   - ☐ Other:

Wentworth Size Classes

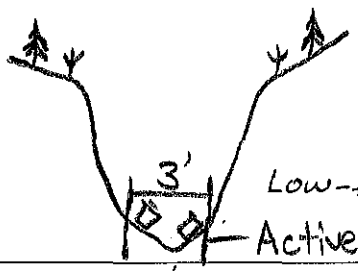
Inches (in)	Millimeters (mm)	Wentworth size class	
10.08	256	Boulder	
		Cobble	Gravel
2.56	64	Pebble	
0.157	4	Granule	
0.079	2.00	Very coarse sand	
0.039	1.00	Coarse sand	
0.020	0.50	Medium sand	Sand
1/2 0.0098	0.25	Fine sand	
1/4 0.005	0.125	Very fine sand	
1/8 0.0025	0.0625	Coarse silt	
1/16 0.0012	0.031	Medium silt	
1/32 0.00061	0.0156	Fine silt	Silt
1/64 0.00031	0.0078	Very fine silt	
1/128 0.00015	0.0039	Clay	Mud



Project ID: 421 **Cross section ID:** S37 **Date:** May 8, 2012 **Time:** 10:12 am

Cross section drawing:

Silt material & large boulders of sandstone in drainage.



V-shaped drainage with mass wasting.

Steep, headwall drainage.

OHWM

GPS point: See location on front

Indicators:

- ☐ Change in average sediment texture
- ☐ Change in vegetation species
- ☐ Change in vegetation cover
- ☐ Break in bank slope
- ☐ Other: _____
- ☐ Other: _____

Comments:

No OHWM indicators

Floodplain unit:

☐ Low-Flow Channel ☒ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: sand

Total veg cover: Ø % Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- ☒ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☒ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☒ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Mix of fine material w/ cobbles & boulders. Ravelling from both banks obscures any (if present) floodplain features. Rapidly eroding.

Project ID: **Cross section ID:** **Date:** **Time:**

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____% Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____% Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Alton Coal
Project Number: 421
Stream: S38
Investigator(s): Jeff Boice, Collin Covington
Date: May 8, 2012 **Time:** 10:28 am
Town: Alton **State:** Utah
Photo begin file#: 453 **Photo end file#:** 455

Y [X] / N [ ] Do normal circumstances exist on the site?

Y [ ] / N [X] Is the site significantly disturbed?

Location Details: Eastern portion of project area.

Projection: UTM **Datum:** NAD83
Coordinates: 371476 mE 4142386 mN

Potential anthropogenic influences on the channel system:

None

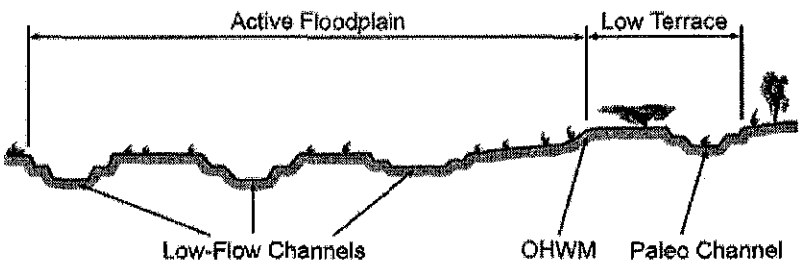
Brief site description:

Pinyon-Juniper & Mahogany dominated hillslope that is rapidly eroding & incised Upland drainage swale.

Checklist of resources (if available):

- [X] Aerial photography
  Dates: June 22, 2011
- [X] Topographic maps
- [ ] Geologic maps
- [ ] Vegetation maps
- [ ] Soils maps
- [ ] Rainfall/precipitation maps
- [ ] Existing delineation(s) for site
- [ ] Global positioning system (GPS)
- [ ] Other studies
- [ ] Stream gage data
  Gage number:
  Period of record:
  - [ ] History of recent effective discharges
  - [ ] Results of flood frequency analysis
  - [ ] Most recent shift-adjusted rating
  - [ ] Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units



Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

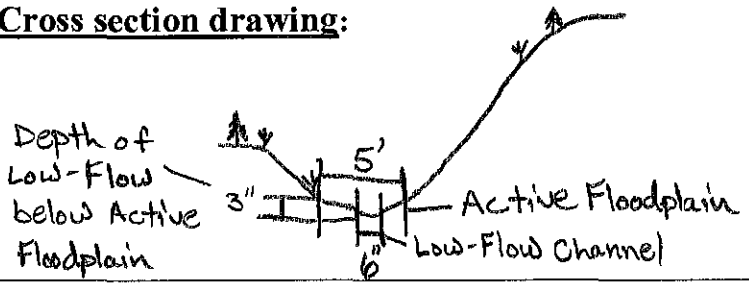
1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - [X] Mapping on aerial photograph
   - [ ] Digitized on computer
   - [X] GPS
   - [ ] Other:

Wentworth Size Classes

Inches (in)	Millimeters (mm)	Wentworth size class	
10.08	256	Boulder	
		Cobble	Gravel
2.56	64		
0.157	4	Pebble	
		Granule	
0.079	2.00		
0.039	1.00	Very coarse sand	
		Coarse sand	
0.020	0.50		Sand
1/2 0.0098	0.25	Medium sand	
1/4 0.005	0.125	Fine sand	
		Very fine sand	
1/8 0.0025	0.0625		
1/16 0.0012	0.031	Coarse silt	
		Medium silt	
1/32 0.00061	0.0156		Silt
1/64 0.00031	0.0078	Fine silt	
		Very fine silt	
1/128 0.00015	0.0039		
		Clay	Mud

Project ID: 421 **Cross section ID:** S38 **Date:** May 8, 2012 **Time:** 10:28 am

Cross section drawing:



Trough shaped drainage. Ravelling along both banks. Boulders mixed in drainage bottom.

OHWM

GPS point: See location on front

Indicators:

- ☐ Change in average sediment texture
- ☐ Change in vegetation species
- ☐ Change in vegetation cover
- ☐ Break in bank slope
- ☐ Other: _____
- ☐ Other: _____

Comments:

No OHWM indicators.

Floodplain unit: ☒ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: Sand

Total veg cover: 0 % Tree: ____% Shrub: ____% Herb: ____%

Community successional stage:

- ☒ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☒ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☒ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Ravelling from bank makes break indistinct.

Project ID: 421 **Cross section ID:** S38 **Date:** May 8, 2012 **Time:** 10:28 am

Floodplain unit: ☐ Low-Flow Channel ☒ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: Sand

Total veg cover: Ø % Tree: ____% Shrub: ____% Herb: ____%

Community successional stage:

- ☒ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☒ Mudcracks
- ☐ Ripples
- ☒ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☒ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Indicators were not distinct as was the breaks.

upland drainage swale.

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: ____% Tree: ____% Shrub: ____% Herb: ____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Alton Coal
Project Number: 421
Stream: S39
Investigator(s): Jeff Boice, Collin Covington
Date: May 8, 2012 **Time:** 10:45 am
Town: Alton **State:** Utah
Photo begin file#: 457 **Photo end file#:** 459

Y [X] / N [ ] Do normal circumstances exist on the site?

Y [ ] / N [X] Is the site significantly disturbed?

Location Details: Eastern portion of project area.

Projection: UTM **Datum:** NAD 83
Coordinates: 371529 m E 4142438 m N

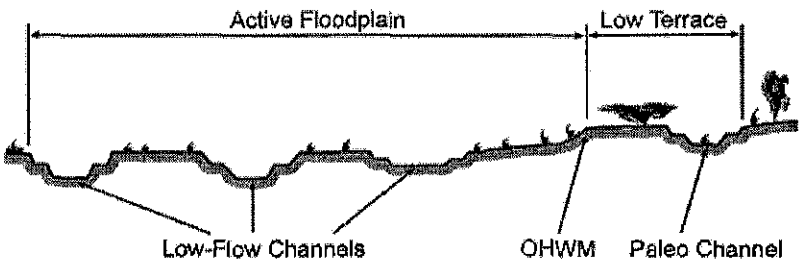
Potential anthropogenic influences on the channel system:
None

Brief site description:
Pinyon-Juniper & Mahogany dominated landscape in a steep drainage with a slope of ~40-50%. Upland drainage swale

Checklist of resources (if available):

- [X] Aerial photography
  Dates: June 22, 2011
- [X] Topographic maps
- [ ] Geologic maps
- [ ] Vegetation maps
- [ ] Soils maps
- [ ] Rainfall/precipitation maps
- [ ] Existing delineation(s) for site
- [ ] Global positioning system (GPS)
- [ ] Other studies
- [ ] Stream gage data
  Gage number:
  Period of record:
  - [ ] History of recent effective discharges
  - [ ] Results of flood frequency analysis
  - [ ] Most recent shift-adjusted rating
  - [ ] Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units

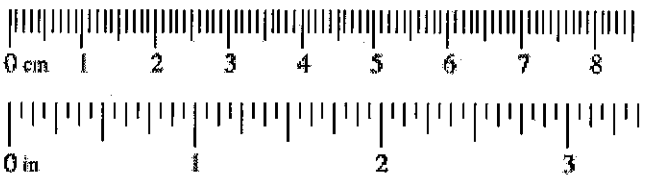


Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - [X] Mapping on aerial photograph
   - [ ] Digitized on computer
   - [X] GPS
   - [ ] Other:

Wentworth Size Classes

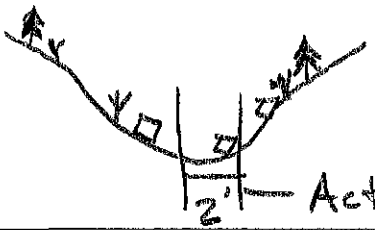
Inches (in)	Millimeters (mm)	Wentworth size class	
10.08	256	Boulder	
		Cobble	Gravel
2.56	64		
0.157	4	Pebble	
		Granule	
0.079	2.00		
0.039	1.00	Very coarse sand	
0.020	0.50	Coarse sand	
1/2 0.0098	0.25	Medium sand	Sand
1/4 0.005	0.125	Fine sand	
1/8 0.0025	0.0625	Very fine sand	
1/16 0.0012	0.031	Coarse silt	
1/32 0.00061	0.0156	Medium silt	Silt
1/64 0.00031	0.0078	Fine silt	
1/128 0.00015	0.0039	Very fine silt	
		Clay	Mud



Project ID: 421 **Cross section ID:** S39 **Date:** May 8, 2012 **Time:** 10:45 am

Cross section drawing:

Drainage filled w/ boulders & cobble.



U-shaped drainage

No Low-Flow Channel discernible

OHWM

GPS point: See front for location

Indicators:

- ☐ Change in average sediment texture
- ☐ Change in vegetation species
- ☐ Change in vegetation cover
- ☐ Break in bank slope
- ☐ Other: _____
- ☐ Other: _____

Comments:

No OHWM indicators.

Floodplain unit: ☐ Low-Flow Channel ☒ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: Cobble, Course angular

Total veg cover: Ø % Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- ☒ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☒ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☒ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Steep, upland drainage swale that has no evidence of recent flow.

Project ID: **Cross section ID:** **Date:** **Time:**

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____% Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____% Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Alton Coal **Date:** May 8, 2012 **Time:** 11:15 am
Project Number: 421 **Town:** Alton **State:** Utah
Stream: S40 **Photo begin file#:** 468 **Photo end file#:** 470
Investigator(s): Jeff Boice, Collin Covington

Y [X] / N [ ] Do normal circumstances exist on the site?

Y [ ] / N [X] Is the site significantly disturbed?

Location Details: Eastern portion of project area.

Projection: UTM **Datum:** NAD83
Coordinates: 371603 m E 4142548 m N

Potential anthropogenic influences on the channel system:

None

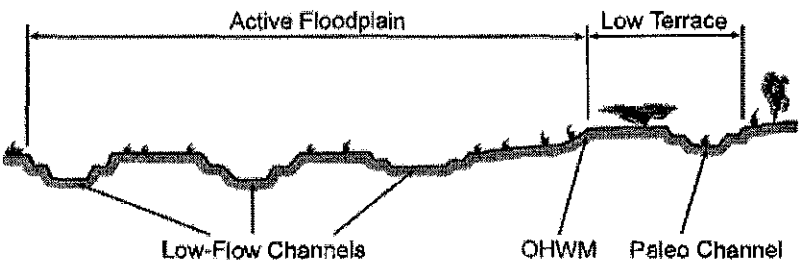
Brief site description:

Pinyon-Juniper & Mahogany dominated landscape that has a steep hillslope drainage cutting through rock. Upland drainage swale

Checklist of resources (if available):

- [X] Aerial photography
  Dates: June 22, 2011
- [X] Topographic maps
- [ ] Geologic maps
- [ ] Vegetation maps
- [ ] Soils maps
- [ ] Rainfall/precipitation maps
- [ ] Existing delineation(s) for site
- [ ] Global positioning system (GPS)
- [ ] Other studies
- [ ] Stream gage data
  Gage number:
  Period of record:
- [ ] History of recent effective discharges
- [ ] Results of flood frequency analysis
- [ ] Most recent shift-adjusted rating
- [ ] Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units



Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

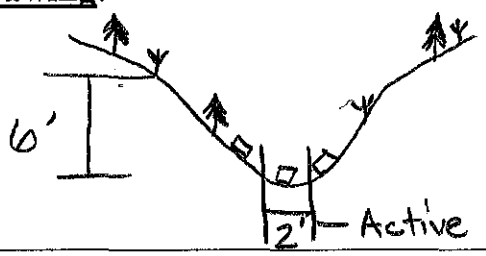
1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - [X] Mapping on aerial photograph
   - [ ] Digitized on computer
   - [X] GPS
   - [ ] Other:

Wentworth Size Classes

Inches (in)	Millimeters (mm)	Wentworth size class	
10.08	256	Boulder	
2.56	64	Cobble	Gravel
0.157	4	Pebble	
0.079	2.00	Granule	
0.039	1.00	Very coarse sand	
0.020	0.50	Coarse sand	
1/2 0.0098	0.25	Medium sand	Sand
1/4 0.005	0.125	Fine sand	
1/8 0.0025	0.0625	Very fine sand	
1/16 0.0012	0.031	Coarse silt	
1/32 0.00061	0.0156	Medium silt	Silt
1/64 0.00031	0.0078	Fine silt	
1/128 0.00015	0.0039	Very fine silt	
		Clay	Mud

Project ID: 421 **Cross section ID:** S40 **Date:** May 8, 2012 **Time:** 11:15 am

Cross section drawing:



V-shaped drainage on a hillslope w/ an ~ 30-40% gradient.

No Low-Flow Channel discernible

OHWM

GPS point: See front for location

Indicators:

- ☐ Change in average sediment texture
- ☐ Change in vegetation species
- ☐ Change in vegetation cover
- ☐ Break in bank slope
- ☐ Other: _____
- ☐ Other: _____

Comments:

No OHWM indicators

Floodplain unit: ☐ Low-Flow Channel ☒ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: pebble, course angular

Total veg cover: 0 % Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- ☒ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☒ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Steep upland drainage swale with no evidence of recent flow.

Project ID: **Cross section ID:** **Date:** **Time:**

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____% Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____% Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Alton Coal
Project Number: 421
Stream: 641
Investigator(s): Jeff Boice, Collin Covington

Date: May 8, 2012 **Time:** 11:39 am
Town: Alton **State:** Utah
Photo begin file#: 476 **Photo end file#:** 478

Y [X] / N [ ] Do normal circumstances exist on the site?

Y [ ] / N [X] Is the site significantly disturbed?

Location Details: Eastern portion of project area.

Projection: UTM **Datum:** NAD 83
Coordinates: 371568 mE 4142561 mN

Potential anthropogenic influences on the channel system:

None

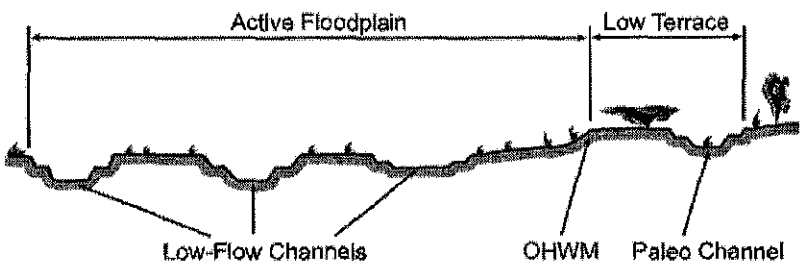
Brief site description:

Pinyon-Juniper & Mahogany dominated landscape in a steep channel that receives input from multiple minor drainages. Ephemeral Stream Channel 11

Checklist of resources (if available):

- [X] Aerial photography
  Dates: June 22, 2011
- [X] Topographic maps
- [ ] Geologic maps
- [ ] Vegetation maps
- [ ] Soils maps
- [ ] Rainfall/precipitation maps
- [ ] Existing delineation(s) for site
- [ ] Global positioning system (GPS)
- [ ] Other studies
- [ ] Stream gage data
  Gage number:
  Period of record:
  - [ ] History of recent effective discharges
  - [ ] Results of flood frequency analysis
  - [ ] Most recent shift-adjusted rating
  - [ ] Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units



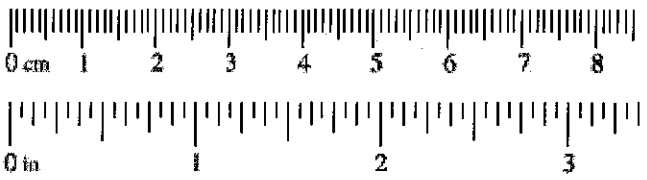
Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - [X] Mapping on aerial photograph
   - [ ] Digitized on computer
   - [X] GPS
   - [ ] Other:

Ephemeral Stream channel 11

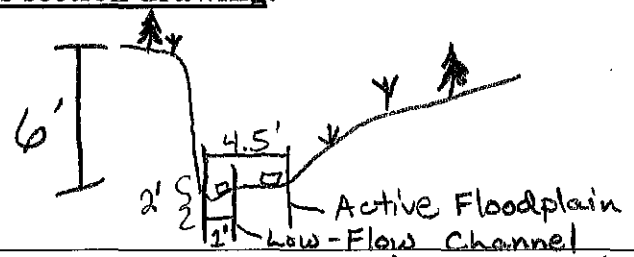
Wentworth Size Classes

Inches (in)	Millimeters (mm)	Wentworth size class	
10.08	256	Boulder	Gravel
2.56	64	Cobble	
0.157	4	Pebble	
		Granule	
0.079	2.00		
0.039	1.00	Very coarse sand	Sand
0.020	0.50	Coarse sand	
1/2 0.0098	0.25	Medium sand	
1/4 0.005	0.125	Fine sand	
1/8 0.0025	0.0625	Very fine sand	
1/16 0.0012	0.031	Coarse silt	Silt
1/32 0.00061	0.0156	Medium silt	
1/64 0.00031	0.0078	Fine silt	
1/128 0.00015	0.0039	Very fine silt	
		Clay	Mud



Project ID: 421 **Cross section ID:** S41 **Date:** May 8, 2012 **Time:** 11:39 am

Cross section drawing:



OHWM = Low-flow channel = 1' WIDE

Left bank is a vertical face w/ minor ravelling. Right bank has a ~20% slope out of channel. Step-pool system w/ bedrock & boulders.

OHWM ESC #11

GPS point: See front for location

Indicators:

- ☐ Change in average sediment texture
- ☐ Change in vegetation species
- ☐ Change in vegetation cover
- ☐ Break in bank slope
- ☐ Other: _____
- ☐ Other: _____

Comments:

OHWM is not very distinct.

Floodplain unit: ☒ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: pebble, course angular

Total veg cover: Ø % Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- ☒ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☒ Drift and/or debris
- ☒ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☒ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

~2" deeper than the active floodplain. No evidence of sorting.

Project ID: 421 **Cross section ID:** S41 **Date:** May 8, 2012 **Time:** 11:39 am

Floodplain unit: ☐ Low-Flow Channel ☒ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: pebble, course angular platy

Total veg cover: ≥1 % Tree: ____ % Shrub: ____ % Herb: ≥1 %

Community successional stage:

- ☐ NA
- ☒ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☒ Drift and/or debris
- ☒ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☒ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: ____ % Tree: ____ % Shrub: ____ % Herb: ____ %

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Alton Coal
Project Number: 421
Stream: S42
Investigator(s): Jeff Boice, Collin Covington
Date: May 14, 2012 **Time:** 3:02 pm
Town: Alton **State:** Utah
Photo begin file#: 538 **Photo end file#:** 540

Y ☒ / N ☐ Do normal circumstances exist on the site?

Y ☐ / N ☒ Is the site significantly disturbed?

Location Details: Central portion of project area.

Projection: UTM **Datum:** NAD 83
Coordinates: 369853 mE 4141175 mN

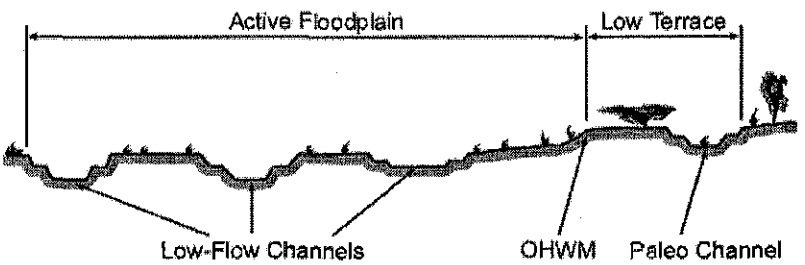
Potential anthropogenic influences on the channel system:
Contributing area of headwaters is gravel pit access road.

Brief site description:
Pinyon-Juniper & sagebrush landscape on hillslope & upland meadow terrain with an incised channel. Channel begins at road crossing.
Ephemeral Stream Channel 12

Checklist of resources (if available):

- ☒ Aerial photography
  Dates: June 22, 2011
- ☒ Topographic maps
- ☐ Geologic maps
- ☐ Vegetation maps
- ☐ Soils maps
- ☐ Rainfall/precipitation maps
- ☐ Existing delineation(s) for site
- ☐ Global positioning system (GPS)
- ☐ Other studies
- ☐ Stream gage data
  Gage number:
  Period of record:
  - ☐ History of recent effective discharges
  - ☐ Results of flood frequency analysis
  - ☐ Most recent shift-adjusted rating
  - ☐ Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units



Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - ☒ Mapping on aerial photograph
   - ☐ Digitized on computer
   - ☒ GPS
   - ☐ Other:

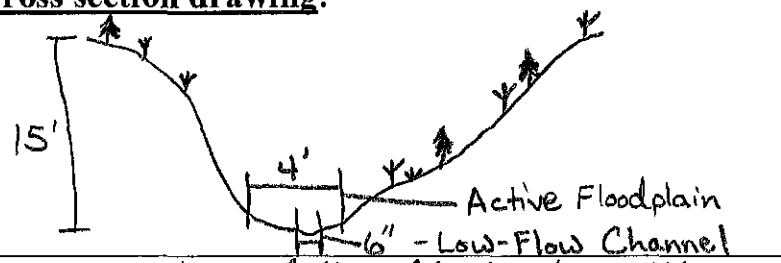
Ephemeral stream channel 12

Wentworth Size Classes

Inches (in)	Millimeters (mm)	Wentworth size class	
10.08	256	Boulder	Gravel
2.56	64	Cobble	Gravel
0.157	4	Pebble	Gravel
0.079	2.00	Granule	Gravel
0.039	1.00	Very coarse sand	Sand
0.020	0.50	Coarse sand	Sand
1/2 0.0098	0.25	Medium sand	Sand
1/4 0.005	0.125	Fine sand	Sand
1/8 0.0025	0.0625	Very fine sand	Sand
1/16 0.0012	0.031	Coarse silt	Silt
1/32 0.00061	0.0156	Medium silt	Silt
1/64 0.00031	0.0078	Fine silt	Silt
1/128 0.00015	0.0039	Very fine silt	Silt
		Clay	Mud

Project ID: 421 **Cross section ID:** S42 **Date:** May 14, 2012 **Time:** 3:02 pm

Cross section drawing:



U-Shaped Channel

Ephemeral Stream Channel 12

OHWM = Active Floodplain = 4' WIDE

OHWM

ESC #12

GPS point: See location on front

Indicators:

- [X] Change in average sediment texture
- [ ] Change in vegetation species
- [X] Change in vegetation cover
- [X] Break in bank slope
- [ ] Other: _____
- [ ] Other: _____

Comments:

OHWM present. Ephemeral Stream Channel 12

Floodplain unit:

[X] Low-Flow Channel [ ] Active Floodplain [ ] Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: pebble, angular, slightly rounded

Total veg cover: Ø % Tree: ____% Shrub: ____% Herb: ____%

Community successional stage:

- [X] NA
- [ ] Early (herbaceous & seedlings)
- [ ] Mid (herbaceous, shrubs, saplings)
- [ ] Late (herbaceous, shrubs, mature trees)

Indicators:

- [X] Mudcracks
- [X] Ripples
- [X] Drift and/or debris
- [X] Presence of bed and bank
- [ ] Benches
- [ ] Soil development
- [X] Surface relief
- [ ] Other: _____
- [ ] Other: _____
- [ ] Other: _____

Comments:

Dominated by small gravel (pebble) with fine material mixed in.

Project ID: **Cross section ID:** **Date:** **Time:**

Floodplain unit: ☐ Low-Flow Channel ☒ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: pebble, angular, slightly rounded

Total veg cover: Ø % Tree: ____% Shrub: ____% Herb: ____%

Community successional stage:

- ☒ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☒ Drift and/or debris
- ☒ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☒ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Does not have the fine material in the floodplain area like the Low-Flow Channel.

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: ____% Tree: ____% Shrub: ____% Herb: ____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Alton Coal
Project Number: 421
Stream: S43
Investigator(s): Jeff Boice, Collin Covington

Date: May 14, 2012 **Time:** 3:35 pm
Town: Alton **State:** Utah
Photo begin file#: 544 **Photo end file#:** 546

Y ☒ / N ☐ Do normal circumstances exist on the site?

Y ☐ / N ☒ Is the site significantly disturbed?

Location Details: Central portion of project area

Projection: UTM **Datum:** NAD 83
Coordinates: 370157 m E 4141412 m N

Potential anthropogenic influences on the channel system:

None

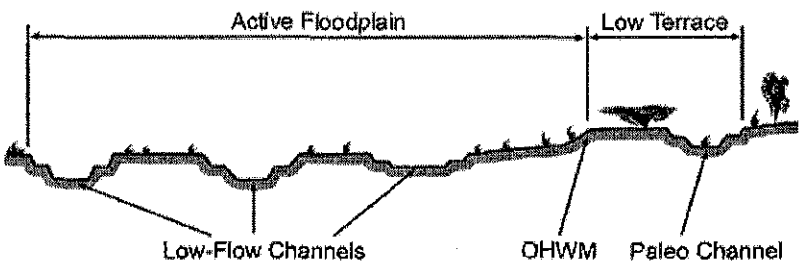
Brief site description:

Pinyon/Juniper & sagebrush meadow. PJ was cleared in the past. The drainage is an upland Drainage Swale.

Checklist of resources (if available):

- ☒ Aerial photography
  Dates: June 22, 2011
- ☒ Topographic maps
- ☐ Geologic maps
- ☐ Vegetation maps
- ☐ Soils maps
- ☐ Rainfall/precipitation maps
- ☐ Existing delineation(s) for site
- ☐ Global positioning system (GPS)
- ☐ Other studies
- ☐ Stream gage data
  Gage number:
  Period of record:
  - ☐ History of recent effective discharges
  - ☐ Results of flood frequency analysis
  - ☐ Most recent shift-adjusted rating
  - ☐ Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units

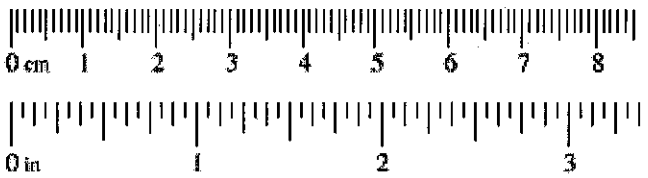


Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - ☒ Mapping on aerial photograph
   - ☐ Digitized on computer
   - ☒ GPS
   - ☐ Other:

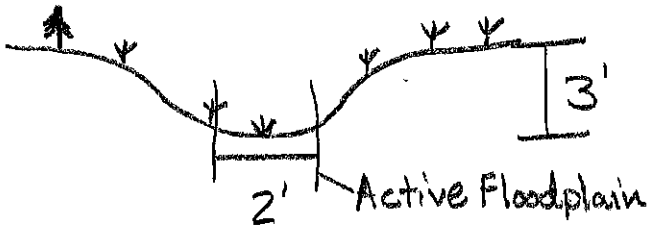
Wentworth Size Classes

Inches (in)		Millimeters (mm)	Wentworth size class	
	10.08	256	Boulder	
	2.56	64	Cobble	Gravel
	0.157	4	Pebble	
	0.079	2.00	Granule	
	0.039	1.00	Very coarse sand	
	0.020	0.50	Coarse sand	
1/2	0.0098	0.25	Medium sand	Sand
1/4	0.005	0.125	Fine sand	
1/8	0.0025	0.0625	Very fine sand	
1/16	0.0012	0.031	Coarse silt	
1/32	0.00061	0.0156	Medium silt	Silt
1/64	0.00031	0.0078	Fine silt	
1/128	0.00015	0.0039	Very fine silt	
			Clay	Mud



Project ID: 421 **Cross section ID:** S43 **Date:** May 14, 2012 **Time:** 3:35 pm

Cross section drawing:



Trough shaped drainage

No Low-Flow Channel present

OHWM

GPS point: See location on front

Indicators:

- ☐ Change in average sediment texture
- ☐ Change in vegetation species
- ☐ Change in vegetation cover
- ☐ Break in bank slope
- ☐ Other: _____
- ☐ Other: _____

Comments:

No OHWM indicators.

Sparsely vegetated drainage bottom

Floodplain unit:

☐ Low-Flow Channel ☒ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: silt

Total veg cover: 5 % Tree: ____ % Shrub: ____ % Herb: 5 %

Community successional stage:

- ☐ NA
- ☒ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☒ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☒ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Cannot discern a Low-Flow Channel. No sorting or indications of regular flow.

Upland Drainage Swale

Project ID: **Cross section ID:** **Date:** **Time:**

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____% Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____% Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Alton Coal
Project Number: 421
Stream: S44
Investigator(s): Jeff Boice, Collin Covington

Date: May 14, 2012 **Time:** 4:31 pm
Town: Alton **State:** Utah
Photo begin file#: 561 **Photo end file#:** 564

Y ☒ / N ☐ Do normal circumstances exist on the site?

Y ☐ / N ☒ Is the site significantly disturbed?

Location Details: Central portion of project area.

Projection: UTM **Datum:** NAD 83
Coordinates: 369479 mE 4141293 m N

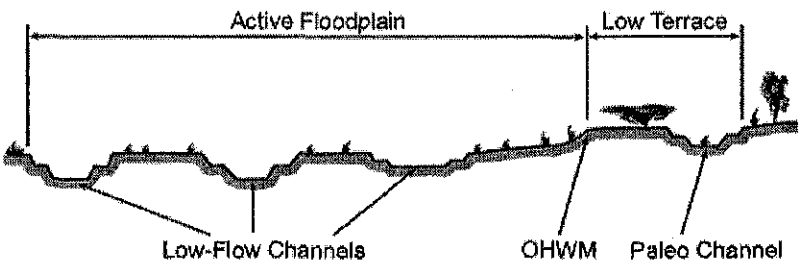
Potential anthropogenic influences on the channel system:
None

Brief site description: Pinyon/Juniper & sagebrush terrace, the PJ to the east has recently been cleared. The drainage is entrenched ~10' & has a wet meadow bottom, the channel is narrow & entrenched. Intermittent Stream Channel 2.

Checklist of resources (if available):

- ☒ Aerial photography
  Dates: June 22, 2011
- ☒ Topographic maps
- ☐ Geologic maps
- ☐ Vegetation maps
- ☐ Soils maps
- ☐ Rainfall/precipitation maps
- ☐ Existing delineation(s) for site
- ☐ Global positioning system (GPS)
- ☐ Other studies
- ☐ Stream gage data
  Gage number:
  Period of record:
  - ☐ History of recent effective discharges
  - ☐ Results of flood frequency analysis
  - ☐ Most recent shift-adjusted rating
  - ☐ Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units



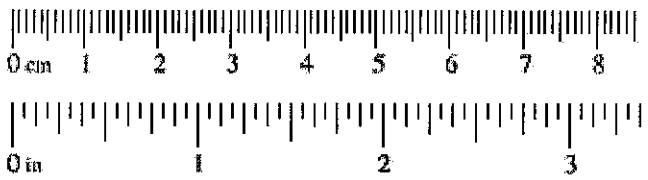
Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - ☒ Mapping on aerial photograph
   - ☐ Digitized on computer
   - ☒ GPS
   - ☐ Other:

Intermittent Stream Channel 2

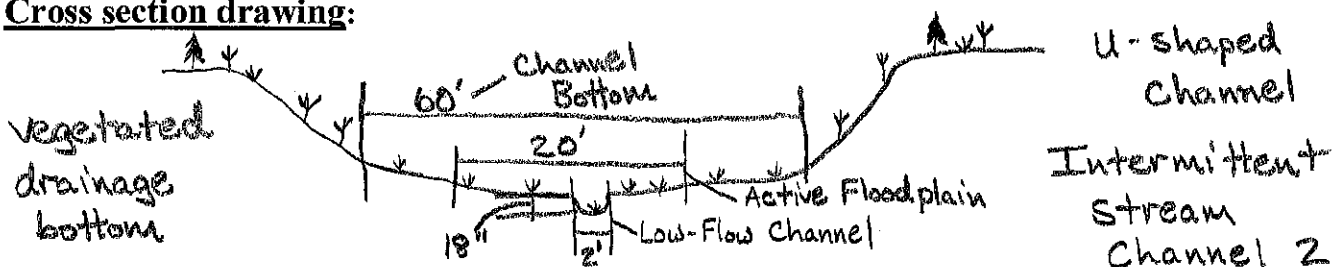
Wentworth Size Classes

Inches (in)	Millimeters (mm)	Wentworth size class	
10.08	256	Boulder	
2.56	64	Cobble	Gravel
0.157	4	Pebble	
0.079	2.00	Granule	
0.039	1.00	Very coarse sand	
0.020	0.50	Coarse sand	
1/2 0.0098	0.25	Medium sand	Sand
1/4 0.005	0.125	Fine sand	
1/8 0.0025	0.0625	Very fine sand	
1/16 0.0012	0.031	Coarse silt	
1/32 0.00061	0.0156	Medium silt	Silt
1/64 0.00031	0.0078	Fine silt	
1/128 0.00015	0.0039	Very fine silt	
		Clay	Mud



Project ID: 421 **Cross section ID:** S 44 **Date:** May 14, 2012 **Time:** 4:31 pm

Cross section drawing:



OHWM = low-flow channel = 2' WIDE

OHWM

ISC#2

GPS point: See location on front

Indicators:

- ☐ Change in average sediment texture
- ☐ Change in vegetation species
- ☒ Change in vegetation cover
- ☒ Break in bank slope
- ☐ Other: _____
- ☐ Other: _____

Comments:

Definitive break in slope.

Active floodplain is vegetated with riparian wetmeadow wetland.

Floodplain unit: ☒ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: Silt

Total veg cover: 80 % Tree: ____ % Shrub: ____ % Herb: 80 %

Community successional stage:

- ☐ NA
- ☒ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☒ Mudcracks
- ☐ Ripples
- ☒ Drift and/or debris
- ☒ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☒ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Very narrow width-to-depth ratio. Indications of entrenchments in the lower channel. Rock placed in channel at certain points in upper drainage.

Project ID: 421 **Cross section ID:** S44 **Date:** May 14, 2012 **Time:** 4:31 pm

Floodplain unit: ☐ Low-Flow Channel ☒ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: silt

Total veg cover: 100 % Tree: ____% Shrub: ____% Herb: 100 %

Community successional stage:

- ☐ NA
- ☒ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☒ Soil development
- ☒ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Completely vegetated with Juncus sp. & Hordeum jubatum. Cannot see beneath the vegetation.

Intermittent Stream Channel 2

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: ____% Tree: ____% Shrub: ____% Herb: ____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

No abandoned terrace features

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Alton Coal
Project Number: 421
Stream: S45
Investigator(s): Jeff Boice, Collin Covington

Date: May 15, 2012 **Time:** 10:33 am
Town: Alton **State:** Utah
Photo begin file#: 594 **Photo end file#:** 596

Y [X] / N [ ] Do normal circumstances exist on the site?

Y [ ] / N [X] Is the site significantly disturbed?

Location Details: Western portion of project area.

Projection: UTM **Datum:** NAD 83
Coordinates: 369370 m E 4141905 m N

Potential anthropogenic influences on the channel system:

None

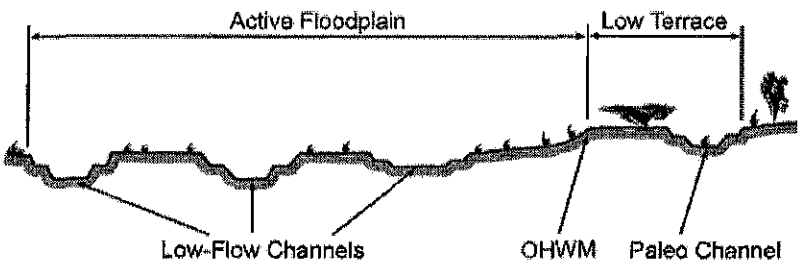
Brief site description:

Pinyon/Juniper, Gamble oak, Sagebrush hillslope with a trough shaped drainage that is stepping down hill through rock. Ephemeral Stream Channel 13

Checklist of resources (if available):

- [X] Aerial photography
  Dates: June 22, 2011
- [X] Topographic maps
- [ ] Geologic maps
- [ ] Vegetation maps
- [ ] Soils maps
- [ ] Rainfall/precipitation maps
- [ ] Existing delineation(s) for site
- [ ] Global positioning system (GPS)
- [ ] Other studies
- [ ] Stream gage data
  Gage number:
  Period of record:
  - [ ] History of recent effective discharges
  - [ ] Results of flood frequency analysis
  - [ ] Most recent shift-adjusted rating
  - [ ] Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units



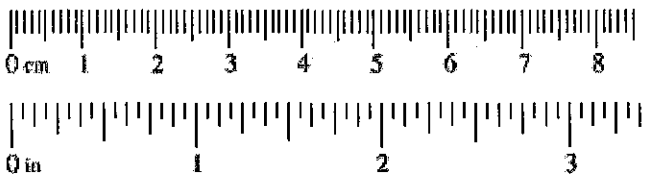
Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - [X] Mapping on aerial photograph
   - [ ] Digitized on computer
   - [X] GPS
   - [ ] Other:

Ephemeral Stream Channel 13

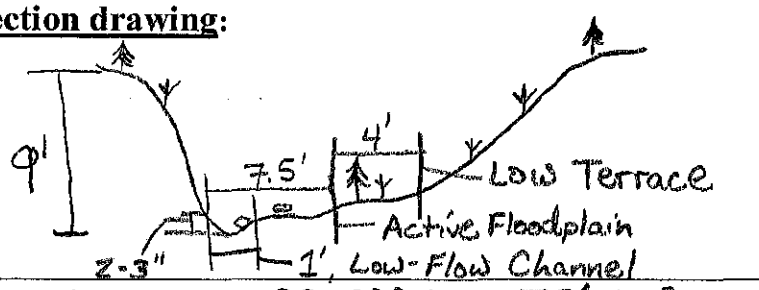
Wentworth Size Classes

Inches (in)	Millimeters (mm)	Wentworth size class	
10.08	256	Boulder	
2.56	64	Cobble	Gravel
0.157	4	Pebble	
0.079	2.00	Granule	
0.039	1.00	Very coarse sand	
0.020	0.50	Coarse sand	
1/2 0.0098	0.25	Medium sand	Sand
1/4 0.005	0.125	Fine sand	
1/8 0.0025	0.0625	Very fine sand	
1/16 0.0012	0.031	Coarse silt	
1/32 0.00061	0.0156	Medium silt	Silt
1/64 0.00031	0.0078	Fine silt	
1/128 0.00015	0.0039	Very fine silt	
		Clay	Mud



Project ID: 421 **Cross section ID:** S45 **Date:** May 15, 2012 **Time:** 10:33 am

Cross section drawing:



OHWM = ACTIVE FLOODPLAIN = 7.5' WIDE

Trough Shaped Channel with some cobbles in the Active Floodplain

Ephemeral Stream Channel 13

OHWM

ESC #13

GPS point: See location on front

Indicators:

- [x] Change in average sediment texture
- [ ] Change in vegetation species
- [ ] Change in vegetation cover
- [x] Break in bank slope
- [ ] Other: _____
- [ ] Other: _____

Comments:

Step-pool system cutting through rock formations with ponding and splash-zones.

Floodplain unit: [x] Low-Flow Channel [ ] Active Floodplain [ ] Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: pebble, course platy rounding

Total veg cover: ≥1 % Tree: _____ % Shrub: _____ % Herb: ≥1 %

Community successional stage:

- [ ] NA
- [x] Early (herbaceous & seedlings)
- [ ] Mid (herbaceous, shrubs, saplings)
- [ ] Late (herbaceous, shrubs, mature trees)

Indicators:

- [x] Mudcracks
- [ ] Ripples
- [x] Drift and/or debris
- [x] Presence of bed and bank
- [x] Benches
- [ ] Soil development
- [x] Surface relief
- [ ] Other: _____
- [ ] Other: _____
- [ ] Other: _____

Comments:

Low-Flow Channel is ~2-3" lower than Active Floodplain

Project ID: 421 **Cross section ID:** S45 **Date:** May 15, 2012 **Time:** 10:33 am

Floodplain unit: ☐ Low-Flow Channel ☒ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: pebble, course platy rounded

Total veg cover: Ø % Tree: ____% Shrub: ____% Herb: ____%

Community successional stage:

- ☒ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☒ Drift and/or debris
- ☒ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☒ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☒ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: Silt

Total veg cover: 15 % Tree: ____% Shrub: 10 % Herb: 5 %

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☒ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☒ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Alton Coal
Project Number: 421
Stream: S46
Investigator(s): Jeff Boice, Collin Covington

Date: May 15, 2012 **Time:** 11:23 am
Town: Alton **State:** Utah
Photo begin file#: 606 **Photo end file#:** 608

Y ☒ / N ☐ Do normal circumstances exist on the site?

Y ☐ / N ☒ Is the site significantly disturbed?

Location Details: Northern portion of project area.

Projection: UTM **Datum:** NAD83
Coordinates: 370176 m E 4142190 m N

Potential anthropogenic influences on the channel system: Appears drainage has been diverted/ cut off into NHD to the north, there is ~15' difference in depth between the two. Does not appear to be active. Upper end of upland drainage swale is no longer connected to drainage area.

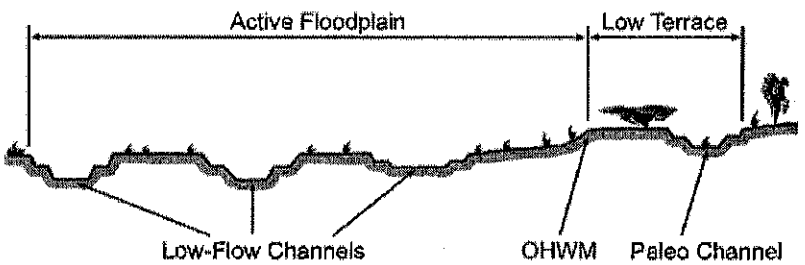
Brief site description:

Sagebrush and Alfalfa upland meadow with an upland Drainage Swale

Checklist of resources (if available):

- ☒ Aerial photography
  Dates: June 22, 2011
- ☒ Topographic maps
- ☐ Geologic maps
- ☐ Vegetation maps
- ☐ Soils maps
- ☐ Rainfall/precipitation maps
- ☐ Existing delineation(s) for site
- ☐ Global positioning system (GPS)
- ☐ Other studies
- ☐ Stream gage data
  Gage number:
  Period of record:
  - ☐ History of recent effective discharges
  - ☐ Results of flood frequency analysis
  - ☐ Most recent shift-adjusted rating
  - ☐ Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units



Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - ☒ Mapping on aerial photograph
   - ☐ Digitized on computer
   - ☒ GPS
   - ☐ Other:

Wentworth Size Classes

Inches (in)	Millimeters (mm)	Wentworth size class	
10.08	256	Boulder	Gravel
2.56	64	Cobble	
0.157	4	Pebble	
		Granule	
0.079	2.00	Very coarse sand	Sand
0.039	1.00	Coarse sand	
0.020	0.50	Medium sand	
1/2 0.0098	0.25	Fine sand	
1/4 0.005	0.125	Very fine sand	
1/8 0.0025	0.0625	Coarse silt	Silt
1/16 0.0012	0.031	Medium silt	
1/32 0.00061	0.0156	Fine silt	
1/64 0.00031	0.0078	Very fine silt	
1/128 0.00015	0.0039	Clay	Mud

Project ID: 421 **Cross section ID:** 546 **Date:** May 15, 2012 **Time:** 11:23 am

Cross section drawing:

U-shaped drainage.

No evidence of any flow or Floodplain Units.

OHWM

GPS point: See location on front.

Indicators:

- ☐ Change in average sediment texture
- ☐ Change in vegetation species
- ☐ Change in vegetation cover
- ☐ Break in bank slope
- ☐ Other: _____
- ☐ Other: _____

Comments:

None, no OHWM indicators present.

Vegetated swale

Floodplain unit:

☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

No Floodplain Units

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: silt

Total veg cover: 70 % Tree: ____% Shrub: ____% Herb: 70 %

Community successional stage:

- ☐ NA
- ☒ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Drainage is a swale that has been cut-off from upper watershed. Vegetation found in drainage includes: Western wheatgrass, alfalfa, common dandelion, Achillea millefolium, Trifolium sp., Poa sp., & unknown forb.

Project ID: **Cross section ID:** **Date:** **Time:**

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____% Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____% Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Alton Coal
Project Number: 421
Stream: S47
Investigator(s): Jeff Boice, Collin Covington

Date: May 15, 2012 **Time:** 11:46 am
Town: Alton **State:** Utah
Photo begin file#: 616 **Photo end file#:** 618

Y ☒ / N ☐ Do normal circumstances exist on the site?

Y ☐ / N ☒ Is the site significantly disturbed?

Location Details: Northern portion of project area.

Projection: UTM **Datum:** NAD 83
Coordinates: 370143 mE 4142219 mN

Potential anthropogenic influences on the channel system:

Runoff from county road that crosses drainage.

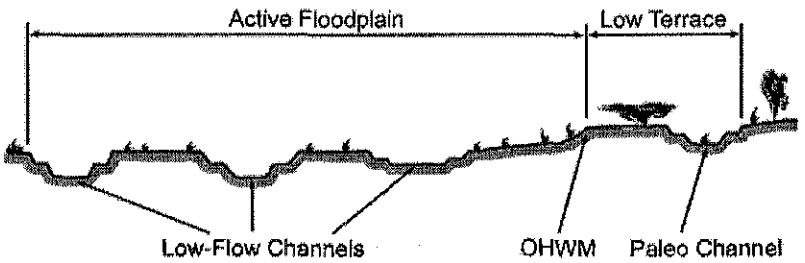
Brief site description:

Deeply incised, V-shaped drainage in a sagebrush & alfalfa meadow. Evidence of mass failure. Bed & wall material are same. Upland drainage swale

Checklist of resources (if available):

- ☒ Aerial photography
  Dates: June 22, 2011
- ☒ Topographic maps
- ☐ Geologic maps
- ☐ Vegetation maps
- ☐ Soils maps
- ☐ Rainfall/precipitation maps
- ☐ Existing delineation(s) for site
- ☐ Global positioning system (GPS)
- ☐ Other studies
- ☐ Stream gage data
  Gage number:
  Period of record:
- ☐ History of recent effective discharges
- ☐ Results of flood frequency analysis
- ☐ Most recent shift-adjusted rating
- ☐ Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units



Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

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3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
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   c) Identify any indicators present at the location.
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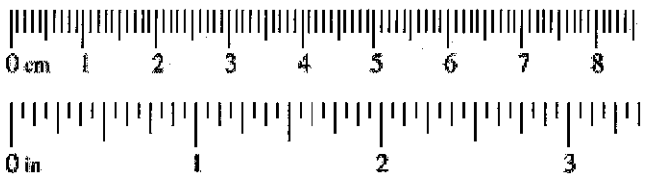
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - ☒ Mapping on aerial photograph
   - ☒ GPS
   - ☐ Digitized on computer
   - ☐ Other:

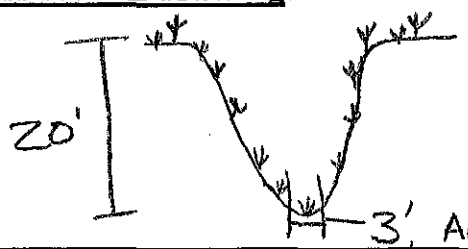
Wentworth Size Classes

Inches (in)		Millimeters (mm)	Wentworth size class	
	10.08	256	Boulder	
	2.56	64	Cobble	Gravel
	0.157	4	Pebble	
	0.079	2.00	Granule	
	0.039	1.00	Very coarse sand	
	0.020	0.50	Coarse sand	
1/2	0.0098	0.25	Medium sand	Sand
1/4	0.005	0.125	Fine sand	
1/8	0.0025	0.0625	Very fine sand	
1/16	0.0012	0.031	Coarse silt	
1/32	0.00061	0.0156	Medium silt	Silt
1/64	0.00031	0.0078	Fine silt	
1/128	0.00015	0.0039	Very fine silt	
			Clay	Mud



Project ID: 421 **Cross section ID:** S47 **Date:** May 15, 2012 **Time:** 11:46 am

Cross section drawing:



V-shaped Drainage

Active Floodplain
Low Flow Channel IS INDISTINCT

OHWM

GPS point: See location on front

Indicators:

- ☐ Change in average sediment texture
- ☐ Change in vegetation species
- ☐ Change in vegetation cover
- ☐ Break in bank slope
- ☐ Other: _____
- ☐ Other: _____

Comments:

No OHWM indicators

NO DISTINCT CHANNEL CHARACTERISTICS

Floodplain unit: ☐ Low-Flow Channel ☒ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: Silt

Total veg cover: 1 % Tree: ____ % Shrub: ____ % Herb: 1 %

Community successional stage:

- ☐ NA
- ☒ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

No indicators, not a channel.

Upland drainage swale

Project ID: **Cross section ID:** **Date:** **Time:**

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____ % Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____ % Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Alton Coal
Project Number: 421
Stream: S48
Investigator(s): Jeff Boice, Collin Covington

Date: May 15, 2012 **Time:** 1:27 pm
Town: Alton **State:** Utah
Photo begin file#: 642 **Photo end file#:** 644

Y [X] / N [ ] Do normal circumstances exist on the site?

Y [ ] / N [X] Is the site significantly disturbed?

Location Details: Northern portion of project area.

Projection: UTM **Datum:** NAD 83
Coordinates: 370871 mE 4142928 mN

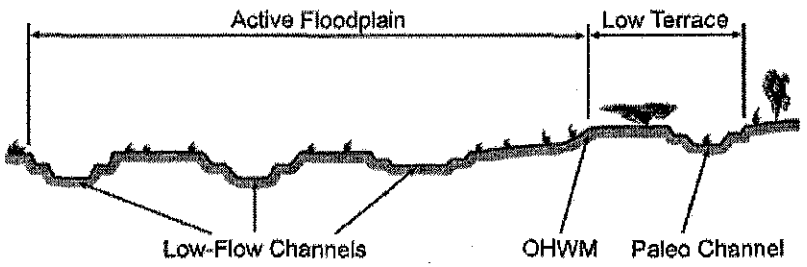
Potential anthropogenic influences on the channel system:
None

Brief site description:
Pinyon/Juniper and sagebrush hill area with entrenched gully drainage. Upland drainage swale

Checklist of resources (if available):

- [X] Aerial photography
  Dates: June 22, 2011
- [X] Topographic maps
- [ ] Geologic maps
- [ ] Vegetation maps
- [ ] Soils maps
- [ ] Rainfall/precipitation maps
- [ ] Existing delineation(s) for site
- [ ] Global positioning system (GPS)
- [ ] Other studies
- [ ] Stream gage data
  Gage number:
  Period of record:
- [ ] History of recent effective discharges
- [ ] Results of flood frequency analysis
- [ ] Most recent shift-adjusted rating
- [ ] Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units



Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
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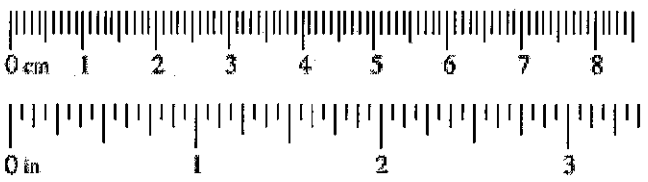
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - [X] Mapping on aerial photograph
   - [ ] Digitized on computer
   - [X] GPS
   - [ ] Other:

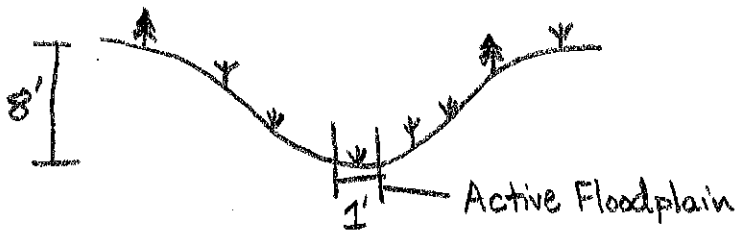
Wentworth Size Classes

Inches (in)		Millimeters (mm)	Wentworth size class	
	10.08	256	Boulder	
	2.56	64	Cobble	Gravel
	0.157	4	Pebble	
	0.079	2.00	Granule	
	0.039	1.00	Very coarse sand	
	0.020	0.50	Coarse sand	
1/2	0.0098	0.25	Medium sand	Sand
1/4	0.005	0.125	Fine sand	
1/8	0.0025	0.0625	Very fine sand	
1/16	0.0012	0.031	Coarse silt	
1/32	0.00061	0.0156	Medium silt	
1/64	0.00031	0.0078	Fine silt	Silt
1/128	0.00015	0.0039	Very fine silt	
			Clay	Mud



Project ID: 421 **Cross section ID:** S48 **Date:** May 15, 2012 **Time:** 1:27 pm

Cross section drawing:



Trough Shaped Drainage
sparsley vegetated 5% cover

LOW FLOW CHANNEL IS INDISTINCT

OHWM

GPS point: See location on front

Indicators:

- ☐ Change in average sediment texture
- ☐ Change in vegetation species
- ☐ Change in vegetation cover
- ☐ Break in bank slope
- ☐ Other: _____
- ☐ Other: _____

Comments:

No OHWM indicators

NO DISTINCT CHANNEL CHARACTERISTICS

Floodplain unit: ☐ Low-Flow Channel ☒ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: pebble, course angular

Total veg cover: 5 % Tree: ____ % Shrub: ____ % Herb: 5 %

Community successional stage:

- ☐ NA
- ☒ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☒ Drift and/or debris
- ☒ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☒ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

No particle sorting, ravelled fine material in the bottom.
Headcuts in lower portion of upland drainage swale.

Project ID: **Cross section ID:** **Date:** **Time:**

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____ % Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____ % Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Alton Coal
Project Number: 421
Stream: S49
Investigator(s): Jeff Boice, Collin Covington

Date: May 15, 2012 **Time:** 2:51 pm
Town: Alton **State:** Utah
Photo begin file#: 659 **Photo end file#:** 661

Y ☒ / N ☐ Do normal circumstances exist on the site?

Y ☐ / N ☒ Is the site significantly disturbed?

Location Details: Northern portion of project area.

Projection: UTM **Datum:** NAD83
Coordinates: 369622 mE 4143705 mN

Potential anthropogenic influences on the channel system:

None

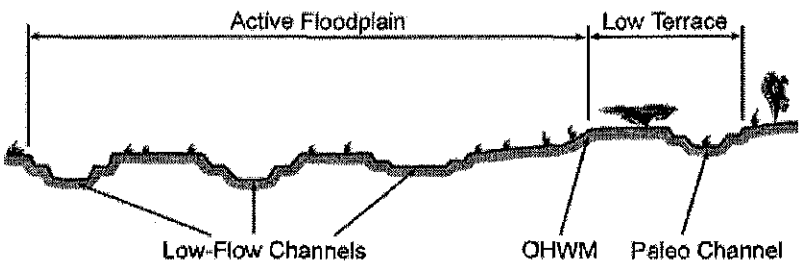
Brief site description:

Alfalfa and Bromus tectorum meadow on edge of irrigation pivot. No evidence of any drainage or channel.

Checklist of resources (if available):

- ☒ Aerial photography
  Dates: June 22, 2011
- ☒ Topographic maps
- ☐ Geologic maps
- ☐ Vegetation maps
- ☐ Soils maps
- ☐ Rainfall/precipitation maps
- ☐ Existing delineation(s) for site
- ☐ Global positioning system (GPS)
- ☐ Other studies
- ☐ Stream gage data
  Gage number:
  Period of record:
- ☐ History of recent effective discharges
- ☐ Results of flood frequency analysis
- ☐ Most recent shift-adjusted rating
- ☐ Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units

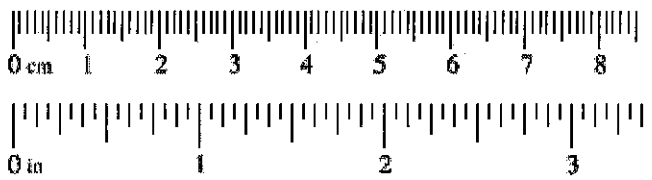


Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - ☒ Mapping on aerial photograph
   - ☐ Digitized on computer
   - ☒ GPS
   - ☐ Other:

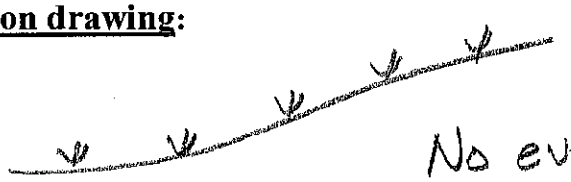
Wentworth Size Classes

Inches (in)	Millimeters (mm)	Wentworth size class	
10.08	256	Boulder	
		Cobble	Gravel
2.56	64		
		Pebble	
0.157	4		
		Granule	
0.079	2.00		
0.039	1.00	Very coarse sand	
		Coarse sand	
0.020	0.50		
		Medium sand	Sand
1/2 0.0098	0.25		
		Fine sand	
1/4 0.005	0.125		
		Very fine sand	
1/8 0.0025	0.0625		
		Coarse silt	
1/16 0.0012	0.031		
		Medium silt	Silt
1/32 0.00061	0.0156		
		Fine silt	
1/64 0.00031	0.0078		
		Very fine silt	
1/128 0.00015	0.0039		
		Clay	Mud



Project ID: 421 **Cross section ID:** S49 **Date:** May 15, 2012 **Time:** 2:51 pm

Cross section drawing:



No evidence of a drainage across the landscape.

OHWM

GPS point: See location on front

Indicators:

- ☐ Change in average sediment texture
- ☐ Change in vegetation species
- ☐ Change in vegetation cover
- ☐ Break in bank slope
- ☐ Other: _____
- ☐ Other: _____

Comments:

No OHWM indicators.

Floodplain unit:

☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____% Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

No Floodplain units.

Project ID: **Cross section ID:** **Date:** **Time:**

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____ % Tree: _____ % Shrub: _____ % Herb: _____ %

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____ % Tree: _____ % Shrub: _____ % Herb: _____ %

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Alton Coal
Project Number: 421
Stream: S50
Investigator(s): Jeff Boice, Collin Covington

Date: May 15, 2012 **Time:** 3:14 pm
Town: Alton **State:** Utah
Photo begin file#: 669 **Photo end file#:** 671

Y ☒ / N ☐ Do normal circumstances exist on the site?

Y ☐ / N ☒ Is the site significantly disturbed?

Location Details: Northern portion of project area.

Projection: UTM **Datum:** NAD83
Coordinates: 369670 mE 4143290 mN

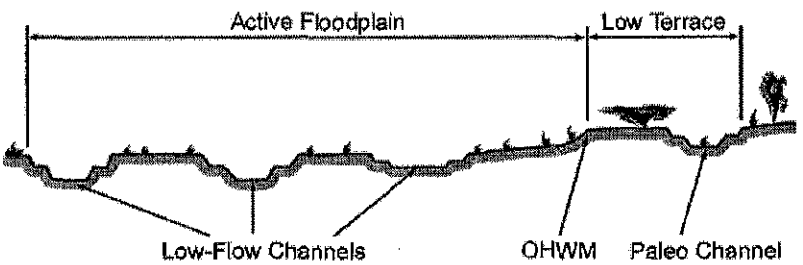
Potential anthropogenic influences on the channel system:
Agriculture production & pivot irrigation.

Brief site description: Upland meadow with major portions of the NHD being unidentifiable. No wetlands present. Vegetation in area: Smooth brome, Western wheatgrass, Cheatgrass, alfalfa, Wood's rose, & Juncus sp.

Checklist of resources (if available):

- ☒ Aerial photography
  Dates: June 20, 2011
- ☒ Topographic maps
- ☐ Geologic maps
- ☐ Vegetation maps
- ☐ Soils maps
- ☐ Rainfall/precipitation maps
- ☐ Existing delineation(s) for site
- ☐ Global positioning system (GPS)
- ☐ Other studies
- ☐ Stream gage data
  Gage number:
  Period of record:
- ☐ History of recent effective discharges
- ☐ Results of flood frequency analysis
- ☐ Most recent shift-adjusted rating
- ☐ Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units

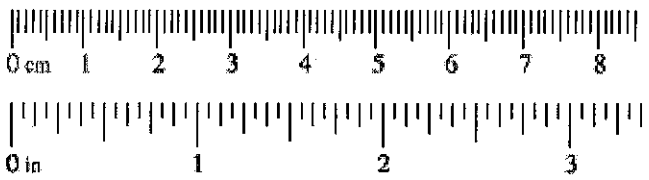


Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - ☒ Mapping on aerial photograph
   - ☐ Digitized on computer
   - ☒ GPS
   - ☐ Other:

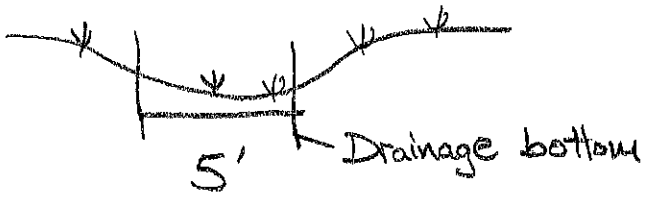
Wentworth Size Classes

Inches (in)	Millimeters (mm)	Wentworth size class	
10.08	256	Boulder	
2.56	64	Cobble	Gravel
0.157	4	Pebble	
0.079	2.00	Granule	
0.039	1.00	Very coarse sand	
0.020	0.50	Coarse sand	
1/2 0.0098	0.25	Medium sand	Sand
1/4 0.005	0.125	Fine sand	
1/8 0.0025	0.0625	Very fine sand	
1/16 0.0012	0.031	Coarse silt	
1/32 0.00061	0.0156	Medium silt	Silt
1/64 0.00031	0.0078	Fine silt	
1/128 0.00015	0.0039	Very fine silt	
		Clay	Mud



Project ID: 421 **Cross section ID:** S50 **Date:** May 15, 2012 **Time:** 3:14 pm

Cross section drawing:



No channel or floodplain indicators.

Upland Drainage swale

OHWM

GPS point: See location on front

Indicators:

- ☐ Change in average sediment texture
- ☐ Change in vegetation species
- ☐ Change in vegetation cover
- ☐ Break in bank slope
- ☐ Other: _____
- ☐ Other: _____

Comments:

No OHWM indicators

Floodplain unit:

☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

No floodplain unit present

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: 5 % Tree: ____% Shrub: ____% Herb: 5 %

Community successional stage:

- ☐ NA
- ☒ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

No indicators or evidence of flooding or water.

Upland drainage swale.

Project ID: **Cross section ID:** **Date:** **Time:**

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____ % Tree: _____ % Shrub: _____ % Herb: _____ %

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____ % Tree: _____ % Shrub: _____ % Herb: _____ %

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Alton Coal
Project Number: 421
Stream: S51
Investigator(s): Jeff Boice, Collin Covington

Date: May 15, 2012 **Time:** 4:30 pm
Town: Alton **State:** Utah
Photo begin file#: 685 **Photo end file#:** 687

Y ☒ / N ☐ Do normal circumstances exist on the site?

Y ☐ / N ☒ Is the site significantly disturbed?

Location Details: Northern portion of project area.

Projection: UTM **Datum:** NAD 83
Coordinates: 369189 mE 4142791 mN

Potential anthropogenic influences on the channel system:

Pinyon/Juniper material from upland clearing in channel.

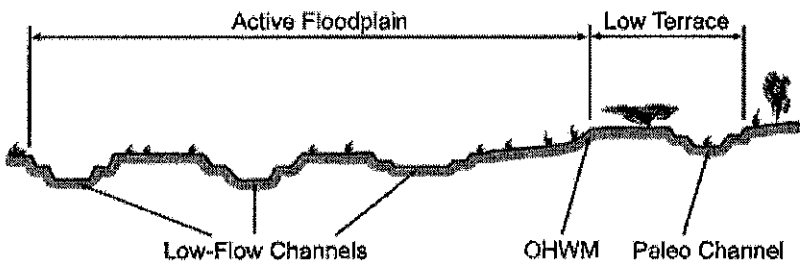
Brief site description:

Cleared upland terrace replanted with wheatgrass and alfalfa. Wetland vegetation in drainage bottom. Intermittent Stream Channel 3

Checklist of resources (if available):

- ☒ Aerial photography
  Dates: June 22, 2011
- ☒ Topographic maps
- ☐ Geologic maps
- ☐ Vegetation maps
- ☐ Soils maps
- ☐ Rainfall/precipitation maps
- ☐ Existing delineation(s) for site
- ☐ Global positioning system (GPS)
- ☐ Other studies
- ☐ Stream gage data
  Gage number:
  Period of record:
  - ☐ History of recent effective discharges
  - ☐ Results of flood frequency analysis
  - ☐ Most recent shift-adjusted rating
  - ☐ Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units



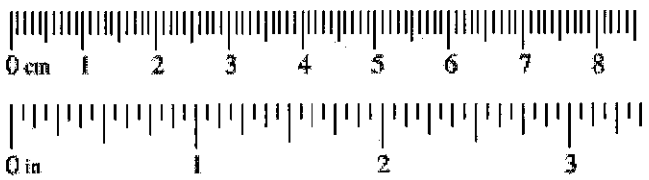
Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - ☒ Mapping on aerial photograph
   - ☐ Digitized on computer
   - ☒ GPS
   - ☐ Other:

Intermittent Stream channel 3

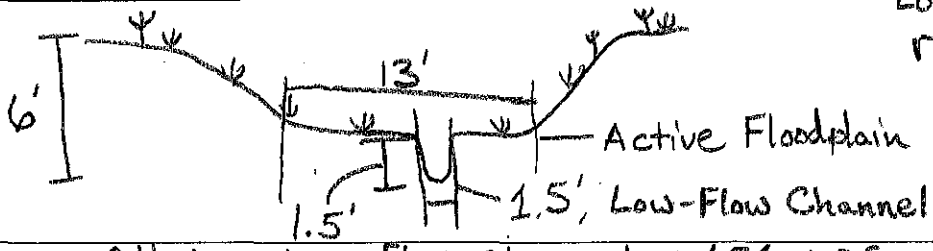
Wentworth Size Classes

Inches (in)		Millimeters (mm)	Wentworth size class	
	10.08	256	Boulder	
	2.56	64	Cobble	Gravel
	0.157	4	Pebble	
			Granule	
	0.079	2.00		
	0.039	1.00	Very coarse sand	
	0.020	0.50	Coarse sand	
1/2	0.0098	0.25	Medium sand	Sand
1/4	0.005	0.125	Fine sand	
1/8	0.0025	0.0625	Very fine sand	
1/16	0.0012	0.031	Coarse silt	
1/32	0.00061	0.0156	Medium silt	
1/64	0.00031	0.0078	Fine silt	Silt
1/128	0.00015	0.0039	Very fine silt	
			Clay	Mud



Project ID: 421 **Cross section ID:** S51 **Date:** May 15, 2012 **Time:** 4:30 pm

Cross section drawing:



Low width-to-depth ratio. Trough shaped channel with a notch for low-flow channel.

OHWM = Low-flow channel = 1.5' wide

OHWM

ISC #3

GPS point: See location on front

Indicators:

- ☐ Change in average sediment texture
- ☒ Change in vegetation species
- ☒ Change in vegetation cover
- ☒ Break in bank slope
- ☐ Other: _____
- ☐ Other: _____

Comments:

None

Floodplain unit: ☒ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: Silt

Total veg cover: Ø % Tree: ____% Shrub: ____% Herb: ____%

Community successional stage:

- ☒ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☒ Mudcracks
- ☐ Ripples
- ☒ Drift and/or debris
- ☒ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☒ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Vertical walls of an entrenched channel.

Project ID: 421 **Cross section ID:** S5/ **Date:** May 15, 2012 **Time:** 4:30 pm

Floodplain unit: ☐ Low-Flow Channel ☒ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: silt

Total veg cover: 100 % Tree: ____% Shrub: ____% Herb: 100 %

Community successional stage:

- ☐ NA
- ☒ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☒ Drift and/or debris
- ☒ Presence of bed and bank
- ☐ Benches
- ☒ Soil development
- ☒ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Active floodplain vegetated with riparian wet meadow wetland
Channel is entrenched within the floodplain.

Intermittent Stream Channel 3

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: ____% Tree: ____% Shrub: ____% Herb: ____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Alton Coal
Project Number: 421
Stream: S52
Investigator(s): Jeff Boice, Collin Covington

Date: May 16, 2012 **Time:** 9:30 am
Town: Alton **State:** Utah
Photo begin file#: 725 **Photo end file#:** 727

Y [X] / N [ ] Do normal circumstances exist on the site?

Y [ ] / N [X] Is the site significantly disturbed?

Location Details: Northern portion of project area.

Projection: UTM **Datum:** NAD 83
Coordinates: 369146 mE 4143405 mN

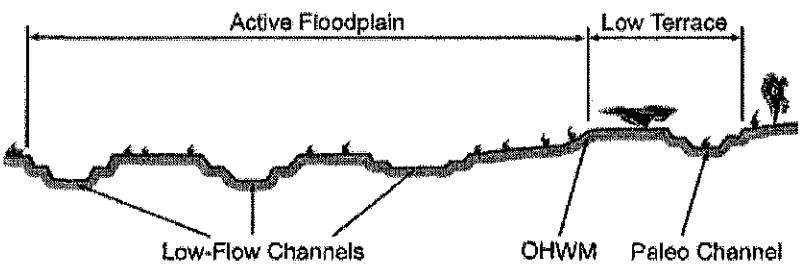
Potential anthropogenic influences on the channel system:
Runoff from excess irrigation on alfalfa field.

Brief site description:
Upland meadow high terrace with sagebrush and wheatgrass. Multiple upland drainage swales draining into NHD. Site is below confluence with another upland drainage swale.

Checklist of resources (if available):

- [X] Aerial photography
  Dates: June 22, 2011
- [X] Topographic maps
- [ ] Geologic maps
- [ ] Vegetation maps
- [ ] Soils maps
- [ ] Rainfall/precipitation maps
- [ ] Existing delineation(s) for site
- [ ] Global positioning system (GPS)
- [ ] Other studies
- [ ] Stream gage data
  Gage number:
  Period of record:
- [ ] History of recent effective discharges
- [ ] Results of flood frequency analysis
- [ ] Most recent shift-adjusted rating
- [ ] Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units

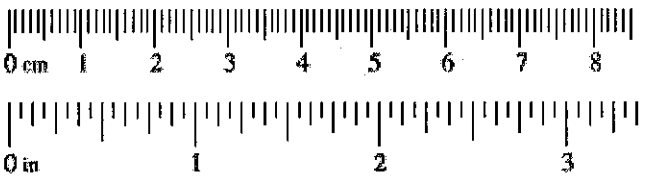


Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - [X] Mapping on aerial photograph
   - [ ] Digitized on computer
   - [X] GPS
   - [ ] Other:

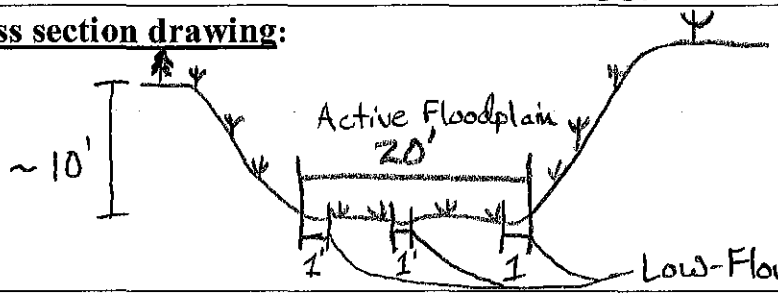
Wentworth Size Classes

Inches (in)	Millimeters (mm)	Wentworth size class	
10.08	256	Boulder	
2.56	64	Cobble	Gravel
0.157	4	Pebble	
		Granule	
0.079	2.00		
0.039	1.00	Very coarse sand	
0.020	0.50	Coarse sand	
1/2 0.0098	0.25	Medium sand	Sand
1/4 0.005	0.125	Fine sand	
1/8 0.0025	0.0625	Very fine sand	
1/16 0.0012	0.031	Coarse silt	
1/32 0.00061	0.0156	Medium silt	Silt
1/64 0.00031	0.0078	Fine silt	
1/128 0.00015	0.0039	Very fine silt	
		Clay	Mud



Project ID: 421 **Cross section ID:** S52 **Date:** May 16, 2012 **Time:** 9:30 am

Cross section drawing:



Trough shaped drainage with multiple Low-Flow Channels and the appearance of sheet flow.

OHWM

GPS point: See location on front

Indicators:

- ☐ Change in average sediment texture
- ☐ Change in vegetation species
- ☐ Change in vegetation cover
- ☐ Break in bank slope
- ☐ Other: _____
- ☐ Other: _____

Comments:

No OHWM indicators observed.

Low-flow channels have >10% vegetated cover dominated by upland plants.

Floodplain unit: ☒ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: Silt

Total veg cover: 10 % Tree: ____% Shrub: ____% Herb: 10 %

Community successional stage:

- ☐ NA
- ☒ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☒ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☒ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Three separate LFC's that are vegetated. Area gets trampled by livestock.

Project ID: 421 **Cross section ID:** S52 **Date:** May 16, 2012 **Time:** 9:30am

Floodplain unit: ☐ Low-Flow Channel ☒ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: silt

Total veg cover: 25 % Tree: ____ % Shrub: ____ % Herb: 25 %

Community successional stage:

- ☐ NA
- ☒ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☒ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☒ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Vegetated with cocklebur, wheatgrass, Hordeum jubatum, & alfalfa. Sheet flow across drainage bottom.

Upland drainage swale.

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: ____ % Tree: ____ % Shrub: ____ % Herb: ____ %

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Alton Coal
Project Number: 421
Stream: S53
Investigator(s): Jeff Boice, Collin Covington

Date: May 16, 2012 **Time:** 11:13 am
Town: Alton **State:** Utah
Photo begin file#: 754 **Photo end file#:** 756

Y [X] / N [ ] Do normal circumstances exist on the site?

Y [ ] / N [X] Is the site significantly disturbed?

Location Details: Northern portion of project area.

Projection: UTM **Datum:** NAD 83
Coordinates: 369002 mE 4142605 mN

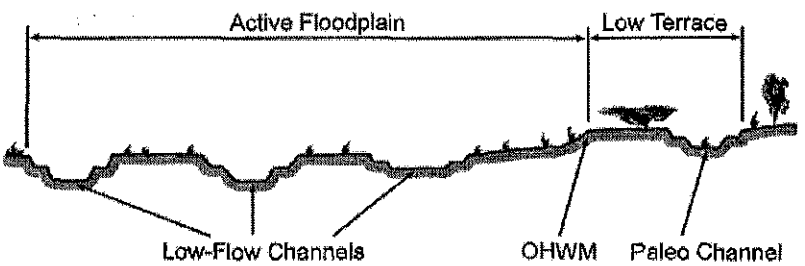
Potential anthropogenic influences on the channel system:
Irrigation runoff & man-made pond w/ ~30' tall dam structure that influences flow.

Brief site description:
Cleared high terrace with alfalfa and sagebrush with pockets of pinyon/juniper. Wetlands adjacent to channel. Top end of Intermittent Stream Channel 2

Checklist of resources (if available):

- [X] Aerial photography
  Dates: June 22, 2011
- [X] Topographic maps
- [ ] Geologic maps
- [ ] Vegetation maps
- [ ] Soils maps
- [ ] Rainfall/precipitation maps
- [ ] Existing delineation(s) for site
- [ ] Global positioning system (GPS)
- [ ] Other studies
- [ ] Stream gage data
  Gage number:
  Period of record:
  - [ ] History of recent effective discharges
  - [ ] Results of flood frequency analysis
  - [ ] Most recent shift-adjusted rating
  - [ ] Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units



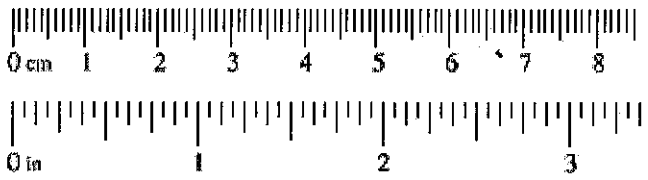
Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - [X] Mapping on aerial photograph
   - [ ] Digitized on computer
   - [X] GPS
   - [ ] Other:

/INTERMITTENT STREAM CHANNEL 2

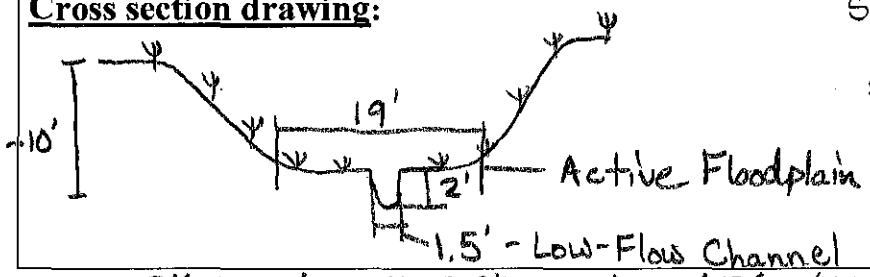
Wentworth Size Classes

Inches (in)	Millimeters (mm)	Wentworth size class	
10.08	256	Boulder	
2.56	64	Cobble	Gravel
0.157	4	Pebble	
0.079	2.00	Granule	
0.039	1.00	Very coarse sand	
0.020	0.50	Coarse sand	
1/2 0.0098	0.25	Medium sand	Sand
1/4 0.005	0.125	Fine sand	
1/8 0.0025	0.0625	Very fine sand	
1/16 0.0012	0.031	Coarse silt	
1/32 0.00061	0.0156	Medium silt	
1/64 0.00031	0.0078	Fine silt	Silt
1/128 0.00015	0.0039	Very fine silt	
		Clay	Mud



Project ID: 421 **Cross section ID:** 553 **Date:** May 16, 2012 **Time:** 11:13 am

Cross section drawing:



Saturated bottom. Trough-shaped channel with notch for LFC. Stable sideslopes. Low width-to-depth ratio.

Intermittent Stream Channel 2

OHWM = Low Flow Channel = 1.5' wide

OHWM

ISC#2

GPS point: See location on front

Indicators:

- ☐ Change in average sediment texture
- ☒ Change in vegetation species
- ☐ Change in vegetation cover
- ☒ Break in bank slope
- ☐ Other: _____
- ☐ Other: _____

Comments:

OHWM present.

Floodplain unit: ☒ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: silt

Total veg cover: Ø% Tree: ____% Shrub: ____% Herb: ____%

Community successional stage:

- ☒ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☒ Drift and/or debris
- ☒ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☒ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Saturated, evidence of recent past flow present
low flow channel is incised within vegetated active floodplain

Project ID: 421 **Cross section ID:** S53 **Date:** May 16, 2012 **Time:** 11:13 am

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: silt

Total veg cover: 100 % Tree: ____ % Shrub: ____ % Herb: 100 %

Community successional stage:

- ☐ NA
- ☒ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☒ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☒ Soil development
- ☒ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Strong hydrogen sulfide smell in bed of channel.
Active floodplain is vegetated with riparian wet meadow wetlands

Intermittent Stream Channel 2

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: ____ % Tree: ____ % Shrub: ____ % Herb: ____ %

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Alton Coal
Project Number: 421
Stream: S54
Investigator(s): Jeff Boice, Collin Covington

Date: May 16, 2012 **Time:** 11:49 am
Town: Alton **State:** Utah
Photo begin file#: 769 **Photo end file#:** 771

Y ☒ / N ☐ Do normal circumstances exist on the site?

Y ☐ / N ☒ Is the site significantly disturbed?

Location Details: Northern portion of project area.

Projection: UTM **Datum:** NAD83
Coordinates: 368812 mE 4143110 mN

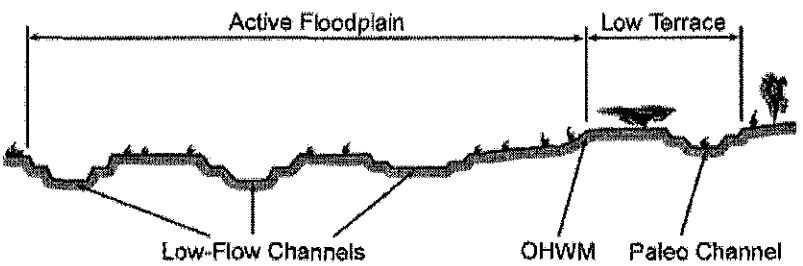
Potential anthropogenic influences on the channel system:
Seepage through dam structure & irrigation runoff.

Brief site description:
Cleared high terrace vegetated with alfalfa & wheatgrass. Adjacent to pond below overflow input. Upland drainage swale

Checklist of resources (if available):

- ☒ Aerial photography
  Dates: June 22, 2011
- ☒ Topographic maps
- ☐ Geologic maps
- ☐ Vegetation maps
- ☐ Soils maps
- ☐ Rainfall/precipitation maps
- ☐ Existing delineation(s) for site
- ☐ Global positioning system (GPS)
- ☐ Other studies
- ☐ Stream gage data
  Gage number:
  Period of record:
  - ☐ History of recent effective discharges
  - ☐ Results of flood frequency analysis
  - ☐ Most recent shift-adjusted rating
  - ☐ Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units

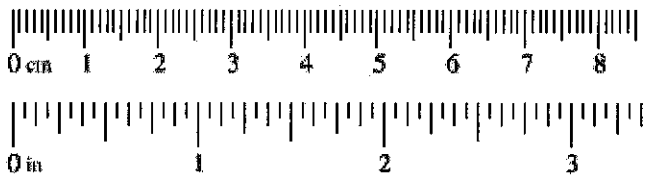


Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - ☒ Mapping on aerial photograph
   - ☐ Digitized on computer
   - ☒ GPS
   - ☐ Other:

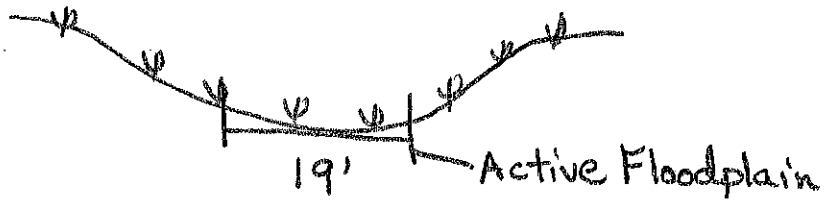
Wentworth Size Classes

Inches (in)	Millimeters (mm)	Wentworth size class	
10.08	256	Boulder	Gravel
2.56	64	Cobble	Gravel
0.157	4	Pebble	Gravel
0.079	2.00	Granule	Gravel
0.039	1.00	Very coarse sand	Sand
0.020	0.50	Coarse sand	Sand
1/2 0.0098	0.25	Medium sand	Sand
1/4 0.005	0.125	Fine sand	Sand
1/8 0.0025	0.0625	Very fine sand	Sand
1/16 0.0012	0.031	Coarse silt	Silt
1/32 0.00061	0.0156	Medium silt	Silt
1/64 0.00031	0.0078	Fine silt	Silt
1/128 0.00015	0.0039	Very fine silt	Silt
		Clay	Mud



Project ID: 421 **Cross section ID:** S54 **Date:** May 16, 2012 **Time:** 11:49 am

Cross section drawing:



Trough shaped, riparian meadow. No channel.

OHWM

GPS point: See location on front

Indicators:

- ☐ Change in average sediment texture
- ☐ Change in vegetation species
- ☐ Change in vegetation cover
- ☐ Break in bank slope
- ☐ Other: _____
- ☐ Other: _____

Comments:

No OHWM indicators observed.

Floodplain unit:

☐ Low-Flow Channel ☒ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: 95 % Tree: ____ % Shrub: ____ % Herb: 95 %

Community successional stage:

- ☐ NA
- ☒ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☒ Soil development
- ☒ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Riparian wet meadow wetland. Strong hydrogen sulfide smell from soil. No channel. Vegetated wetland drainage

Project ID: **Cross section ID:** **Date:** **Time:**

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____ % Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____ % Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Alton Coal
Project Number: 421
Stream: S55
Investigator(s): Jeff Boice, Collin Covington
Date: May 16, 2012 **Time:** 12:32 pm
Town: Alton **State:** Utah
Photo begin file#: 789 **Photo end file#:** 791

Y [X] / N [ ] Do normal circumstances exist on the site?

Y [ ] / N [X] Is the site significantly disturbed?

Location Details: Northern portion of project area.

Projection: UTM **Datum:** NAD83
Coordinates: 368604 mE 4143329 m N

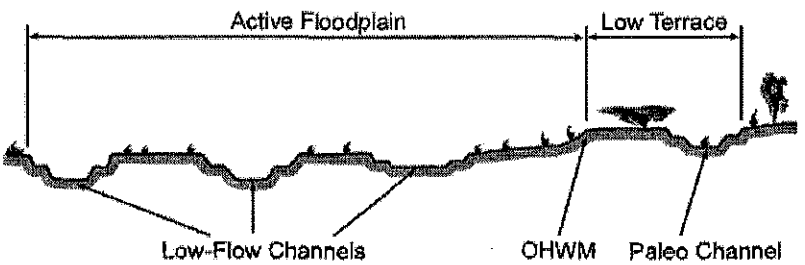
Potential anthropogenic influences on the channel system:
Irrigation runoff from alfalfa field

Brief site description:
Channel with flowing water present with adjcant wetlands & a high terrace of wheatgrass & alfalfa. Strong hydrogen sulfide smell Intermittent stream channel 4

Checklist of resources (if available):

- [X] Aerial photography
  Dates: June 22, 2011
- [X] Topographic maps
- [ ] Geologic maps
- [ ] Vegetation maps
- [ ] Soils maps
- [ ] Rainfall/precipitation maps
- [ ] Existing delineation(s) for site
- [ ] Global positioning system (GPS)
- [ ] Other studies
- [ ] Stream gage data
  Gage number:
  Period of record:
  - [ ] History of recent effective discharges
  - [ ] Results of flood frequency analysis
  - [ ] Most recent shift-adjusted rating
  - [ ] Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units



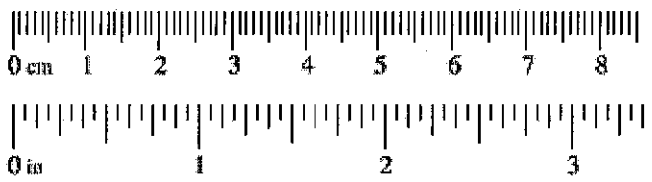
Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - [X] Mapping on aerial photograph
   - [ ] Digitized on computer
   - [X] GPS
   - [ ] Other:

Intermittent Stream channel 4

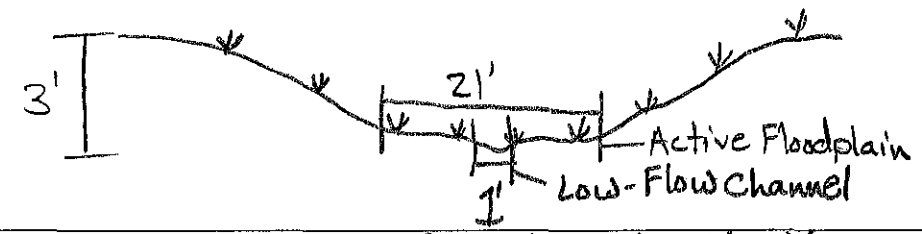
Wentworth Size Classes

Inches (in)	Millimeters (mm)	Wentworth size class	
10.08	256	Boulder	
		Cobble	Gravel
2.56	64		
		Pebble	
0.157	4		
		Granule	
0.079	2.00		
		Very coarse sand	
0.039	1.00		
		Coarse sand	
0.020	0.50		Sand
		Medium sand	
1/2 0.0098	0.25		
		Fine sand	
1/4 0.005	0.125		
		Very fine sand	
1/8 0.0025	0.0625		
		Coarse silt	
1/16 0.0012	0.031		
		Medium silt	
1/32 0.00061	0.0156		Silt
		Fine silt	
1/64 0.00031	0.0078		
		Very fine silt	
1/128 0.00015	0.0039		
		Clay	Mud



Project ID: 421 **Cross section ID:** S55 **Date:** May 16, 2012 **Time:** 12:32 pm

Cross section drawing:



Trough shaped channel with flowing water

OHWM = Low-flow channel = 1' wide

OHWM

ISC #4

GPS point: See location on front

Indicators:

- ☐ Change in average sediment texture
- ☒ Change in vegetation species
- ☒ Change in vegetation cover
- ☒ Break in bank slope
- ☐ Other: _____
- ☐ Other: _____

Comments: OHWM present

— channel is incised within the active floodplain. Active floodplain is vegetated with riparian wet meadow wetland

Floodplain unit:

☒ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: Silt

Total veg cover: Ø % Tree: ____% Shrub: ____% Herb: ____%

Community successional stage:

- ☒ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☒ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☒ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Flowing water in channel

Project ID: 421 **Cross section ID:** S55 **Date:** May 16, 2012 **Time:** 12:32 pm

Floodplain unit: ☐ Low-Flow Channel ☒ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: silt

Total veg cover: 100 % Tree: ____% Shrub: ____% Herb: 100 %

Community successional stage:

- ☐ NA
- ☒ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☒ Soil development
- ☒ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Strong hydrophytic soil development.
riparian wet meadow wetland

Intermittent Stream Channel 4

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: ____% Tree: ____% Shrub: ____% Herb: ____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Alton Coal
Project Number: 421
Stream: S56
Investigator(s): Jeff Boice, Collin Covington

Date: May 16, 2012 **Time:** 12:47 pm
Town: Alton **State:** Utah
Photo begin file#: 793 **Photo end file#:** 795

Y [X] / N [ ] Do normal circumstances exist on the site?

Y [ ] / N [X] Is the site significantly disturbed?

Location Details: Northern portion of project area.

Projection: UTM **Datum:** NAD83
Coordinates: 368562 mE 4143384 mN

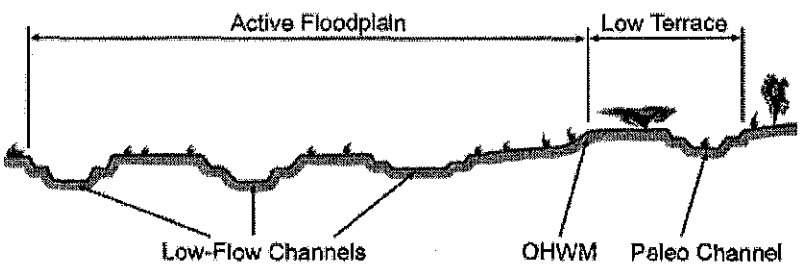
Potential anthropogenic influences on the channel system:
Irrigation runoff.

Brief site description:
Upland, rangeland high terrace with a broad, wet drainage swale. No evidence of an OHWM.

Checklist of resources (if available):

- [X] Aerial photography
  Dates: June 22, 2011
- [X] Topographic maps
- [ ] Geologic maps
- [ ] Vegetation maps
- [ ] Soils maps
- [ ] Rainfall/precipitation maps
- [ ] Existing delineation(s) for site
- [ ] Global positioning system (GPS)
- [ ] Other studies
- [ ] Stream gage data
  Gage number:
  Period of record:
  - [ ] History of recent effective discharges
  - [ ] Results of flood frequency analysis
  - [ ] Most recent shift-adjusted rating
  - [ ] Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units

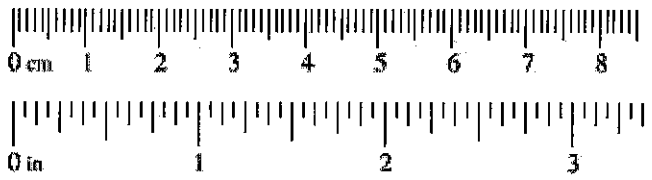


Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - [X] Mapping on aerial photograph
   - [ ] Digitized on computer
   - [X] GPS
   - [ ] Other:

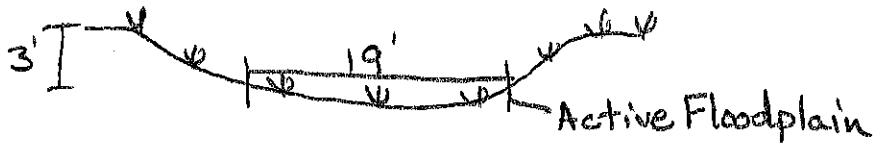
Wentworth Size Classes

Inches (in)	Millimeters (mm)	Wentworth size class	
10.08	256	Boulder	
2.56	64	Cobble	Gravel
0.157	4	Pebble	
0.079	2.00	Granule	
0.039	1.00	Very coarse sand	
0.020	0.50	Coarse sand	
1/2 0.0098	0.25	Medium sand	Sand
1/4 0.005	0.125	Fine sand	
1/8 0.0025	0.0625	Very fine sand	
1/16 0.0012	0.031	Coarse silt	
1/32 0.00061	0.0156	Medium silt	Silt
1/64 0.00031	0.0078	Fine silt	
1/128 0.00015	0.0039	Very fine silt	
		Clay	Mud



Project ID: 421 **Cross section ID:** S 56 **Date:** May 16, 2012 **Time:** 12:47 pm

Cross section drawing:



Trough shaped drainage
Bottom was saturated.

NO CHANNEL PRESENT 100% vegetated floodplain

OHWM

GPS point: See location on front

Indicators:

- ☐ Change in average sediment texture
- ☐ Change in vegetation species
- ☐ Change in vegetation cover
- ☐ Break in bank slope
- ☐ Other: _____
- ☐ Other: _____

Comments:

No OHWM indicators.

Floodplain unit: ☐ Low-Flow Channel ☒ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: silt

Total veg cover: 100 % Tree: ____ % Shrub: ____ % Herb: 100 %

Community successional stage:

- ☐ NA
- ☒ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☒ Soil development
- ☒ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Saturated soil under hydrophytic conditions.
No channel evident. Vegetated with Juncus sp. & Carex sp. riparian wet meadow wetland

Project ID: **Cross section ID:** **Date:** **Time:**

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____% Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____% Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Alton Coal
Project Number: 421
Stream: S57
Investigator(s): Jeff Boice, Collin Covington

Date: May 16, 2012 **Time:** 1:20 pm
Town: Alton **State:** Utah
Photo begin file#: 799 **Photo end file#:** 801

Y ☒ / N ☐ Do normal circumstances exist on the site?

Y ☐ / N ☒ Is the site significantly disturbed?

Location Details: Northern portion of project area.

Projection: UTM **Datum:** NAD83
Coordinates: 368570 mE 4143537 mN

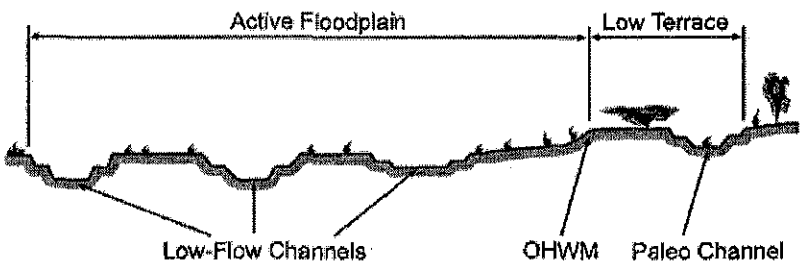
Potential anthropogenic influences on the channel system:
Irrigation runoff.

Brief site description:
Meadow high terrace with vegetated channel bottom. Flowing water present. Top part of Intermittent Stream Channel 4

Checklist of resources (if available):

- ☒ Aerial photography
  Dates: June 22, 2011
- ☒ Topographic maps
- ☐ Geologic maps
- ☐ Vegetation maps
- ☐ Soils maps
- ☐ Rainfall/precipitation maps
- ☐ Existing delineation(s) for site
- ☐ Global positioning system (GPS)
- ☐ Other studies
- ☐ Stream gage data
  Gage number:
  Period of record:
- ☐ History of recent effective discharges
- ☐ Results of flood frequency analysis
- ☐ Most recent shift-adjusted rating
- ☐ Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units



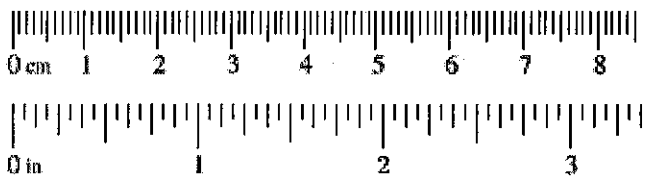
Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - ☒ Mapping on aerial photograph
   - ☐ Digitized on computer
   - ☒ GPS
   - ☐ Other:

Intermittent Stream Channel 4

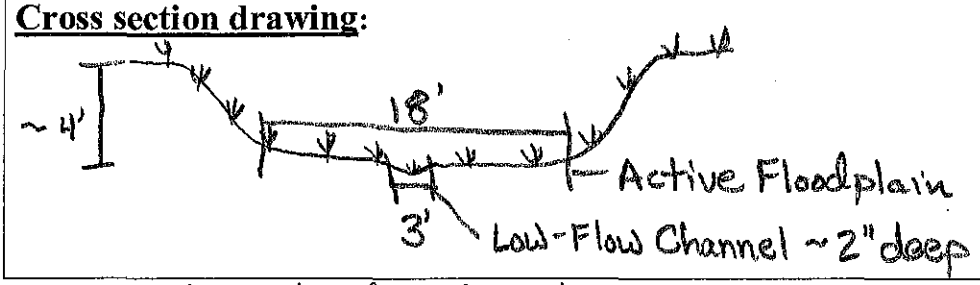
Wentworth Size Classes

Inches (in)	Millimeters (mm)	Wentworth size class	
10.08	256	Boulder	Gravel
2.56	64	Cobble	Gravel
0.157	4	Pebble	Gravel
0.079	2.00	Granule	Gravel
0.039	1.00	Very coarse sand	Sand
0.020	0.50	Coarse sand	Sand
1/2 0.0098	0.25	Medium sand	Sand
1/4 0.005	0.125	Fine sand	Sand
1/8 0.0025	0.0625	Very fine sand	Sand
1/16 0.0012	0.031	Coarse silt	Silt
1/32 0.00061	0.0156	Medium silt	Silt
1/64 0.00031	0.0078	Fine silt	Silt
1/128 0.00015	0.0039	Very fine silt	Silt
		Clay	Mud



Project ID: 421 **Cross section ID:** S57 **Date:** May 16, 2012 **Time:** 1:20 pm

Cross section drawing:



Trough shaped channel. Densely vegetated. Flowing water.

OHWM = low flow channel = 3' WIDE

OHWM

ISC #4

GPS point: See location on front

Indicators:

- [ ] Change in average sediment texture
- [x] Change in vegetation species
- [x] Change in vegetation cover
- [x] Break in bank slope
- [ ] Other: _____
- [ ] Other: _____

Comments:

Flowing water present in channel.
Channel incised within active flood plain
Active flood plain vegetated with riparian wet meadow wetland.

Floodplain unit: [x] Low-Flow Channel [ ] Active Floodplain [ ] Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: Silt

Total veg cover: 20 % Tree: ____ % Shrub: ____ % Herb: 20 %

Community successional stage:

- [ ] NA
- [ ] Early (herbaceous & seedlings)
- [ ] Mid (herbaceous, shrubs, saplings)
- [ ] Late (herbaceous, shrubs, mature trees)

Indicators:

- [ ] Mudcracks
- [ ] Ripples
- [ ] Drift and/or debris
- [ ] Presence of bed and bank
- [ ] Benches
- [x] Soil development
- [x] Surface relief
- [x] Other: Distinct banks
- [ ] Other: _____
- [ ] Other: _____

Comments:

Water present. Strong hydrogen sulfide smell.

Project ID: 421 **Cross section ID:** S57 **Date:** May 16, 2012 **Time:** 1:20 pm

Floodplain unit: ☐ Low-Flow Channel ☒ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: silt

Total veg cover: 95 % Tree: ____% Shrub: ____% Herb: 95 %

Community successional stage:

- ☐ NA
- ☒ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☒ Soil development
- ☒ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Histosol dominated by hydrogen sulfide. Vegetated with Juncus sp. & Carex sp.

Floodplain for Intermittent Stream Channel 4

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: ____% Tree: ____% Shrub: ____% Herb: ____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Alton Coal
Project Number: 421
Stream: S58
Investigator(s): Jeff Boice, Collin Covington

Date: May 16, 2012 **Time:** 1:38 pm
Town: Alton **State:** Utah
Photo begin file#: 804 **Photo end file#:** 806

Y [X] / N [ ] Do normal circumstances exist on the site?

Y [ ] / N [X] Is the site significantly disturbed?

Location Details: Northern portion of project area.

Projection: UTM **Datum:** NAD83
Coordinates: 368640 mE 4143572 mN

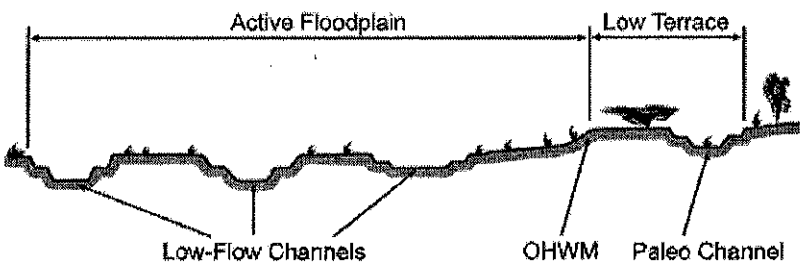
Potential anthropogenic influences on the channel system:
Irrigation runoff

Brief site description:
Sagebrush high terrace with a Juncus sp. dominated drainage swale.

Checklist of resources (if available):

- [X] Aerial photography
  Dates: June 22, 2011
- [X] Topographic maps
- [ ] Geologic maps
- [ ] Vegetation maps
- [ ] Soils maps
- [ ] Rainfall/precipitation maps
- [ ] Existing delineation(s) for site
- [ ] Global positioning system (GPS)
- [ ] Other studies
- [ ] Stream gage data
  Gage number:
  Period of record:
- [ ] History of recent effective discharges
- [ ] Results of flood frequency analysis
- [ ] Most recent shift-adjusted rating
- [ ] Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units

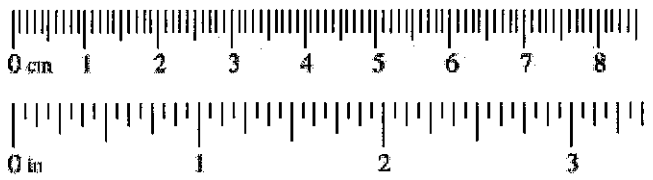


Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - [X] Mapping on aerial photograph
   - [ ] Digitized on computer
   - [X] GPS
   - [ ] Other:

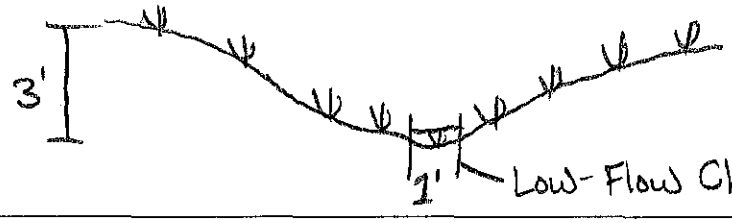
Wentworth Size Classes

Inches (in)	Millimeters (mm)	Wentworth size class	
10.08	256	Boulder	Gravel
2.56	64	Cobble	Gravel
0.157	4	Pebble	Gravel
0.079	2.00	Granule	Gravel
0.039	1.00	Very coarse sand	Sand
0.020	0.50	Coarse sand	Sand
1/2 0.0098	0.25	Medium sand	Sand
1/4 0.005	0.125	Fine sand	Sand
1/8 0.0025	0.0625	Very fine sand	Sand
1/16 0.0012	0.031	Coarse silt	Silt
1/32 0.00061	0.0156	Medium silt	Silt
1/64 0.00031	0.0078	Fine silt	Silt
1/128 0.00015	0.0039	Very fine silt	Silt
		Clay	Mud



Project ID: 421 **Cross section ID:** S58 **Date:** May 16, 2012 **Time:** 1:38 pm

Cross section drawing:



Trough shaped drainage with no channel indicators

OHWM

GPS point: See location on front

Indicators:

- ☐ Change in average sediment texture
- ☐ Change in vegetation species
- ☐ Change in vegetation cover
- ☐ Break in bank slope
- ☐ Other: _____
- ☐ Other: _____

Comments:

No OHWM indicators observed.
Vegetated drainage swale 50% plant cover present

Floodplain unit:

☒ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: silt

Total veg cover: 50 % Tree: ____ % Shrub: ____ % Herb: 50 %

Community successional stage:

- ☐ NA
- ☒ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☒ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

No channel. Vegetated Drainage swale.
riparian wet meadow wetland

Project ID: **Cross section ID:** **Date:** **Time:**

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____ % Tree: _____ % Shrub: _____ % Herb: _____ %

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____ % Tree: _____ % Shrub: _____ % Herb: _____ %

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Alton Coal
Project Number: 421
Stream: S59
Investigator(s): Jeff Boice, Collin Covington

Date: May 16, 2012 **Time:** 1:50 pm
Town: Alton **State:** Utah
Photo begin file#: 809 **Photo end file#:** 811

Y [X] / N [ ] Do normal circumstances exist on the site?

Y [ ] / N [X] Is the site significantly disturbed?

Location Details: Northern portion of project area.

Projection: UTM **Datum:** NAD83
Coordinates: 368811 mE 4143576 mN

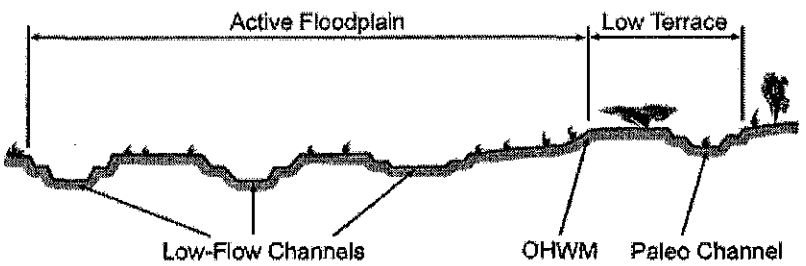
Potential anthropogenic influences on the channel system:
Irrigation runoff

Brief site description:
Pinyon/Juniper and sagebrush upland high terrace.
Upland drainage swale

Checklist of resources (if available):

- [X] Aerial photography
  Dates: June 22, 2011
- [X] Topographic maps
- [ ] Geologic maps
- [ ] Vegetation maps
- [ ] Soils maps
- [ ] Rainfall/precipitation maps
- [ ] Existing delineation(s) for site
- [ ] Global positioning system (GPS)
- [ ] Other studies
- [ ] Stream gage data
  Gage number:
  Period of record:
  - [ ] History of recent effective discharges
  - [ ] Results of flood frequency analysis
  - [ ] Most recent shift-adjusted rating
  - [ ] Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units

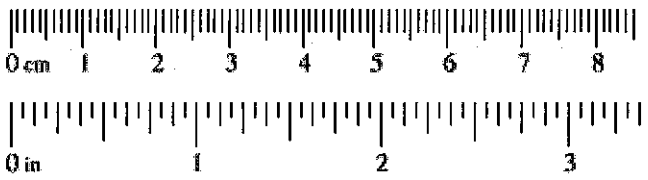


Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - [X] Mapping on aerial photograph
   - [ ] Digitized on computer
   - [X] GPS
   - [ ] Other:

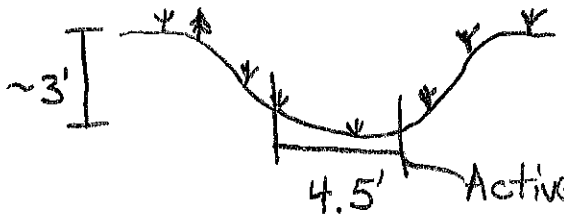
Wentworth Size Classes

Inches (in)	Millimeters (mm)	Wentworth size class	
10.08	256	Boulder	Gravel
2.56	64	Cobble	
0.157	4	Pebble	
		Granule	
0.079	2.00		
0.039	1.00	Very coarse sand	Sand
0.020	0.50	Coarse sand	
1/2 0.0098	0.25	Medium sand	
1/4 0.005	0.125	Fine sand	
1/8 0.0025	0.0625	Very fine sand	
1/16 0.0012	0.031	Coarse silt	Silt
1/32 0.00061	0.0156	Medium silt	
1/64 0.00031	0.0078	Fine silt	
1/128 0.00015	0.0039	Very fine silt	
		Clay	Mud



Project ID: 421 **Cross section ID:** S59 **Date:** May 16, 2012 **Time:** 1:50 pm

Cross section drawing:



U-shaped drainage. The active floodplain encompasses the Low-Flow channel

Upland Drainage Swale

NO Low flow channel present

OHWM

GPS point: See location on front

Indicators:

- ☐ Change in average sediment texture
- ☐ Change in vegetation species
- ☐ Change in vegetation cover
- ☐ Break in bank slope
- ☐ Other: _____
- ☐ Other: _____

Comments:

No OHWM indicators
No channel present
Vegetated drainage swale with 80% plant cover

Floodplain unit: ☐ Low-Flow Channel ☒ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: silt

Total veg cover: 80 % Tree: ____ % Shrub: ____ % Herb: 80 %

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☒ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

No active flow evident. Upland drainage swale.

Project ID: **Cross section ID:** **Date:** **Time:**

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____ % Tree: _____ % Shrub: _____ % Herb: _____ %

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____ % Tree: _____ % Shrub: _____ % Herb: _____ %

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Alton Coal
Project Number: 421
Stream: S60
Investigator(s): Jeff Boice, Dennis Wenger, Collin Covington

Date: May 21, 2012 **Time:** 3:32 pm
Town: Alton **State:** Utah
Photo begin file#: 820 **Photo end file#:** 822

Y ☒ / N ☐ Do normal circumstances exist on the site?

Y ☐ / N ☒ Is the site significantly disturbed?

Location Details: Northern portion of project area.

Projection: UTM **Datum:** NAD83
Coordinates: 370040 mE 4142332 mN

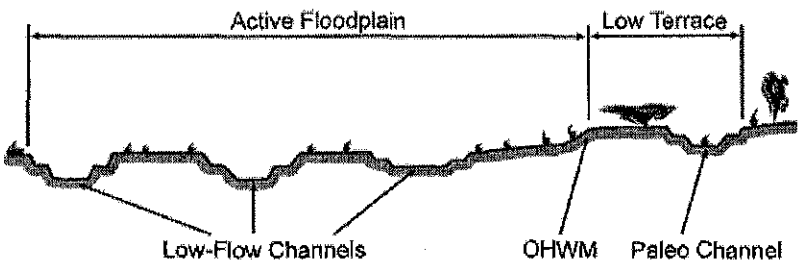
Potential anthropogenic influences on the channel system:
Road & culverts on the drainage upstream.

Brief site description:
Pinyon/Juniper & Sagebrush high terrace with an incised drainage with an active floodplain channel. Ephemeral Stream Channel 16

Checklist of resources (if available):

- ☒ Aerial photography
  Dates: June 22, 2011
- ☒ Topographic maps
- ☐ Geologic maps
- ☐ Vegetation maps
- ☐ Soils maps
- ☐ Rainfall/precipitation maps
- ☐ Existing delineation(s) for site
- ☐ Global positioning system (GPS)
- ☐ Other studies
- ☐ Stream gage data
  Gage number:
  Period of record:
- ☐ History of recent effective discharges
- ☐ Results of flood frequency analysis
- ☐ Most recent shift-adjusted rating
- ☐ Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units



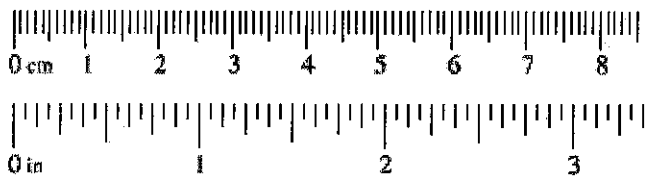
Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - ☒ Mapping on aerial photograph
   - ☐ Digitized on computer
   - ☒ GPS
   - ☐ Other:

Ephemeral Stream Channel 16

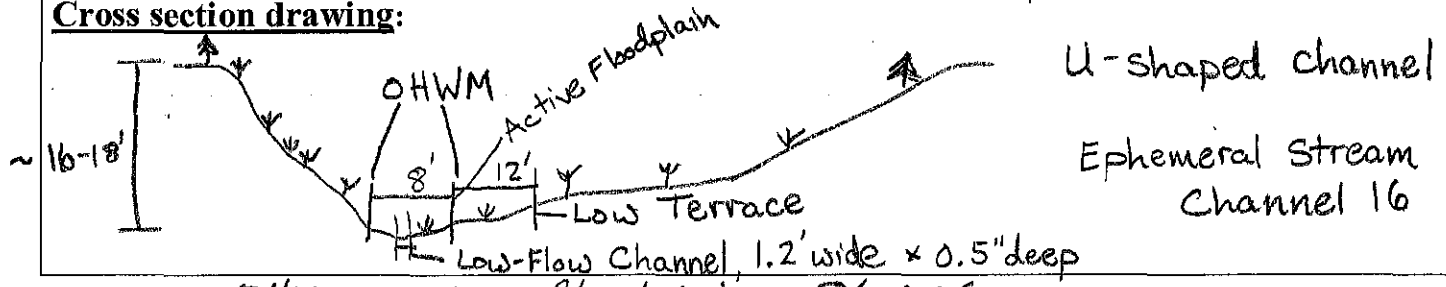
Wentworth Size Classes

Inches (in)	Millimeters (mm)	Wentworth size class	
10.08	256	Boulder	
2.56	64	Cobble	Gravel
0.157	4	Pebble	
0.079	2.00	Granule	
0.039	1.00	Very coarse sand	
0.020	0.50	Coarse sand	
1/2 0.0098	0.25	Medium sand	Sand
1/4 0.005	0.125	Fine sand	
1/8 0.0025	0.0625	Very fine sand	
1/16 0.0012	0.031	Coarse silt	
1/32 0.00061	0.0156	Medium silt	Silt
1/64 0.00031	0.0078	Fine silt	
1/128 0.00015	0.0039	Very fine silt	
		Clay	Mud



Project ID: 421 **Cross section ID:** S60 **Date:** May 21, 2012 **Time:** 3:32 pm

Cross section drawing:



OHWM = ACTIVE floodplain = 8' WIDE

OHWM

ESC #16

GPS point: See location on front

Indicators:

- [x] Change in average sediment texture
- [ ] Change in vegetation species
- [x] Change in vegetation cover
- [x] Break in bank slope
- [ ] Other: _____
- [ ] Other: _____

Comments:

Wracking debris. OHWM is not very distinct.

Floodplain unit: [x] Low-Flow Channel [ ] Active Floodplain [ ] Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: Silt

Total veg cover: >2 % Tree: ____% Shrub: ____% Herb: >2 %

Community successional stage:

- [ ] NA
- [x] Early (herbaceous & seedlings)
- [ ] Mid (herbaceous, shrubs, saplings)
- [ ] Late (herbaceous, shrubs, mature trees)

Indicators:

- [x] Mudcracks
- [ ] Ripples
- [x] Drift and/or debris
- [x] Presence of bed and bank
- [ ] Benches
- [ ] Soil development
- [x] Surface relief
- [ ] Other: _____
- [ ] Other: _____
- [ ] Other: _____

Comments:

Poorly defined banks ~0.5" deep

Project ID: 421 **Cross section ID:** S60 **Date:** May 21, 2012 **Time:** 3:32 pm

Floodplain unit: ☐ Low-Flow Channel ☒ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: pebble

Total veg cover: 5 % Tree: ____ % Shrub: ____ % Herb: 5 %

Community successional stage:

- ☐ NA
- ☒ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☒ Drift and/or debris
- ☒ Presence of bed and bank
- ☐ Benches
- ☒ Soil development
- ☒ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Poorly defined bank

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☒ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: pebble

Total veg cover: 30 % Tree: ____ % Shrub: 25 % Herb: 5 %

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☒ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☒ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Dry, Sagebrush dominated

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Alton Coal
Project Number: 421
Stream: S61
Investigator(s): Jeff Boice, Dennis Wenger, Collin Covington

Date: May 21, 2012 **Time:** 3:46 pm
Town: Alton **State:** Utah
Photo begin file#: 824 **Photo end file#:** 826

Y [X] / N [ ] Do normal circumstances exist on the site?

Y [ ] / N [X] Is the site significantly disturbed?

Location Details: Northern portion of project area.

Projection: UTM **Datum:** NAD83
Coordinates: 369994 mE 4142386 mN

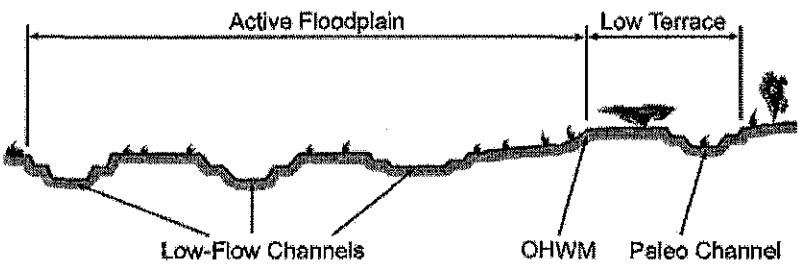
Potential anthropogenic influences on the channel system:
County road & drainage culvert

Brief site description:
Pinyon/Juniper & sagebrush upland high terrace. Point is below confluence of two upland drainage swale's.

Checklist of resources (if available):

- [X] Aerial photography
  Dates: June 22, 2011
- [X] Topographic maps
- [ ] Geologic maps
- [ ] Vegetation maps
- [ ] Soils maps
- [ ] Rainfall/precipitation maps
- [ ] Existing delineation(s) for site
- [ ] Global positioning system (GPS)
- [ ] Other studies
- [ ] Stream gage data
  Gage number:
  Period of record:
- [ ] History of recent effective discharges
- [ ] Results of flood frequency analysis
- [ ] Most recent shift-adjusted rating
- [ ] Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units

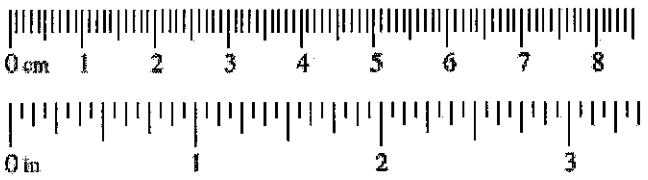


Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - [X] Mapping on aerial photograph
   - [ ] Digitized on computer
   - [X] GPS
   - [ ] Other:

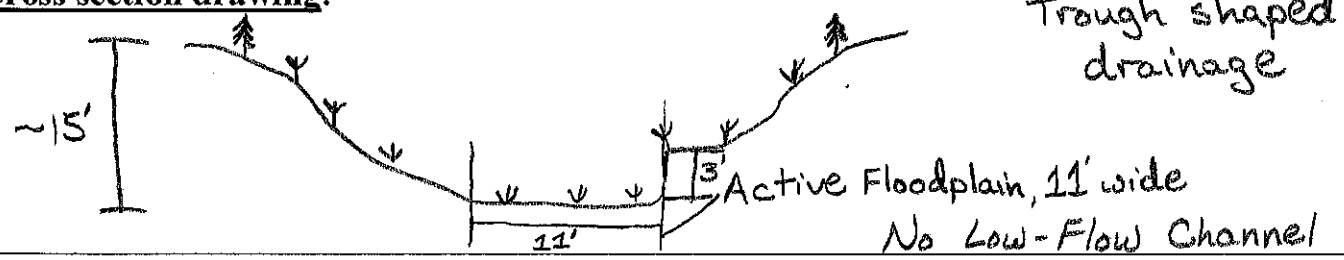
Wentworth Size Classes

Inches (in)	Millimeters (mm)	Wentworth size class	
10.08	256	Boulder	
2.56	64	Cobble	Gravel
0.157	4	Pebble	
0.079	2.00	Granule	
0.039	1.00	Very coarse sand	
0.020	0.50	Coarse sand	
1/2 0.0098	0.25	Medium sand	Sand
1/4 0.005	0.125	Fine sand	
1/8 0.0025	0.0625	Very fine sand	
1/16 0.0012	0.031	Coarse silt	
1/32 0.00061	0.0156	Medium silt	Silt
1/64 0.00031	0.0078	Fine silt	
1/128 0.00015	0.0039	Very fine silt	
		Clay	Mud



Project ID: 421 **Cross section ID:** S61 **Date:** May 21, 2012 **Time:** 3:46 pm

Cross section drawing:



OHWM

GPS point: See location on front

Indicators:

- ☐ Change in average sediment texture
- ☐ Change in vegetation species
- ☐ Change in vegetation cover
- ☐ Break in bank slope
- ☐ Other: _____
- ☐ Other: _____

Comments:

No OHWM indicators

Floodplain unit: ☐ Low-Flow Channel ☒ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: Silt

Total veg cover: 100 % Tree: ____ % Shrub: ____ % Herb: 100 %

Community successional stage:

- ☐ NA
- ☒ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☒ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☒ Soil development
- ☒ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

No channel characteristics or OHWM indicators.

Vegetation dominated by Bromus inermis.

Project ID: **Cross section ID:** **Date:** **Time:**

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____ % Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: _____ % Tree: _____% Shrub: _____% Herb: _____%

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Arid West Ephemeral and Intermittent Streams OHWM Datasheet

Project: Alton Coal
Project Number: 421
Stream: S62
Investigator(s): Jeff Boice, Dennis Wenger, Collin Covington

Date: May 21, 2012 **Time:** 4:10 pm
Town: Alton **State:** Utah
Photo begin file#: 829 **Photo end file#:** 831

Y [X] / N [ ] Do normal circumstances exist on the site?

Y [ ] / N [X] Is the site significantly disturbed?

Location Details: Eastern portion of project area.

Projection: UTM **Datum:** NAD83
Coordinates: 370913 mE 4141797 mN

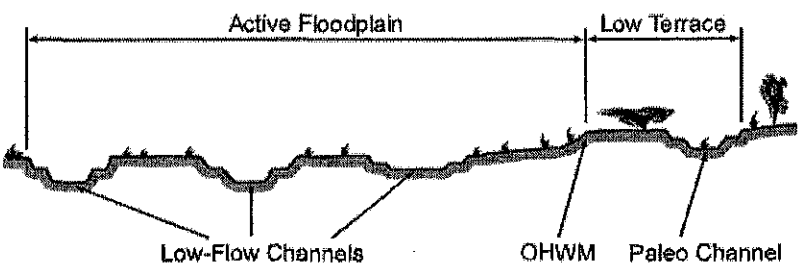
Potential anthropogenic influences on the channel system:
Cleared Pinyon/Juniper from high terrace placed in channel.

Brief site description:
Sagebrush & Bromus inermis on the high terrace that has been cleared of Pinyon/Juniper. Ephemeral Stream Channel 10

Checklist of resources (if available):

- [X] Aerial photography
  Dates: June 22, 2011
- [X] Topographic maps
- [ ] Geologic maps
- [ ] Vegetation maps
- [ ] Soils maps
- [ ] Rainfall/precipitation maps
- [ ] Existing delineation(s) for site
- [ ] Global positioning system (GPS)
- [ ] Other studies
- [ ] Stream gage data
  Gage number:
  Period of record:
  - [ ] History of recent effective discharges
  - [ ] Results of flood frequency analysis
  - [ ] Most recent shift-adjusted rating
  - [ ] Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

Hydrogeomorphic Floodplain Units



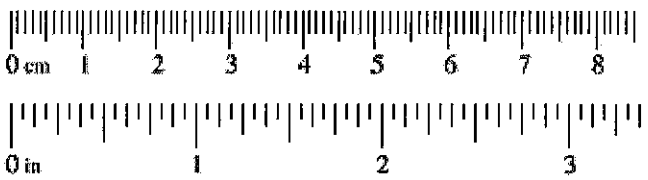
Procedure for identifying and characterizing the floodplain units to assist in identifying the OHWM:

1. Walk the channel and floodplain within the study area to get an impression of the geomorphology and vegetation present at the site.
2. Select a representative cross section across the channel. Draw the cross section and label the floodplain units.
3. Determine a point on the cross section that is characteristic of one of the hydrogeomorphic floodplain units.
   a) Record the floodplain unit and GPS position.
   b) Describe the sediment texture (using the Wentworth class size) and the vegetation characteristics of the floodplain unit.
   c) Identify any indicators present at the location.
4. Repeat for other points in different hydrogeomorphic floodplain units across the cross section.
5. Identify the OHWM and record the indicators. Record the OHWM position via:
   - [X] Mapping on aerial photograph
   - [ ] Digitized on computer
   - [X] GPS
   - [ ] Other:

Ephemeral Stream Channel 10

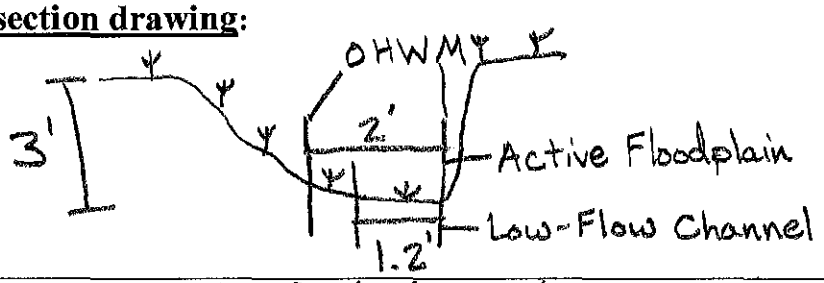
Wentworth Size Classes

Inches (in)		Millimeters (mm)	Wentworth size class	
	10.08	256	Boulder	Gravel
	2.56	64	Cobble	
	0.157	4	Pebble	
	0.079	2.00	Granule	
	0.039	1.00	Very coarse sand	Sand
	0.020	0.50	Coarse sand	
1/2	0.0098	0.25	Medium sand	
1/4	0.005	0.125	Fine sand	
1/8	0.0025	0.0625	Very fine sand	
1/16	0.0012	0.031	Coarse silt	Silt
1/32	0.00061	0.0156	Medium silt	
1/64	0.00031	0.0078	Fine silt	
1/128	0.00015	0.0039	Very fine silt	
			Clay	Mud



Project ID: 421 **Cross section ID:** S62 **Date:** May 21, 2012 **Time:** 4:10 pm

Cross section drawing:



U-shaped Channel

Ephemeral Stream
Channel 10

OHWM = Active floodplain = 2' WIDE

OHWM

ESC #10

GPS point: See location on front

Indicators:

- ☐ Change in average sediment texture
- ☒ Change in vegetation species
- ☒ Change in vegetation cover
- ☒ Break in bank slope
- ☐ Other: _____
- ☐ Other: _____

Comments:

OHWM is not very distinct

Floodplain unit: ☒ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: Silt

Total veg cover: >2 % Tree: ____ % Shrub: ____ % Herb: >2 %

Community successional stage:

- ☐ NA
- ☒ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☒ Mudcracks
- ☐ Ripples
- ☒ Drift and/or debris
- ☒ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☒ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

—

Project ID: 421 **Cross section ID:** S62 **Date:** May 21, 2012 **Time:** 4:10 pm

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: silt

Total veg cover: 10 % Tree: ____ % Shrub: ____ % Herb: 10 %

Community successional stage:

- ☐ NA
- ☒ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☒ Mudcracks
- ☐ Ripples
- ☒ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☒ Soil development
- ☒ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

Vegetated demarcation between the Active Floodplain & Low-Flow Channel.

Ephemeral Stream Channel 10

Floodplain unit: ☐ Low-Flow Channel ☐ Active Floodplain ☐ Low Terrace

GPS point: _____

Characteristics of the floodplain unit:

Average sediment texture: _____

Total veg cover: ____ % Tree: ____ % Shrub: ____ % Herb: ____ %

Community successional stage:

- ☐ NA
- ☐ Early (herbaceous & seedlings)
- ☐ Mid (herbaceous, shrubs, saplings)
- ☐ Late (herbaceous, shrubs, mature trees)

Indicators:

- ☐ Mudcracks
- ☐ Ripples
- ☐ Drift and/or debris
- ☐ Presence of bed and bank
- ☐ Benches
- ☐ Soil development
- ☐ Surface relief
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

Comments:

APPENDIX E

Representative Photos of Wetland and Stream Channel Conditions

Photo Point Locations shown in Universal Transverse Mercator (UTM) Coordinates

Photo Point	Note	Easting	Northing
1	Wetland A	371074	4137483
2	Wetland B	371099	4137569
3	Wetland C	371236	4137633
4	Wetland D	371044	4137897
5	Wetland E	371498	4138374
6	Wetland F	369383	4138492
7	Wetland G	370581	4140647
8	Wetland H	368875	4140999
9	Wetland I	369191	4140085
10	Wetland X	369542	4140469
11	Wetland K	369864	4141735
12	Wetland K	369732	4141406
13	Wetland L	369493	4141303
14	Wetland M	369966	4142136
15	Wetland N	369108	4142471
16	Wetland O	369203	4143102
17	Wetland W	369031	4143843
18	Wetland W	369195	4143663
19	Wetland Q	368649	4143270
20	Wetland R	368511	4143303
21	Wetland S	368569	4143476
22	Wetland T	368568	4143381
23	Wetland U	368637	4143487
24	Wetland V	368653	4143742
25	Wetland J	368643	4143660
26	Wetland P	369664	4143269
27	Ephemeral Stream Channel 1	370460	4137225
28	Ephemeral Stream Channel 2	370317	4137440
29	Ephemeral Stream Channel 3	370638	4137437
30	Ephemeral Stream Channel 4	369287	4139173
31	Ephemeral Stream Channel 5	369772	4139778
32	Ephemeral Stream Channel 6	369926	4140069
33	Ephemeral Stream Channel 7	370412	4140281
34	Ephemeral Stream Channel 8	370533	4140341
35	Ephemeral Stream Channel 9	368914	4140235
36	Ephemeral Stream Channel 10	371238	4141806
37	Ephemeral Stream Channel 11	370273	4141857
38	Ephemeral Stream Channel 11	371562	4142562
39	Ephemeral Stream Channel 12	369847	4141171
40	Ephemeral Stream Channel 13	369364	4141901
41	Ephemeral Stream Channel 14	369245	4138500
42	Ephemeral Stream Channel 15	368945	4140156
43	Ephemeral Stream Channel 16	370039	4142325
44	Intermittent Stream Channel 1	369811	4139852
45	Intermittent Stream Channel 1	371797	4140695
46	Intermittent Stream Channel 2	369481	4141287
47	Intermittent Stream Channel 2	369004	4142597
48	Intermittent Stream Channel 3	369187	4142794
49	Intermittent Stream Channel 4	368602	4143324

Photo Point Locations shown in Universal Transverse Mercator (UTM) Coordinates

Photo Point	Note	Easting	Northing
50	Perennial Stream Channel 1	369802	4141511
51	Perennial Stream Channel 1	370127	4142329
52	Perennial Stream Channel 1	369582	4140769
53	Irrigation Ditch Diversion Point	369572	4141130
54	Surveying	368890	4140668
55	Irrigation Reservoir	368693	4143081
56	Stream Sample Point 2	371013	4137287
57	Stream Sample Point 16	369785	4139186
58	Stream Sample Point 38	371471	4142390
59	Stream Sample Point 47	370148	4142219
60	Stream Sample Point 49	369621	4143700
61	Stream Sample Point 54	368815	4143115
62	Sagebrush Habitat	370211	4138384
63	Overlook, east side of project area	369736	4138854
64	Valley Floor	370308	4140333
65	Overlook, southwest side of project area	371656	4142184
66	Northwest Meadow	368486	4143826
67	Overlooking north side wetlands	369490	4143663
68	Wetland Sample Point 01	370022	4142430
69	Wetland Sample Point 07	370115	4138243
70	Wetland Sample Point 09	369566	4139259
71	Wetland Sample Point 52	369654	4143582

**Photo point locations are shown as UTM Coordinates using a NAD83 Projection*

Photo 1. Looking southeast at Wetland A. Photo taken on May 22, 2012.

Photo 2. Looking northwest at Wetland B. Photo taken on May 22, 2012.

Photo 3. Looking south at Wetland C. Photo taken on May 22, 2012.

Photo 4. Looking southwest at Wetland D. Photo taken on May 22, 2012.

Photo 5. Looking southeast at Wetland E. Photo taken on May 22, 2012.

Photo 6. Looking southeast at Wetland F. Photo taken on May 22, 2012.

Photo 7. Looking southwest at Wetland G. Photo taken on May 22, 2012.

Photo 8. Looking southwest at Wetland H. Photo taken on May 23, 2012.

Photo 9. Looking northeast at Wetland I. Photo taken on May 23, 2012.

Photo 10. Panoramic photo looking north to east at Wetland X. Photo taken on May 23, 2012.

Photo 11. Looking northeast at Wetland K. Photo taken on May 24, 2012.

Photo 12. Looking northeast at Wetland K. Photo taken on May 24, 2012.

Photo 13. Looking north at Wetland L. Photo taken on May 23, 2012.

Photo 14. Panoramic photo looking north to east at Wetland M. Photo taken on May 24, 2012.

Photo 15. Looking north at Wetland N. Photo taken on June 6, 2012.

Photo 16. Looking north at Wetland O. Photo taken on June 7, 2012.

Photo 17. Looking east at Wetland W. Photo taken on June 7, 2012.

Photo 18. Looking south at Wetland W. Photo taken on June 7, 2012.

Photo 19. Looking south at Wetland Q. Photo taken on June 7, 2012.

Photo 20. Looking southeast at Wetland R. Photo taken on June 7, 2012.

Photo 21. Looking north at Wetland S. Photo taken on June 7, 2012.

Photo 22. Looking northwest at Wetland T. Photo taken on June 7, 2012.

Photo 23. Looking southwest at Wetland U. Photo taken on June 6, 2012.

Photo 24. Looking northeast at Wetland V. Photo taken on June 6, 2012.

Photo 25. Looking south at Wetland J. Photo taken on June 6, 2012.

Photo 26. Looking east at Wetland P. Photo taken on June 4, 2012.

Photo 27. Looking east at Ephemeral Stream Channel 1. Photo taken on May 4, 2012.

Photo 28. Looking northeast at Ephemeral Stream Channel 2. Photo taken on May 4, 2012.

Photo 29. Looking north at Ephemeral Stream Channel 3. Photo taken on May 4, 2012.

Photo 30. Looking south at Ephemeral Stream Channel 4. Photo taken on May 5, 2012.

Photo 31. Looking southeast at Ephemeral Stream Channel 5. Photo taken on May 5, 2012.

Photo 32. Looking southwest at Ephemeral Stream Channel 6. Photo taken on May 6, 2012.

Photo 33. Looking south at Ephemeral Stream Channel 7. Photo taken on May 6, 2012.

Photo 34. Looking west at Ephemeral Stream Channel 8. Photo taken on May 6, 2012.

Photo 35. Looking west at Ephemeral Stream Channel 9. Photo taken on May 6, 2012.

Photo 36. Looking northeast at Ephemeral Stream Channel 10. Photo taken on May 7, 2012.

Photo 37. Looking east at Ephemeral Stream Channel 11. Photo taken on May 7, 2012.

Photo 38. Looking east at Ephemeral Stream Channel 11. Photo taken on May 8, 2012.

Photo 39. Looking northeast at Ephemeral Stream Channel 12. Photo taken on May 14, 2012.

Photo 40. Looking northeast at Ephemeral Stream Channel 13. Photo taken on May 15, 2012.

Photo 41. Looking east at Ephemeral Stream Channel 14. Photo taken on May 5, 2012.

Photo 42. Looking north at Ephemeral Stream Channel 15. Photo taken on May 6, 2012.

Photo 43. Looking north at Ephemeral Stream Channel 16. Photo taken on May 21, 2012.

Photo 44. Looking west at Intermittent Stream Channel 1. Photo taken on May 5, 2012.

Photo 45. Looking east at Intermittent Stream Channel 1. Photo taken on May 7, 2012.

Photo 46. Looking north at Intermittent Stream Channel 2. Photo taken on May 14, 2012.

Photo 47. Looking northwest at Intermittent Stream Channel 2. Photo taken on May 16, 2012.

Photo 48. Looking south at Intermittent Stream Channel 3. Photo taken on May 15, 2012.

Photo 49. Looking north at Intermittent Stream Channel 4. Photo taken on May 16, 2012.

Photo 50. Looking north at Perennial Stream Channel 1 (Kanab Creek). Photo taken on May 4, 2012.

Photo 51. Looking north at Perennial Stream Channel 1. Photo taken on May 24, 2012.

Photo 52. Looking southwest at Perennial Stream Channel 1. Photo taken on May 4, 2012.

Photo 53. Looking east at irrigation ditch diversion point. Photo taken on May 14, 2012.

Photo 54. Looking south at surveying of Stream Sample Point 28. Photo taken on May 6, 2012.

Photo 55. Panoramic photo looking northwest to northeast at the irrigation reservoir. Photo taken on May 16, 2012.

Photo 56. Looking north at Stream Sample Point 2.
Photo taken on May 3, 2012. No OHWM present.

Photo 57. Looking north at Stream Sample Point 16.
Photo taken on May 5, 2012. No OHWM present.

Photo 58. Looking southeast at Stream Sample Point 38.
Photo taken on May 8, 2012. No OHWM present.

Photo 59. Looking west at Stream Sample Point 47.
Photo taken on May 15, 2012. No OHWM present.

Photo 60. Looking north at Stream Sample Point 49.
Photo taken on May 15, 2012. No OHWM present.

Photo 61. Looking southwest at Stream Sample Point 54.
Photo taken on May 16, 2012. No OHWM present.

Photo 62. Looking east at a sagebrush opening. Photo taken on May 4, 2012.

Photo 63. Looking southwest at the southwest corner of the project area. Photo taken on May 5, 2012.

Photo 64. Looking south at a valley floor. Existing coal mine visible in background. Photo taken on May 6, 2012.

Photo 65. Looking southwest at the east-central portion of the project area. Photo taken on May 8, 2012.

Photo 66. Looking east at the northwest portion of the project area. Photo taken on June 6, 2012.

Photo 67. Looking west at northern portion of the project area. Photo taken on June 6, 2012.

Photo 68. Looking northwest at Wetland Sample Point 01. Photo taken on May 21, 2012. Did not meet wetland criteria.

Photo 69. Looking west at Wetland Sample Point 07. Photo taken on May 22, 2012. Did not meet wetland criteria.

Photo 70. Looking southeast at Wetland Sample Point 09. Photo taken on May 22, 2012. Did not meet wetland criteria.

Photo 71. Looking north at Wetland Sample Point 52. Photo taken on June 6, 2012. Did not meet wetland criteria.

I.4. Alton Coal Tract Special Status Plant Species Clearance Survey Report

ALTON COAL TRACT SPECIAL STATUS PLANT SPECIES CLEARANCE SURVEY REPORT

INTRODUCTION

The Alton Coal Tract is in Kane County, Utah, approximately 0.10 mile south of the town of Alton and 2.9 miles east of U.S. Route 89 (US-89). The tract occurs at approximately 6,900 feet above sea level in the semiarid foothills of the Colorado Plateau Semidesert Province (Woods et al. 2001) of south-central Utah. Vegetation in the tract is predominantly pinyon-juniper woodlands (40.2%), with large areas of sagebrush/grassland (24.1%) and sagebrush/grassland (treated) (20.9%), and more limited distribution of annual and perennial grasses (9.1%), mountain brush (1.8%), meadow (1.8%), riparian (1.5%), and rabbitbrush (0.3%) vegetation communities (detailed discussion of each vegetation community is presented in Section 3.15.2 of the SDEIS). These vegetation communities are typical of the surrounding Colorado Plateau vegetation. Numerous plant species have limited distributions in Kane County and nearby counties because of the area's unique geologic or soil conditions, or because of other habitat conditions that have contributed to rarity or restricted ranges.

Five federally listed plant species and 16 BLM-listed sensitive plant species are known to occur in Kane County, Utah. Of these, only a few are known to occur at the elevational range in the tract, and potential habitats are limited. Surveys for suitable habitat for special status plant species were conducted in November 2007, August 2008, and September 2008, and no potential habitats were identified. Because the conservation status and known distributions of both federally listed and BLM-listed plant species have changed since the 2008 surveys, additional potential habitat surveys were required to determine if currently listed special status species or their habitats occur in the tract. This report presents the current knowledge of special status plant species with potential to occur in Kane County, Utah, and the results of the June 2012 field surveys to validate the potential for special status plant species distributions in the tract.

METHODS

Federally Listed Plant Species

In their comments on the DEIS, the U.S. Fish and Wildlife Service indicated four federally listed species that are known to occur in Kane County, Utah: Welsh's milkweed (*Asclepias welshii*), Las Vegas buckwheat (*Eriogonum corymbosum* var. *nilesii*), Kodachrome bladderpod (*Lesquerella tumulosa*), and Siler pincushion cactus (*Pediocactus sileri*). In addition, Jones cycladenia (*Cycladenia humilis* var. *jonesii*) was added because it is listed in the USFWS *Federally Listed and Proposed Endangered, Threatened and Candidate Species and Critical Habitat in Utah – Species List by County* (USFWS 2012).

Consultation and Coordination with USFWS following Comments on the DEIS

SWCA consulted with biologists at the USFWS and BLM to determine the potential for the federally listed plant species listed for Kane County, Utah, (Table 1) to occur in the tract. Potential habitat distributions for these federally listed plant species was determined using geographic information systems (GIS) analysis of Southwest Regional Gap Analysis Project (SWReGAP) land cover types, vegetation communities delineated during 2007 field reconnaissance, elevational range, and surface geology. SWCA

identified Welsh's milkvetch as having limited potential to occur in the tract, but further review of the species' current distributions and habitat associations indicates that it is unlikely to be distributed in the tract (personal communication, Gubler 2012). Table 1 summarizes the distributions and habitat associations of the federally listed plant species known to occur in Kane County, Utah, and the rationale for eliminating these species from further analysis.

Table 1. Federally Listed Plant Species Potential to Occur in the Alton Coal Tract

Species Name/ Common Name	Status*	Location/Habitat (county—location; geologic stratum; plant community; elevation range)	Potential for Occurrence in the Alton Tract†
No Potential in Tract			
Asclepias welshii Welsh's milkweed	T	Garfield, Kane—sand dunes; sagebrush, juniper, and ponderosa pine communities; 5,600–6,200 feet above mean sea level (amsl). June–early September. (UNPS 2003–2013).	None. Igneous gravel substrates and species' elevational range do not occur in the tract (personal communication, Defreese 2012a).
Cycladenia humilis var. *jonesii* Jones cycladenia	T	Garfield, Kane—gypsiferous soils of the Chinle, Cutler, and Summerville formations; desert shrub and juniper communities; 4,400–6,000 feet amsl. Mid-May–June. (UNPS 2003–2013).	None. Potential habitats and the species' elevational range do not occur in the tract (personal communication, Defreese 2012b).
Eriogonum corymbosum var. *nilesii* Las Vegas buckwheat	C	Kane—Paria River; Moenkopi formation, sandstone talus slopes, gypsiferous soils, burned or eroding basalt slopes; sparse vegetation; 650–2,800 feet amsl. Late September–early October. (Tilley 2012).	None. Potential habitat for the species does not occur in the tract (personal communication, Defreese 2012c).
Lesquerella tumulosa Kodachrome bladderpod	E	Kane—known only from the Kodachrome Flats area of the Paria River on white shale knolls; Utah juniper communities; 5,700 feet amsl. May–June. (Tilley et al. 2010).	None. Highly restricted local endemic. The species' potential habitats and elevational range do not occur in the tract (Tilley et al. 2010).
Pediocactus sileri Siler pincushion cactus	T	Kane—gypsiferous clay and sandy soils derived from the Moenkopi Formation; desert shrub communities; 2,800–5,400 feet amsl. April–June. (USFWS 2008)	None. The species' potential habitats and elevational range do not occur in the tract (USFWS 2008).

* Status: C = federal candidate; E = federally endangered; T = federally threatened.

† Occurrence: None = suitable and/or potential habitat for this species are unknown in survey area; Low = some suitable and/or potential habitat for this species, but populations unknown near survey area; Moderate = substantial suitable and/or potential habitat for this species, or know populations near, but unknown in survey area; High = populations known in survey area or immediate proximity.

BLM Sensitive Plant Species

The *INTERIM Bureau of Land Management Sensitive Plant Species List for Utah February 2011* provides guidance for the management of sensitive plant species occurring on BLM lands in Utah and is maintained by the BLM's Utah State Office (BLM 2011). In accordance with Utah BLM Instruction Memorandum (IM) No. 2011-037, the updated sensitive plant species list became effective for BLM lands in Utah April 18, 2011. The *INTERIM Bureau of Land Management Sensitive Plant Species List for Utah February 2011* replaces the 2002 list. The 2011 list contains 16 sensitive plant species that are known to occur or have potential to occur in Kane County, Utah.

SWCA identified three BLM sensitive species as having limited potential to occur in the tract: Cronquist's phacelia (*Phacelia cronquistiana*), pinnate spring-parsley (*Cymopterus beckii*), and escarpment milkvetch (*Astragalus striatiflorus*). Review of the current distributions and habitat associations for these species indicated that only *Phacelia cronquistiana* had potential to occur on the

tract. Before conducting clearance surveys, SWCA botanists met with BLM ecologist Kim Anderson, who recommended that surveys be conducted for *Phacelia cronquistiana*.

Table 2 summarizes all Utah BLM sensitive plant species known to occur in Kane County, their distributions and habitat associations, and the rationale for either retaining or eliminating each species from further analysis.

Table 2. Utah BLM Sensitive Plant Species Potential to Occur in the Alton Coal Tract

Species Name/ Common Name	Status*	Location/Habitat (county—location; geologic stratum; plant community; elevation range)	Potential for Occurrence in the Alton Tract†
Moderate Potential			
Phacelia cronquistiana Cronquist's phacelia	S	Kane—clay outcrops; pinyon-juniper, sagebrush, and ponderosa pine communities; (5,700) 6,000–6,900 feet amsl. May–June. (UNPS 2003–2013)	Moderate. Potential habitats occur in the tract (personal communication, Gubler 2012). Surveyed in June 2012. No individuals were found during surveys of the tract and reference sites.
Low Potential			
Cymopterus beckii Pinnate spring-parsley	S	Kane (?)—sandy or stony soils, rock crevices and cliffs; pinyon-juniper, mountain brush, ponderosa/manzanita, conifer/oak and Douglas fir communities; 5,600–7,500 feet amsl. April–July (UNPS 2003–2013)	Low. Species is not known to occur in Kane County. Limited or no potential habitats in the tract (personal communication, Gubler 2012). No surveys performed.
Astragalus welshii Welsh's milkvetch	S	Garfield, Kane—igneous gravels; sagebrush, pinyon-juniper, and sagebrush-aspen communities; 7,000–9,200 feet amsl. May–early June. (UNPS 2003–2013)	Low. Potential habitats on igneous gravels do not occur in the tract (personal communication, Gubler 2012). No surveys performed.
Astragalus striatiflorus Escarpment milkvetch	S	Kane, Washington—Navajo Sandstone; sandy channels in ponderosa pine, sandy desert shrub, and pinyon-juniper; 4,900–6,600 feet amsl. May–June. (UNPS 2003–2013)	Low. Potential habitats and distribution may occur, but the species is not predicted to occur in the tract based on GIS-based predictive models (Krause 2012). No surveys performed.
No Potential in the Tract			
Astragalus ampullarius Gumbo milkvetch	S	Kane, Washington—clay soils of the Chinle and Tropic (?) shale formations; mixed desert shrub and juniper communities; 3,200-5,400 feet amsl. April–May. (UNPS 2003–2013)	None. Elevational range of the species is below the elevations present in the tract.
Dalea flavescens var. *epica* Hole-in-the-rock prairie clover	S	Garfield, Kane—sandstone bedrock and sandy soils; blackbrush and mixed desert shrub communities; 4,700–5,000 feet amsl. (No flowering dates published). (UNPS 2003–2013)	None. Elevational range of the species is below the elevations present in the tract.
Euphorbia nephradenia Utah spurge	S	Garfield, Kane—dark clay hills, blown sand, and stabilized dunes derived from Tropic shale and Entrada formations; mat saltbush, blackbrush, *Ephedra*, mixed salt desert scrub, and grassland communities; 3,800–4,800 feet amsl. June–August. (UNPS 2003–2013)	None. Elevational range of the species is below the elevations present in the tract.
Haplopappus zionis Cedar Breaks goldenbush	S	Garfield, Kane—Cedar Breaks (Claron limestone) formation; spruce-fir and ponderosa pine communities; 8,000–10,000 feet amsl. Mid-July–August. (UNPS 2003–2013)	None. Elevational range of the species is above the elevations present in the tract.

Table 2. Utah BLM Sensitive Plant Species Potential to Occur in the Alton Coal Tract

Species Name/ Common Name	Status*	Location/Habitat (county—location; geologic stratum; plant community; elevation range)	Potential for Occurrence in the Alton Tract†
Jamesia americana var. *zionis* Zion jamesia	S	Kane— hanging gardens, sandstone crevices, cliff sides and bases; pinyon-juniper, oak, and ponderosa pine communities; 3,900–6,600 (8,200) feet amsl. (No flowering dates published). (UNPS 2003–2013)	None. Potential habitats are not present in tract.
Lupinus caudatus var. *cutleri* Cutler lupine	S	Kane—pinyon-juniper woodland communities; 5,150 feet amsl. Mid-April–May. (UNPS 2003–2013)	None. Elevational range of the species is below the elevations present in the tract.
Oenothera murdockii Chinle evening primrose	S	Kane—red-purple or grey clay silty barrens of the Chinle and Moenkopi(?) formations; pinyon-juniper communities; 4,400–5,600 feet amsl. April–May. (UNPS 2003–2013)	None. Elevational range of the species is below the elevations present in the tract.
Pediomelum epipsilum Kane breadroot	S	Kane—Chinle and Moenkopi formations; pinyon-juniper woodland and desert shrub communities; 4,000–5,500 feet amsl. May–June. (UNPS 2003–2013)	None. Elevational range of the species is below the elevations present in the tract.
Phacelia pulchella var. *atwoodii* Atwood's pretty phacelia	S	Kane—Moenkopi and Carmel derived soils; pinyon-juniper, oak, sagebrush, ash, and serviceberry communities; 5,100–5,500 feet amsl. April–May. (UNPS 2003–2013)	None. Elevational range of the species is below the elevations present in the tract.
Salvia columbariae var. *argillacea* Chinle chia	S	Kane—saline clay silts and "gypsum boils" of the Chinle formation on alluvium or colluvium; sparse pinyon-juniper communities; 4,250–5,600 feet amsl. Mid-May–mid-June. (UNPS 2003–2013)	None. Elevational range of the species is below the elevations present in the tract.
Sphaeralcea grossulariifolia var. *fumariensis* Smoky Mountain mallow	S	Kane—Straight Cliffs, Tropic Shale, and Dakota formations on and near Smoky Mountain; matchweed, *Ephedra*, galleta, shadscale, and juniper communities; 4,400–5,400 feet amsl. April–June. (UNPS 2003–2013)	None. Elevational range of the species is below the elevations present in the tract.
Thelypodiopsis ambigua var. *erecta* Kanab thelepody	S	Kane—clay soils derived from purple Chinle shales; Pinyon-juniper and desert shrub communities; 5,000–5,400 feet amsl. April–May. (UNPS 2003–2013)	None. Elevational range of the species is below the elevations present in the tract.
Trifolium variegatum var. *parunuweapensis* Variegated clover	S	Kane—sand seeps; pinyon-juniper and ponderosa pine communities; 4,200–5,905 feet amsl. (No flowering dates published). (UNPS 2009; UNPS 2003–2013)	None. Elevational range of the species is below the elevations present in the tract.

* Status: C = federal candidate; E = federally endangered; T = federally threatened.

† Occurrence: None = suitable and/or potential habitat for this species are unknown in survey area; Low = some suitable and/or potential habitat for this species, but populations unknown near survey area; Moderate = substantial suitable and/or potential habitat for this species, or know populations near, but unknown in survey area; High = populations known in survey area or immediate proximity.

Clearance Survey Results

Presence/absence surveys for *Phacelia cronquistiana* were conducted by SWCA botanists on June 25 and 26, 2012. Clearance surveys followed the protocols established in the *U.S. Fish and Wildlife Service Utah Field Office Guidelines for Conducting and Reporting Botanical Inventories and Monitoring of Federally Listed, Proposed and Candidate Plants* (USFWS 2011). Under these guidelines, SWCA conducted clearance surveys for plants within suitable habitats (pinyon-juniper and sagebrush communities) on the

Alton Coal Tract. Clearance surveys included the tract and all potential habitats within a 300-foot buffer of the tract boundary.

No individuals of *Phacelia cronquistiana* were found in the tract or at two reference populations visited before the site surveys. The species absence at the reference populations may have been due to the very hot and dry early growing season of 2012, which may have limited or prevented the germination and/or growth of this annual flowering plant.

SUMMARY

Of the five federally listed and 16 BLM sensitive plant species known to occur in Kane County, Utah, one species, *Phacelia cronquistiana* (BLM sensitive), was identified as warranting surveys of potential habitats in the Alton Coal Tract. Surveys for *Phacelia cronquistiana* in pinyon-juniper and sagebrush vegetation communities were conducted on June 26 and 27, 2012. No individuals were found either on the tract or during site visits to reference sites. The absence of the annual forb from the reference sites may have been due to the very hot and dry conditions during the early 2012 growing season.

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APPENDIX J.

AN ASSESSMENT OF THE IMPACT OF POTENTIAL MINING OPERATIONS AT THE ALTON COAL TRACT ON THE DARK SKIES OF BRYCE CANYON NATIONAL PARK AND CEDAR BREAKS NATIONAL MONUMENT, ORIGINAL REPORT (2009) AND PART II (2014)

APPENDIX J CONTENTS

J.1. An Assessment of the Impact of Potential Mining Operations at the Alton Coal Tract on the Dark skies of Bryce Canyon National Park and Cedar Breaks National Monument

J.2. An Assessment of the Impact of Potential Mining Operations at the Alton Coal Tract on the Dark Skies of Bryce Canyon National Park and Cedar Breaks National Monument
Part II. An Additional Lighting Scenario, Dust Effects, Projected Future Increases in Skyglow due to Growth, and the Average Sky Luminance Parameter

J.1. An Assessment of the Impact of Potential Mining Operations at the Alton Coal Tract on the Dark skies of Bryce Canyon National Park and Cedar Breaks National Monument

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APRIL 29, 2009 REPORT: ASSESSMENT OF THE IMPACT OF POTENTIAL MINING OPERATIONS AT THE ALTON COAL TRACT ON THE DARK SKIES OF BRYCE CANYON NATIONAL PARK AND CEDAR BREAKS NATIONAL MONUMENT

Attachment 1. 3/26/2008 Memo from National Park Service Night Sky Program Manager to SWCA Project Manager: Discussion of second observation point, Alton coal mine night sky aesthetic analysis, and graphic attachment accompanying memo

Attachment 2. 4/28/2009 Correspondence between National Park Service Air Resources Division and BLM Project Manager re: Alton Coal Mine Lightscape Analysis

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AN ASSESSMENT OF THE IMPACT OF POTENTIAL MINING OPERATIONS AT THE ALTON COAL TRACT ON THE DARK SKIES OF BRYCE CANYON NATIONAL PARK AND CEDAR BREAKS NATIONAL MONUMENT

NIGHT SKY FROM YOVIMPA POINT, BRYCE CANYON NATIONAL PARK
(NPS NIGHT SKY TEAM IMAGE)

FINAL REPORT

Prepared by Dark Sky Partners, LLC
for
SWCA Environmental Consultants

April 2009

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EXECUTIVE SUMMARY

This study presents results from computer calculations of the sky brightness due to mining operations in the Alton Coal Tract when viewed from Yovimpa Point in Bryce Canyon National Park and from Brianhead Peak near Cedar Breaks National Monument. Two scenarios were suggested by Alton Coal Development for analysis, one for *typical* lighting and one for *brightest* expected lighting. The calculations show that, under the *typical* lighting scenario, the lighting would not produce a sky glow visible above the horizon from Yovimpa Point; any sky glow would be seen only when looking just above the mine site and just below the distant horizon. The predicted sky glow would be less than that produced by several small towns in the general area that are usually not discernable according to the National Park Service, and significantly less than the visible glow arising from the distant large cities of St.George and Cedar City, Utah. Under the *brightest* lighting scenario described in this report, the sky glow seen from Yovimpa Point is found to be comparable to that produced by small, local towns but still less than that of the larger distant towns.

From Brianhead Peak, the analysis shows that the mine lighting under the *typical* lighting scenario would produce less sky glow than that produced by nearby towns. Under the *brightest* lighting scenario the sky glow would be comparable with that produced by several nearby towns

A separate analysis by SWCA shows that intervening terrain would prevent direct visibility of lights in the Alton Coal Tract from Yovimpa Point, but the same does not hold true for Brianhead Peak. If visible, the unshielded 1000 watt metal halide lights suggested for potential use at the active mine site are likely to be the brightest artificial lights visible in the night landscape and would look significantly brighter than the planet Venus.

Options that could reduce the sky glow and direct fixture brightness associated with lighting in the Alton Coal Tract lighting are presented.

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I. INTRODUCTION

Dark night skies are increasingly recognized as one of the premier attractions of National Parks and Monuments, particularly those in the western U.S. Bryce Canyon National Park (BCNP) and Cedar Breaks National Monument (CBNM) are two premier dark sky sites; BCNP in particular attracts many thousands of visitors annually to enjoy a nearly pristine dark sky experience. Unfortunately, many other dark sky sites have been adversely affected by light pollution, from the intrusion of visible light sources into the naturally dark night landscape, the direct illumination of the park or portions of the park by lighting located within or outside of the park, and artificial sky glow arising from light emitted directly from fixtures or reflected from the ground and scattered (re-directed) toward the ground by atmospheric molecules and aerosols. Increasingly, proposed developments that could impact dark sky sites are now being required to address the potential impact of new outdoor lighting on dark skies as part of the environmental assessment process.

This study examines the sky glow that would arise from surface coal mining operations in the Alton Coal Tract (ACT) south of Alton, UT. The Tract is shown in Figure 1, along with nearby Bryce Canyon National Park and Cedar Breaks National Monument. Details of the ACT, showing the potential areas for mining as well as those for the mine headquarters, are shown in Figure 2. The sky glow created by the lighting described in this report is calculated using a sophisticated model describing the interaction of light emitted near the ground and interacting with objects and surfaces near the ground, the atmosphere of molecules and aerosols over the mine site and between the mine site and points of observation. These models are described in detail in published papers by Garstang (1986, 1989, 1991) and by Luginbuhl et al. (2009b). These models have been incorporated into a computer program by Dark Sky Partners LLC (DSP).

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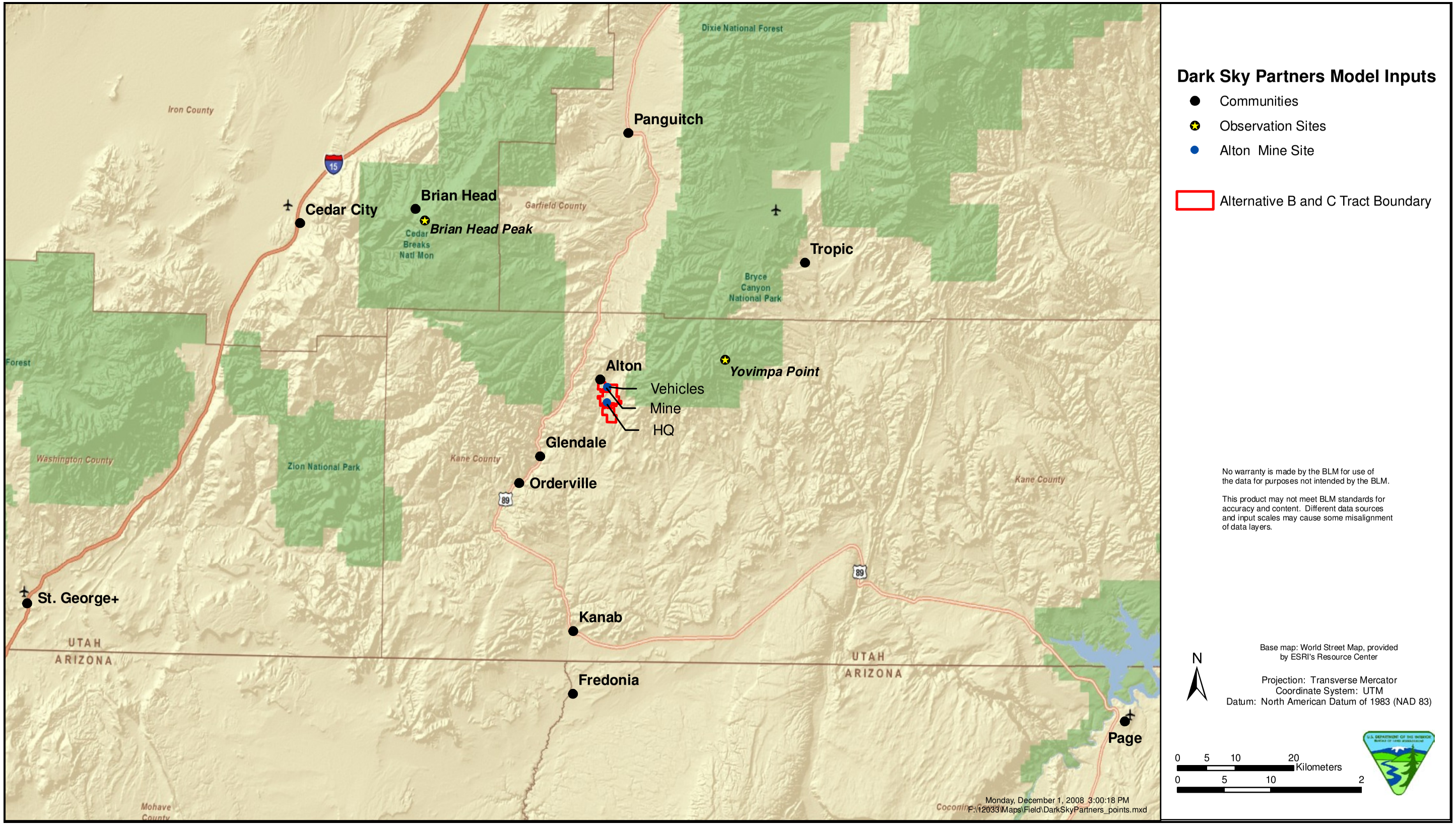

Figure 1. The location of the Alton Coal Tract, Yovimpa Point and Brianhead Peak, together with regional towns and cities included in sky glow models.

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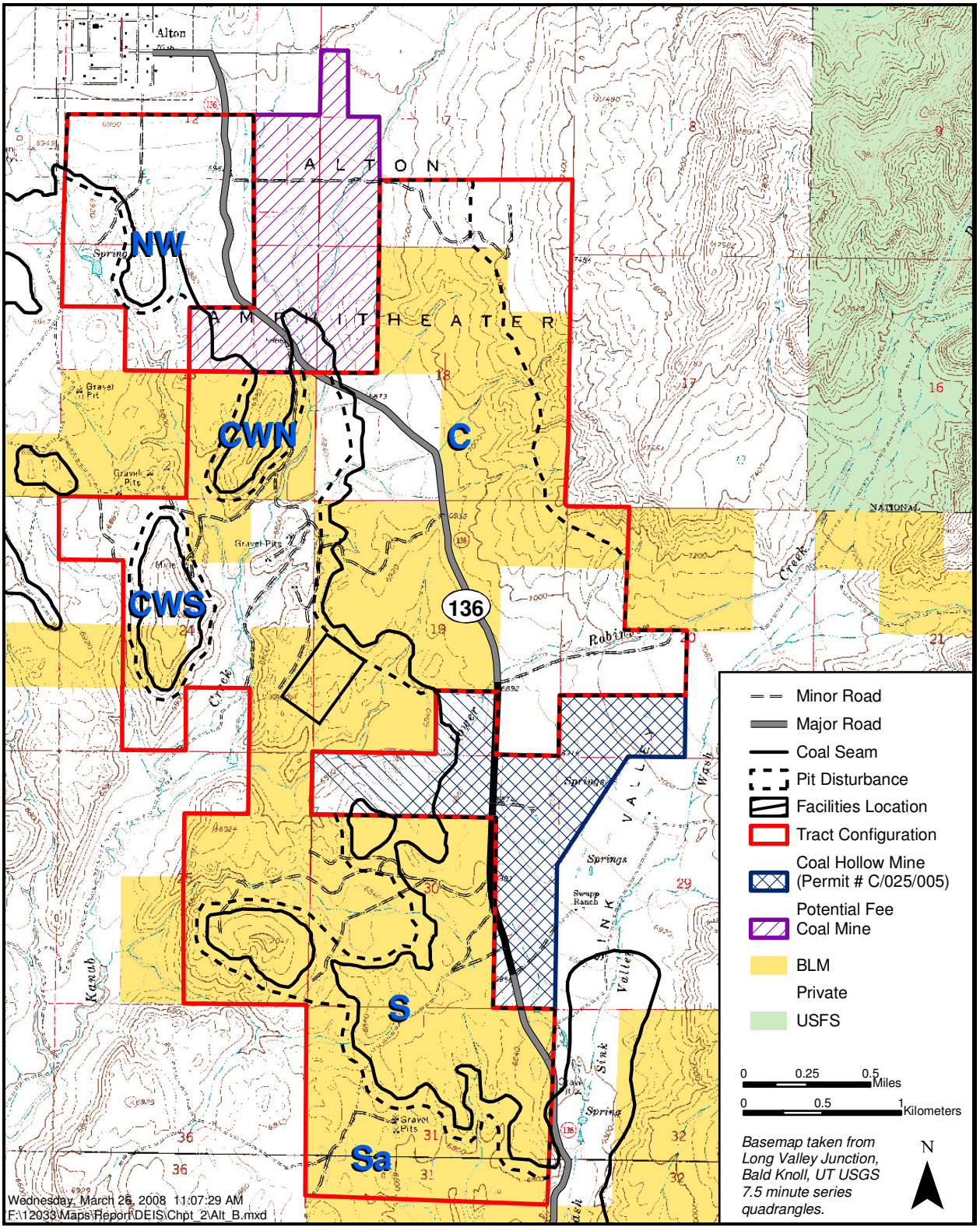

Figure 2. Details of the Alton Coal Tract and potential headquarters (facilities) site.

II. STUDY METHODOLOGY

A. The Numerical Model

R. Garstang (Garstang 1986, 1989, 1991) developed and published a model for calculating sky brightness arising from artificial outdoor lighting. This model has been recently improved by Luginbuhl et al. (2009b) to include effects on light propagation caused by blocking of the light emissions by objects near the ground, such as buildings, vegetation and terrain, an improvement essential to accurately connect light emissions measured at the light sources (lamps) with the resultant sky glow. A computer program based on this improved model, developed by Dark Sky Partners LLC, calculates the sky brightness observable from any location and toward any viewing direction due to light emitted from cities and towns or any specific light source or sources (i.e. fixtures). This program allows modeling of specific sources of artificial lighting such as shopping centers, housing developments or industrial projects, with the capability of specifying details such as amounts, spatial distribution, and shielding characteristics of lighting sources (Davis et al. 2006). This computer program was used to assess the impact of lighting at potential ACT mining operations on dark skies of BCNP and CBNM.

B. Data Input for the Model

The inputs for the computer model include parameters describing the atmosphere and ground reflectivity, the location and amounts of light emitted (measured in lumens), the fraction of this light that escapes directly upward into the night sky (the uplight fraction), and the locations from which the sky is observed.

Atmosphere and Ground

Table 1 shows the parameters characterizing the atmosphere and ground; these values were kept constant for all locations. The parameter that describes the amount of aerosol (particulates) or clarity of the atmosphere, K, was set to 0.05. This is lower than the value used by Garstang for typical western cities (K=0.5), but is based on observations made by the National Park Service (NPS) Night Sky Team at CBNM and describes the 90th percentile (i.e. the K value was observed to be larger than this 90% of the time), and was recommended by NPS as the most appropriate condition for the analysis. Such a low value is not entirely unexpected due to the extreme clarity of the air in this region and at these altitudes. (It is important to recognize the modeling does not account for increased aerosols that may result from some weather conditions, air pollution, or the mining operations themselves.) The E_b and β parameters describe blocking of light emitted from light fixtures due to near-ground factors (vegetation, terrain), and affect both the amount of light escaping into the sky as well as the angular distribution of this upward-directed light. The values indicated for these parameters produced the best agreement between the model calculations and sky brightness measurements in the work described by Luginbuhl et al. (2009b), except that for this study the β parameter has been increased from their best value of 0.0 to 0.1 to compensate for the relatively un-vegetated and open nature of the near-ground environment in this region. The ground reflectivity of 0.15 is typical of a wide variety of surfaces (except snow) including terrain, vegetation, dirty concrete and aged asphalt hardtop, and has been found to adequately characterize ground reflectivity for all warm season light pollution modeling efforts to date (Garstang 1986, 1989, 1991, Luginbuhl et al. 2009b and references therein).

These atmospheric parameters describe very clear conditions and will lead to modeling results that will show smaller impacts from potential lighting in the ACT as well as from nearby towns than will typically be the case. The NPS night sky team purpose in recommending these clear conditions for the analysis is to show what the impacts would be during the "best" observation nights, when the air is clearest and the stars most visible. It is important to recognize that 90% of the time the air will be less clear, and the impacts larger.

Some of the towns in this region lie within narrow valleys or canyons, and thus light emitted from them would suffer, in some directions, considerably greater blocking by the terrain. There has been no attempt to model this effect on a town-by-town basis in this study.

Table 1. Atmospheric and Ground Parameters

Parameter	Value
K	0.05
E_b	0.40
β	0.10
Ground Reflectivity	0.15

Alton Coal Tract Lighting

The number and types of lights to be modeled as representative of lighting in the ACT were discussed and agreed to through telecoms with Alton Coal Development (ACD), SWCA, NPS, and BLM on September 25 and 30, 2008 and subsequent emails. The parameters listed in Tables 1 through 4 were distributed to these agencies for review and final approval.

Lighting required for nighttime mining operations on the tract would consist of three types of lights: 1) fixed lights at the mine headquarters for parking, walkway, security and general nighttime activity; 2) portable light towers with individually aimable fixtures located at the active mine site that would be moved as the mining operations shift; and 3) lighting (i.e. headlights) on mining vehicles, also assumed to be located at the active mine site.

The fixed lights at the headquarters buildings would utilize 250 watt metal halide lamps producing 25,000 lumens each, contained within fully shielded fixtures, i.e. none of the light is emitted directly upward. The portable lights would utilize 1000 watt metal halide lamps producing 110,000 lumens each. These fixtures are mounted with adjustable gimbals, allowing the fixtures to be aimed in different directions and at different angles relative to the horizon (see Appendix A). Although DSP contacted Baldor Electric Company, a manufacturer of a potential portable lighting system suggested by ACD representatives, the representatives of Baldor were unable to produce the photometric information needed to accurately evaluate the fraction of light directed upward as a function of aiming angle of the fixtures. Therefore, for this study DSP is forced to estimate this fractional uplight value. We assume that they would typically be aimed at 30° below the horizon and direct 30% of the light upward, but they may at times be directed essentially straight sideways toward the horizon, as is often observed when such lights are used on construction sites. The *typical* case (see Tables 2 and 3) is intended to represent most of the mining operations while the *brightest* case, utilizing the larger number of lights indicated, is for occasional intense activities, described by ACD representatives as expected to occur less than 10% of the time. The *brightest* case scenario also

considers that the portable lights are aimed horizontally, producing a larger uplight fraction (0.50). These figures are summarized in Table 2.

For the vehicular lighting we have no specific information either on the manufacturers and types of the mining vehicles to be used, nor for the lighting that would be installed on this equipment. To estimate the light output from the vehicles, we scale the lumens from values typical of automobile headlights. From Schoettle et al. (2004), car headlights average 3786 effective lumens/vehicle with an uplight fraction of 0.11. We assume the same uplight fraction, but increase the light output from each mine vehicle to 10,000 lumens, about three times that of a typical car. All vehicular lighting is assumed to be located at the active mining site, i.e. no attempt has been made to model lighting produced when the vehicles are transporting materials on roadways.

Table 2 gives the details of how the total lumens were calculated for the mine lighting sources, while Table 3 gives the locations and lighting associated with all modeled light sources, including both scenarios detailed for the ACT as well as 11 towns and cities expected to be contributors to sky glow in the region (see below). Though there is a specific location indicated for the active mine site in Table 3, it is expected that active mining would occur at many sites within the tract. This location is chosen to provide specific inputs to the model and to give results representative of the lighting impacts of potential mining operations within the ACT.

Table 2. Details of Alton Coal Tract Lighting (MH=metal halide; INC=incandescent).

Description	Lamp	lumens each	Number	total lm	fraction up
Typical Case					
Fixed lighting	250W MH	25000	4	100000	0.00
Portable towers	1000W MH	110000	4	440000	0.30
Headlights	INC	10000	20	200000	0.11
Brightest Case					
Fixed lighting	250W MH	25000	6	150000	0.00
Portable towers	1000W MH	110000	12	1320000	0.50
Headlights	INC	10000	36	360000	0.11

Towns

The light outputs for all towns included in this study were calculated assuming 2500 lm per capita with 10% uplight fraction. These are typical values for communities without any outdoor lighting controls (Luginbuhl et al 2009a and references therein).

Observation Points

The observation sites listed in Table 4 were set in consultation with NPS and BLM representatives. These sites were chosen to provide a representative evaluation of the sky glow impacts of lighting in the ACT for visitors to BCNP and CBNM. For further discussion of the observation points see below and the memo presented in Appendix B.

All calculations are for the Johnson V bandpass, an astronomically defined wavelength vs. sensitivity response similar to the dark-adapted human eye. Though the system is not strictly equivalent to the sensitivity function for the human eye, it is reasonably close and has become the standard for both astronomical measurements of sky brightness and those produced by the National Park Service (Duriscoe, Luginbuhl & Moore, 2007).

Table 3. Light Source Locations and Outputs.

Site	Latitude dms	Longitude dms	Elevation m	Azimuth[1] deg	Distance[1] km	Population	Typical lumens	Typical uplight	Brightest lumens	Brightest uplight
Alton Tract										
HQ	+37 24 11	–112 28 05	2090	249/134	21.5/44.5		100000	0.00	150000	0.00
mine	+37 25 37	–112 28 06	2110	256/131	20.7/42.6		440000	0.30	1320000	0.50
vehicles	+37 25 37	–112 28 06	2110	256/131	20.7/42.6		200000	0.11	360000	0.11
Towns										
Alton	+37 26 21	–112 28 59	2156	260/131	21.7/40.8	141	352500	0.10		
Brianhead	+37 41 55	–112 50 58	2993	295/319	59.3/2.6	125	312500	0.10		
Cedar City	+37 40 22	–113 04 28	1777	287/268	76.8/21.5	27823	69557500	0.10		
Fredonia	+36 57 00	–112 31 35	1426	204/162	63.3/85.6	1096	2740000	0.10		
Glendale	+37 19 05	–112 35 50	1763	242/153	35.9/45.3	336	840000	0.10		
Kanab	+37 02 50	–112 31 39	1512	208/159	53.7/75.4	3769	9422500	0.10		
Orderville	+37 16 33	–112 38 15	1661	238/159	41.3/48.2	599	1497500	0.10		
Page	+36 54 57	–111 27 26	1321	131/125	92.9/148.3	6904	17260000	0.10		
Panguitch	+37 49 22	–112 26 08	2019	336/65	42.6/38.1	1473	3682500	0.10		
St. George[2]	+37 06 04	–113 34 31	895	251/226	125.1/92.1	121356	303390000	0.10		
Tropic	+37 37 30	–112 05 13	1933	38/95	21.7/65.8	464	1160000	0.10		

[1] Azimuth and distance from Yovimpa Point/Brianhead Peak
[2] Includes towns of St George, Ivins, Santa Clara, Springdale, Washington, Hurricane, LaVerkin, Toquerville

Table 4. Observation Sites

Observation Site	Latitude dms	Longitude dms	Elevation m
Yovimpa Point	+37 28 20	–112 14 25	2770
Brianhead Peak	+37 40 52	–112 49 50	3446

III. Impact of Potential Alton Coal Tract Lighting on Night Sky Brightness

We calculated predicted sky brightness for both the *typical* and *brightest* ACT lighting (see Tables 2 and 3) as seen from the two observation points listed in Table 4. For each case, we calculated the sky brightness from the horizon directly above the mine site (zenith angle of 89°) to the horizon directly opposite (zenith angle of –89°), passing through the zenith. We show both the total sky brightness in nanoLamberts[1] (nL) and the fractional increase in sky brightness due to lighting as listed in Table 3. Though the ACT appears about 1.8° below the true horizon or at about 91.8° zenith angle from the two observation points of Table 4 (see e.g. Appendix B), the calculations do not extend beyond 89° zenith angle due to model limitations (see discussion below).

For reference, we compare these predicted profiles to the artificial sky brightening predicted toward each of the eleven nearby towns and cities identified in Figure 1 and Table 3. Fractional brightness increases for all town calculations are as compared against the natural condition, i.e. to the sky with no towns present. The fractional brightness increases for all ACT calculations are as compared with the current condition, i.e. including any towns or cities whose sky glow may overlap with that produced by the tract lighting. This is the most appropriate way to judge the impacts, as the sky glow arising from towns is viewed against a (generally) unpolluted horizon, while the sky glow produced by lighting installed in the ACT would be added to that already present.

To understand the visual impact of the numbers and ratios described in the following two subsections, readers should be aware that a brightness ratio of 1.1:1 (or 10%) is only just perceptible to most people when the two sources of light can be directly compared, with one appearing directly adjacent to the other. In this sense a 10% brightening may seem to be likewise only just perceptible. A brightness ratio of 50% (1.5:1) would be perceptible to most observers. However, a natural visual reference for the sky brightness impacts described here is the natural largely un-polluted night skies in this region. Here, the impact of a sky glow "dome" comparable to, say, the sky glow produced by a town already visible from the observation point may be best judged by considering the impacts this other town or towns have on the night landscape. For this purpose we have included the sky glow predictions for the eleven towns listed in Table 3.

A. Bryce Canyon National Park

The observation point chosen to examine impacts at Bryce Canyon National Park is Yovimpa Point, located near the southern end of the park and relatively close (21 km) to the mine site. Yovimpa Point is also used by the park for night sky observation and interpretation.

Figure 3 shows the variation in sky brightness along the semi-circle passing through the mine site (right side of the graph), the zenith (middle of the graph) and ending at the horizon opposite the mine site (left side of the graph). The lowest curve shows the natural condition, i.e. the sky glow that would be observed without any artificial light in the region.

The predicted current sky glow arising from natural air glow plus artificial sky glow from the 11 cities and towns listed in Table 3, as well as the effect of the two lighting scenarios at the mine site,

[1] A nanoLambert (nL) is a unit of luminance or surface brightness. 1 Lambert = 1 lumen/sq cm for a uniformly diffusing surface. An naturally dark sky has a brightness of about 54 nL at the zenith, rising (due to natural causes) to approximately 100 nL 10° above the horizon (see the lowest curve in Figure 3).

are shown as the three increasingly brighter curves lying above the natural curve and distinguishable particularly toward the ACT (right side of the graph). This figure shows that there is essentially no increase in sky brightness from the zenith to the horizon opposite the tract location.

To more clearly display the effects of the ACT lighting on the night sky, Figure 4 displays fractional sky brightness increases, i.e. ratios of the predicted sky brightness to either the current or natural condition. The two ACT lighting scenarios are displayed as ratios of the predicted brightness along this semi-circle to the brightness already there, i.e. the current condition. For comparison, the ratios of brightness produced by the towns and cities listed in Table 3 are compared to the natural condition, i.e. the sky glow that would be present with no other artificial light sources. This figure displays only zenith angles from 80° – 89° to the horizon in the direction of the light source. A value of 1.10 means that the indicated condition is 10% brighter than the reference condition; 1.05 is 5% brighter.

From Figure 4 and Table 5 it can be seen that the *typical* lighting condition would brighten the sky by about 1% at a zenith angle of 80° (or an altitude of 10° above the horizon), increasing to 10% at a zenith angle of 89° (1° above the horizon). At zenith angles of less than 71°, the sky brightness increase is less than 1%. Under the *brightest* lighting condition the sky would brighten by about 3% at zenith angle of 80°, and by 31% at a zenith angle of 89°. This increased sky brightening falls to less than 1% at zenith angles less than 45° in the direction of the ACT. Looking at the other cities and towns included in Table 3, we see that the lighting at the ACT is superimposed fairly closely on the sky glow produced by Alton town and St. George, Utah (see further discussion below). At 85° zenith angle, these two towns contribute an approximate 10% and 35% brightening over the natural condition, respectively, though the brightest centers of these sky glow domes are located a few degrees right and left of the site analyzed here.

Here we must point out that the model predictions for angles within 10° of the horizon must be considered with caution. Localized and unpredictable variations in very low altitude atmospheric dust content, caused for example by low-level winds or by the mining operations themselves, and blocking by vegetation or terrain, including (variable) terrain relief produced by the mining operations, can make these values much larger or much smaller than predicted here. The values indicated in the study should be taken only as a general indication, useful for comparing one lighting scenario to another or for comparing one town to another, but not likely accurate to better than 50% in predicting absolute sky brightnesses for any given night. Because of these uncertainties calculations were not made for angles greater than 89° from the zenith or 1° altitude.

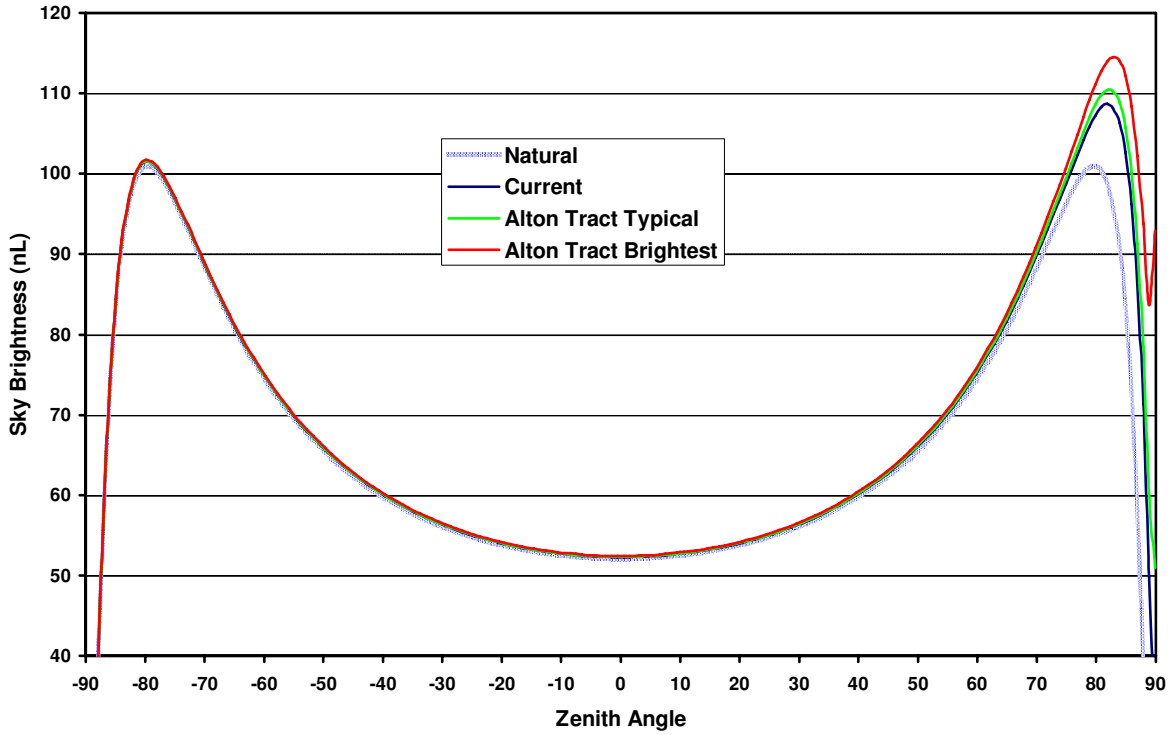

Figure 3. Horizon to horizon sky brightness at Yovimpa Point on the semi-circle originating toward the Alton site (azimuth 256°, zenith angle 90°) and ending at the point on the horizon opposite (azimuth 76°, zenith angle –90°). The blue line shows the predicted current sky brightness profile arising from the 11 existing cities and towns listed in Table 3; the green and red lines show the predicted additional contributions of the two Alton tract lighting conditions described in the text.

With these uncertainties in mind, Figure 4 shows that the greatest sources of sky glow at this site arise from Cedar City and St. George, Utah, located 77 km and 125 km distant at azimuth 287° and 251°. At 5° above the horizon in the direction of either of these two cities the sky appears about 35% brighter than the natural condition. The predicted sky glow produced by the *typical* mine lighting scenario does not reach this level at any calculated point, rising to 20% above the natural condition when viewed 1° above the horizon in the direction of the site (azimuth 256°). The impact appears to be smaller than the sky glow predicted for all of the towns and cities in this region, and by coincidence would be more difficult to discern due to its chance alignment with the brighter sky glow a rising from St. George. The *brightest* lighting scenario would produce a larger impact, rising to almost 70% brighter than the natural condition when viewed 1° above the horizon toward the mine, and 30% when viewed 2° above the horizon. The increase does not fall below 10% until the viewing angle increases to about 5° above the horizon. Under this condition the sky glow appears comparable to that visible from the towns of Orderville and Fredonia, and to that produced by a distant cities of Kanab and Page, Arizona. NPS personnel (Moore, personal communication) indicate that some of these towns do not produce a visible sky glow from this location. This may be due to terrain blocking by the nearby valley walls.

An important consideration, decreasing the likely visibility of above-horizon sky glow from both lighting scenarios within the ACT, is that the site detailed in Table 3, at azimuth 256°, is coincidentally closely aligned with St. George from this viewing location. However, since the ACT appears about 1.5° below the distant horizon, any artificial "sky" glow appearing immediately above

the mining operations would appear projected against the landscape, below and distinct from the distant St. George sky glow, and thus more visible.

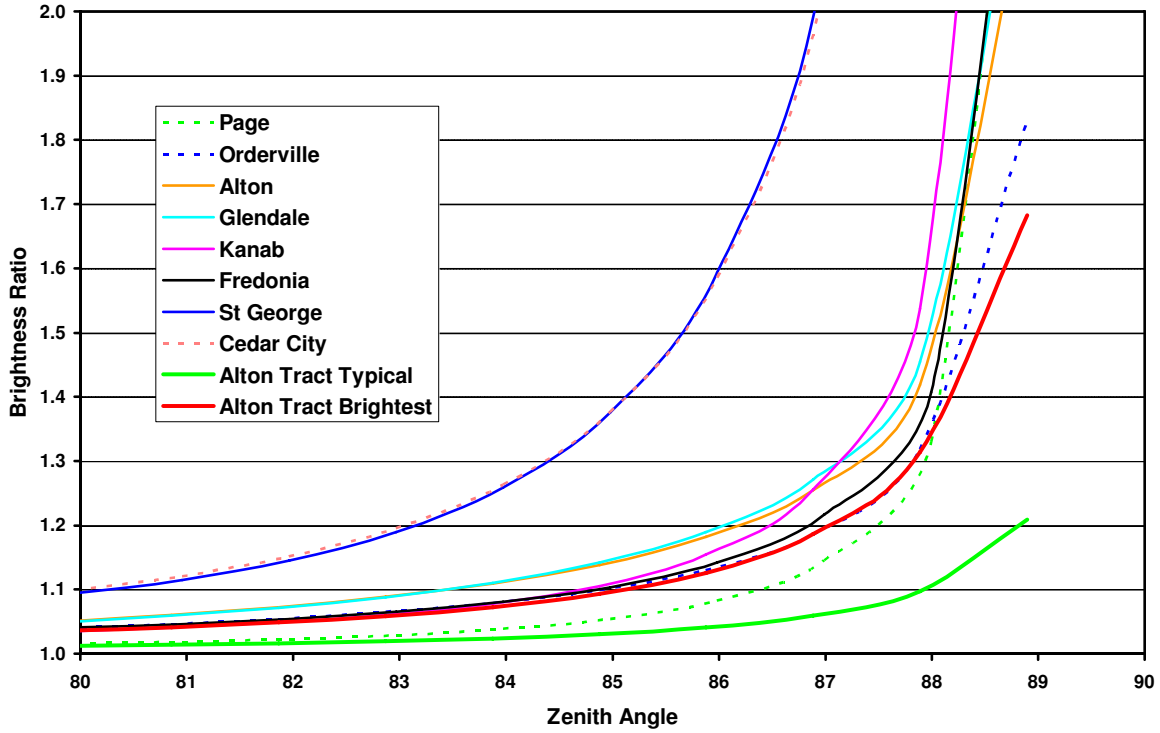

Figure 4. Brightness ratio as viewed from Yovimpa Point toward the Alton site as well as toward a selection of regional towns/cities indicated in the key. The Brightness Ratio display for the towns is as compared to the natural condition (i.e., no towns): the Brightness Ratio for the Alton tract conditions is to the current condition (i.e., including sky glow from St. George, Kanab, etc.).

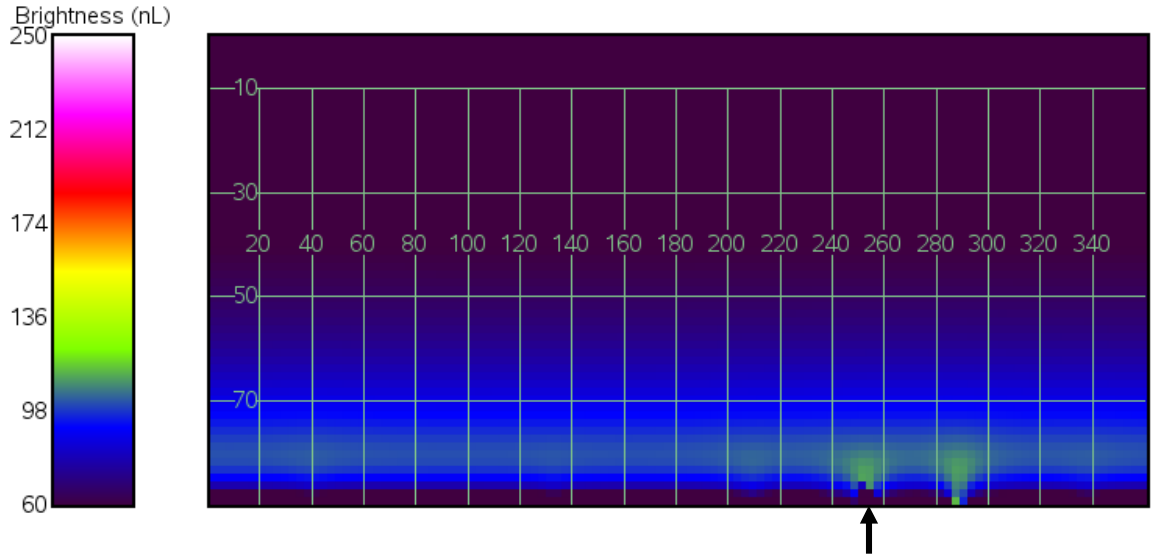

Figure 5. An all-sky false-color panoramic map of the predicted current sky glow visible from Yovimpa Point. The grid and numbers on this and the following images indicate altitude and azimuth; the arrow indicates the azimuth of the Alton mine site in Table 3.

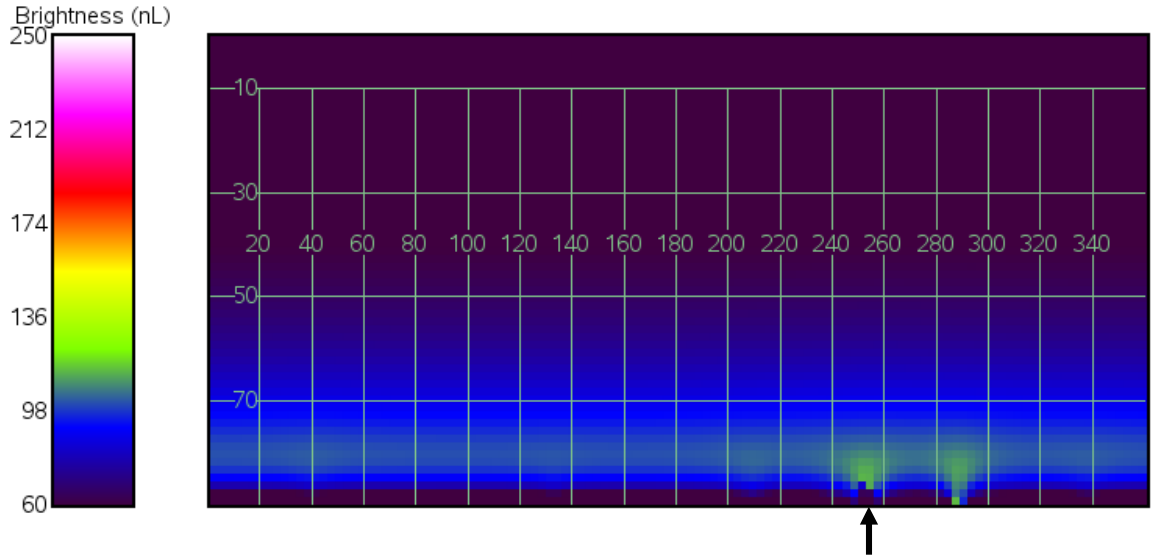

Figure 6. As Figure 5, with *typical* lighting at the Alton tract.

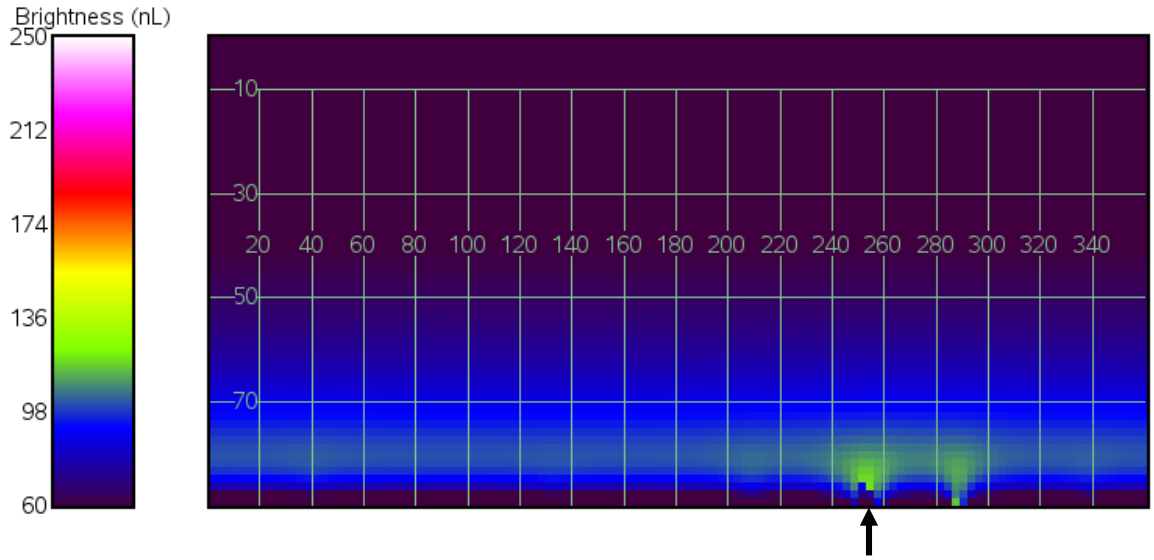

Figure 7. As Figure 5, with *brightest* lighting at the Alton tract.

Figures 5, 6 and 7 are false-color maps showing sky brightness over the entire sky as viewed from Yovimpa Point. Figure 5 shows the current condition, while Figures 6 and 7 show the addition of the *typical* and *brightest* lighting scenarios at the mine site. An increase in the sky glow above the ACT site (azimuth 256°, indicated by the arrow) is discernible in Figures 6 and 7, though this relatively nearby lighting is viewed against the distant and brighter sky glow arising from St. George at azimuth 251° and a small contribution from Alton town at azimuth 260°. The other distinct sky glow dome at azimuth 287° arises from Cedar City.

Table 5. Sky brightness ratios as viewed from Yovimpa Point at selected zenith angles toward the Alton site

Zenith Angle	Brightness Ratio (predicted/current)	
(degrees)	Typical	Brightest
0	1.00	1.00
45	1.00	1.01
60	1.00	1.01
80	1.01	1.03
85	1.02	1.07
87	1.04	1.13
89	1.10	1.31

B. Cedar Breaks National Monument

The observation point chosen to examine impacts at Cedar Breaks National Monument was the subject of some additional consideration (see Appendix B.). Brianhead Peak, located approximately 1.5 kilometers north of the park boundary in the Dixie National Forest, was chosen for its proximity to CBNM and the availability of NPS night sky team data for this site.

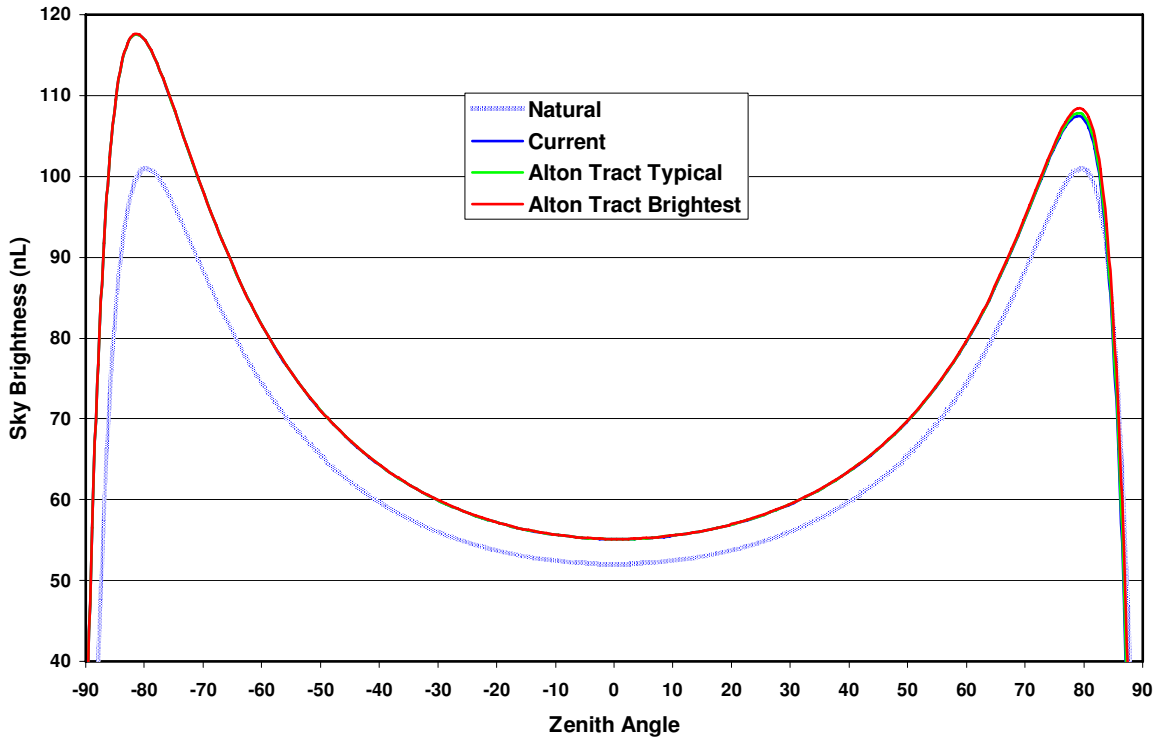

Figure 8. Horizon to horizon sky brightness at Brianhead Peak on the semi-circle originating toward the Alton site (azimuth 131°, zenith angle 90°) and ending at the point on the horizon opposite (azimuth 311°, zenith angle –90°). The green line shows the predicted current sky brightness profile arising from the 11 existing cities and towns listed in Table 3; the blue and red lines show the predicted additional contributions of the two Alton tract lighting conditions described in the text.

Figure 8 shows the sky brightness along the semi-circle originating at the ACT site (right side of the graph), passing through the zenith and ending up at the horizon opposite the mine site (cf. Figure 3). From this figure is clear that this is a much more heavily light-polluted site due mostly to the proximity of Cedar City and St. George, Utah, with the zenith appearing approximately 6% brighter than the natural condition with or without lighting at the ACT. This brightening rises to approximately 25% and 80% above natural condition when viewed 10° above the horizon toward St. George and Cedar City, respectively (see Figures 9 and 10).

Figures 9 and 10 display the fractional sky brightness increase over the current condition for the two ACT lighting scenarios, and over the natural condition for the semi-circles toward the indicated cities and towns. Here we can see that sky glow produced by the *typical* ACT lighting scenario is fainter than from all other sources in the study. Seven light domes are calculated to be brighter than that predicted for the *brightest* lighting scenario at the mine site, including, in decreasing order (name@azimuth), Cedar City @268°, St. George @226°, Brian Head @319°, Orderville @159°, Panguitch @65°, Fredonia @162°, and Glendale @153°.

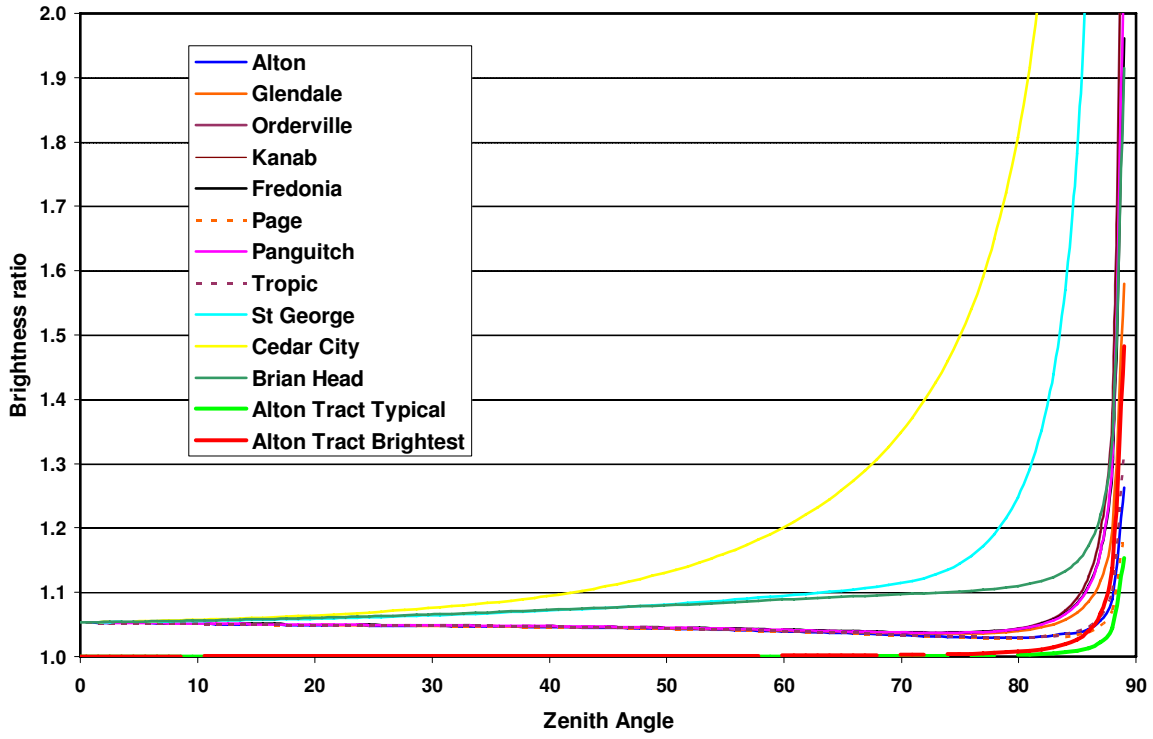

Figure 9. Brightness ratio as viewed from Brianhead Peak toward the Alton site as well as toward a selection of regional towns/cities indicated in the key. The Brightness Ratio display for the towns is as compared to the natural condition (i.e., no towns): the Brightness Ratio for the Alton tract conditions is to the current condition (i.e., including sky glow from cities and towns). Zenith angles from 80°–90° are detailed in Figure 10.

Figures 11 and 12 show false-color maps of sky brightness over the entire sky as viewed from Brianhead Peak; Figure 11 represents the current condition, while Figure 12 includes the addition of the *brightest* lighting at the ACT. This representation does not show any discernible increase in sky glow above the ACT (indicated by the arrow).

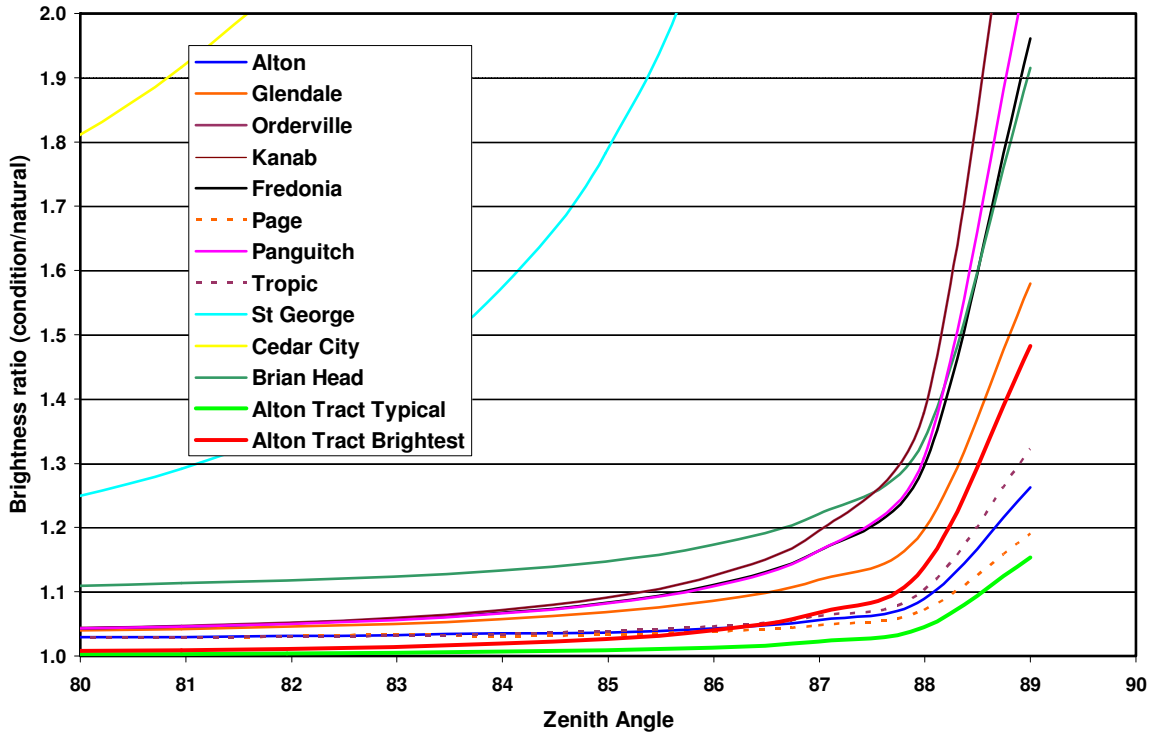

Figure 10. As Figure 9, from zenith angles 80°-90°.

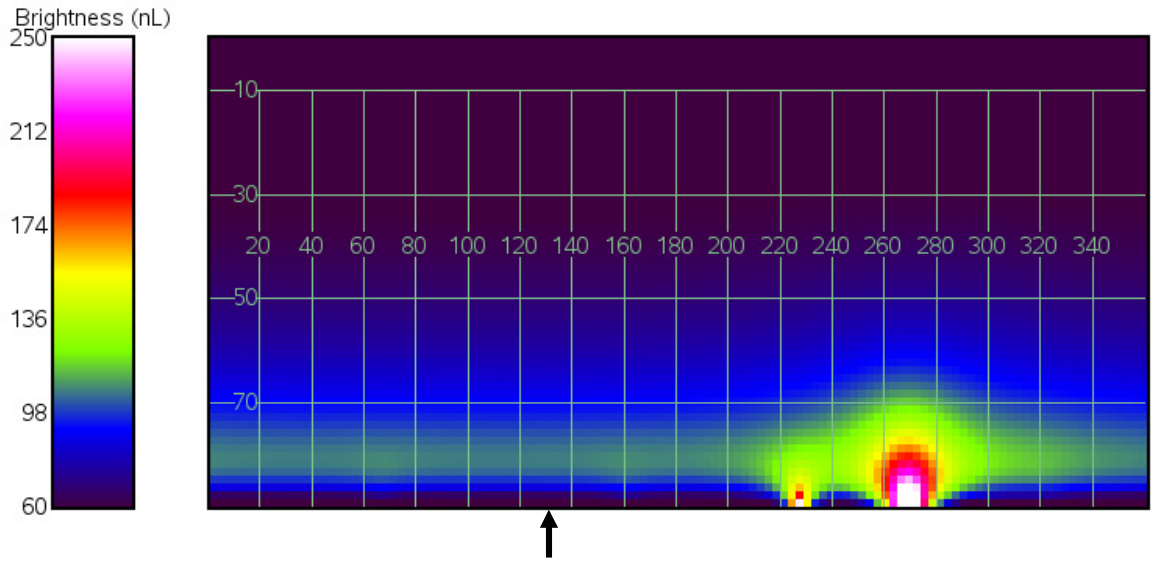

Figure 11. An all-sky false-color panoramic map of the predicted current sky glow visible from Brianhead Peak. The grid and numbers on this and the following image indicate altitude and azimuth; the arrow indicates the azimuth of the Alton mine site in Table 3.

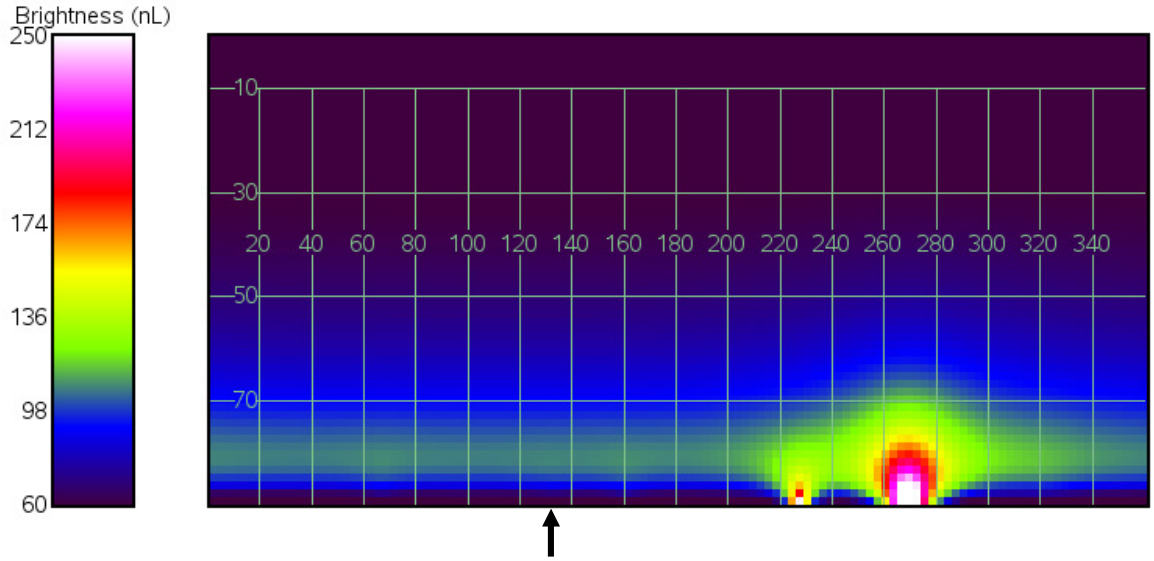

Figure 12. As Figure 11, with *brightest* lighting at the Alton tract.

Table 6. Sky brightness ratios as viewed from Brianhead Peak at selected zenith angles toward the Alton site

Zenith Angle	Brightness Ratio	
(degrees)	Typical	Brightest
0	1.00	1.00
45	1.00	1.00
60	1.00	1.00
80	1.00	1.01
85	1.01	1.03
87	1.02	1.06
89	1.13	1.42

IV. Impact of Potential Alton Coal Tract Lighting on the Viewshed

Though not directly apart of the analysis forthis report based on DSP sky brightness modelling, the question has been raised of the potential direct visibility of light fixtures in the ACT from BCNP and CBNM. To address this concern SWCA performed a viewshed analysis to determine what parts of the ACT might be directly visible from the observation points of Table 4 (see Appendix C) and conversely what parts of BCNP and CBNM might be visible from within the ACT.

The results of this analysis show that no part of the ACT is directly visible from Yovimpa Point or any part of BCNP due to intervening terrain, and thus no light fixtures used in the ACT would be directly visible from BCNP.

The analysis shows however that a portion of the potential mining sites in the ACT are directly visible from Brianhead Peak near CBNM and more importantly from portions of the Markagunt Plateau in the northeast portion of CBNM itself. Light fixtures used in these portions of the ACT could therefore be directly visible from within CBNM. The unshielded portable fixtures particularly, using1000 watt 110,000 lumen lamps, would almost certainly be the brightest artificial light sources visible in the night landscape. Though a precise calculation of the brightness of these lights would require detailed specification of the fixtures' photometric properties, aiming configuration and other details, an order-of-magnitude calculation yields that the lights would appear significantly brighter than the planet Venus, the brightest object in the night sky after the moon. This calculation assumes the Brightest Case lighting described in Table 2 and that the lights are pointing toward Brianhead Peak.

V. POTENTIAL MITIGATION STRATEGIES

In rough order of importance or mitigation effectiveness, the following strategies could be employed to decrease the impacts of the lighting used at the Alton Coal mine site on BCNP and CBNM.

A. Hours of operation

Performing mining operations during daylight hours only would allow the elimination of 86%-92% of the total lighting, and completely eliminate all unshielded lighting. The sky glow reduction arising from the ACT would be reduced by somewhat more than this figure due to the elimination of unshielded floodlighting at the ACT site. Alternatively, mining activities could be reduced during hours of night visitor use.

B. Lamp type

All of the lighting suggested for the mine operations, excepting only that on the mining vehicles themselves, is to be provided by metal halide lamps. For the *typical* scenario 73% of the lighting would come from metal halide lamps, while in the *brightest* scenario this figure would be 88% (see Table 3). Luginbuhl et al. (2008) have shown that, at small zenith angles (i.e. near the zenith) and under clear atmospheric conditions appropriate to this region, the visible sky glow produced by metal halide lighting is approximately 3 times that produced by high-pressure sodium lighting, and 12 times that produced by low-pressure sodium lighting, on a lumen-for-lumen basis. At high zenith angles (i.e. at viewing angles more directly toward the light sources) this effect would decrease. Nonetheless, a reasonable way to decrease sky glow impacts from lighting in the ACT would be to use low-pressure sodium lighting at the mine headquarters and high-pressure sodium for the portable floodlights used at the active mine site.

C. Portable fixture shielding

The uplight fraction from these very poorly shielded fixtures could be improved with the addition of shields on the upward portion of the luminaires, conceptually following the huge improvements in sports lighting technology seen in the last five to 10 years. If the shields are not available from the manufacturer, it may not be an unreasonable number to have manufactured. It may be possible to entirely replace the stock flood light fixtures with higher quality partially shielded or completely shielded floodlights generally used for sports lighting (see Appendix C for an example). Though the precise reduction in sky glow and the brightness of directly visible light fixtures is difficult to precisely quantify, a reduction of sky glow under the *typical* lighting scenario of three quarters (75%), and the intensity of directly visible fixtures by an order of magnitude (10 times) could be easily expected. The sky glow and direct fixture brightness reduction under the *brightest* scenario would be greater.

D. Portable fixture aiming

Keeping the portable light fixtures located at the active mine site aimed as far as possible below the horizon and away from the directions toward these parks could substantially reduce sky glow and direct visibility impacts. Without specific photometric information for the fixtures or information on aiming constraints the improvements expected cannot be quantified, and practically assuring that such aiming is maintained could be problematic.

E. Dust reduction

Methods to mitigate dust reduction such as paving heavily used roads, wetting the ground or limiting operation during windy conditions can considerably decrease aerosol/dust concentrations in the lower atmosphere and therefore light scattered toward the observation points from the mine site. The sky glow reductions from this mitigation are unknown.

F. Headquarters lighting

Depending on activity expected at the headquarters building during nighttime hours, it may be possible to reduce or eliminate much of the lighting planned in this area, which amounts to 8%-14% of the total lighting. Particularly lighting used for security purposes can be reduced or eliminated by limiting access to the site through physical means such as fences and gates or security patrols.

VI. Discussion and Conclusions

The calculations performed for this study indicate that the outdoor lighting for mining operations within the ACT would produce a detectable sky glow when viewed from Yovimpa Point in BCNP for only the *brightest* lighting scenario analyzed. Under this scenario, sky glow produced by lighting in the ACT would appear similar to that produced by the towns of Orderville, Utah, and Fredonia and Page, Arizona, but less than that produced by the distant large cities of St. George and Cedar City, Utah.

Though sky glow produced by ACT lighting under the *typical* scenario might otherwise be visible from Yovimpa Point, the chance alignment of the ACT site and the distant city of St. George would likely render the predicted small increase visually undetectable against the brighter sky glow arising from St. George.

From Brianhead Peak near CBNM the *typical* lighting scenario produces a sky glow fainter than any nearby town, and we judge it unlikely to be visually detectable above the horizon. The *brightest* scenario produces a sky glow comparable to nearby small towns, and would likely be visible under some conditions and by some observers when looking at or above the horizon.

A viewshed analysis indicates that light fixtures used in some areas of the ACT would probably be directly visible from both Brianhead Peak and from some locations within CBNM. There would be no direct visibility of fixtures within the ACT from BCNP. If visible, the unshielded 1000 watt metal halide lights suggested for potential use at the active mine site would probably be the brightest artificial light sources visible in the night landscape.

Though the sky glow impacts of the potential lighting appear small, particularly when considering the *typical* lighting expected to be used 90% of the time that the mine is active, the unusually pristine nature of the nighttime landscapes in this region, combined with the high resource value attached to natural nightscapes by BCNP mean that even small impacts may be of concern.

Options that could produce significant reductions in these impacts are available. Though restriction of mining operations to daylight hours may be unlikely, improved shielding and restrictions on vertical aiming angles and azimuths for the portable mine lighting, combined with the potential to use yellow light sources such as high-pressure and low-pressure sodium instead of metal halide lamps could reduce impacts substantially.

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Appendix A:
Portable Light Tower for Potential Use at Alton Coal Tract

VIII. APPENDICES

Appendix A. Portable light tower for potential use at the Alton Coal Tract

BALDOR

PL6000K

Baldor POW'R LITE Light Tower

Baldor's compact mobile light tower provides 4000 watts of light anywhere you need it: Construction, Emergency, Industrial, Mining, Civil Engineering and Event Lighting. With metal-halide lamps the Baldor POW'R LITE models will provide light coverage for over 5-7 acres.

- **Baldor's 6kW Generator –** powered by an 1800 RPM liquid-cooled Kubota diesel engine. The Baldor Generator and Kubota engine arebacked by a 3-Year Limited Warranty.
- **Baldor's new elliptical light fixtures –** provide a more efficient light pattern than conventional round fixtures. The 4 – 1000 Watt metal halidelamps are supported on both ends to enhancedurability and long life.
- **Corrosion resistant aluminum enclosure –** heavy duty 12 gauge side panels and lockable doors. Durable powder coat finish.
- **Convenience outlets –** 2000 watts, 120 VAC and 240 VAC.
- **Designed for easy service –** the side fender and side panel are easily removed allowing full access in minutes for engine/alternator service.
- **Mast and outriggers –** zinc plated for long life.
- **30' extended light tower –** Tower rotates 360 degrees
- **4-section mast –** allows for compact trailering length. Coiled mast cords.
- **Dual forklift pockets –** located on light mast and bottom of trailer for easy lifting.
- **Internal control panel –** protects against elements. Hour meter and keylock standard.
- **Engine shutdown –** low oil/high temperature shutdown protection.
- **50 Gallon fuel tank –** provides 100 hours of runtime and outside fill cap.
- **Radiator fill –** easily accessible from end panel cutout.
- **Battery included.**

Mast/Enclosure

Lighting Coverage	5-7 Acres @ 0.5 foot candles
Mast Height	30'
Mast Material	Zinc Plated
Mast Sections	4
Tower Rotation	360 Deg
Mast Cord	Coiled
Enclosure Material	12 Gauge
Finish/Coating Enclosure	Powder Coat
Finish/Coating Hardware	Zinc Plated
Lockable Doors	Yes
Hinge Material	Aluminum
Fenders	Steel
Outrigger System	3 Point
Forklift Pockets	Standard
Maximum Wind Load	65 MPH

Engine Specifications

Manufacturer	Kubota
Model	D905E
Cylinders	3
Induction System	Naturally Aspirated
Displacement, cc (cu. in.)	898 cc (54)
EPA Emissions Level	Tier 2
HP @ Rated Speed	17
RPM	1800
Bore and Stroke	2.83" x 2.90"
Lubrication Capacity (with filter)	5.4 Qts
Battery Recommendation (min. cold cranking amps)	525

- Battery, battery rack, and cable supplied
- Spin-on oil filter
- Thermostat controlled liquid cooling system
- Glow plugs
- 12V engine alternator
- 12V starter motor

Trailer

Standard Hitch	2" Ball
Trailer Tongue	Removable
Trailer Lights	DOT Approved
Transport Tie-downs	Standard
Tires	205 / 75D14
Towing Speed (MPH)	60

Fuel System Specifications

Fuel Consumption	**GPH**
Full Load	0.5
Approximate Run Time	**Hours**
Full Load	100
Fuel Capacity	
Gallons	50
Fuel	Diesel

Weights and Dimensions

Weight Without Fuel	1800
Dimensions Stowed (L x W x H)	162" x 54" x 73"
Dimensions Extended (L x W x H)	106" x 122" x 396"

Sound Level

Sound level dB(A) 72
Measured @ 7 meters, full load

Engine, Generator Instrumentation

Digital controller with integral hour meter, operator keylock, engine preheat, and engine start selection. Low oil, high temperature, low battery, and overspeed protection with LED indicators.

Receptacle Specifications

120 Volt 20 Amp Duplex GFCI	1
120/240 Volt 30 Amp Twistlock (L630R)	1
Voltage Regulation	± 5%
Frequency	60 Hz

Baldor reserves the right to implement specifications or design changes without notice.

WARNING: Do not connect generator to any building's electrical system unless a disconnect switch has been installed.

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Baldor Electric Company
P.O. Box 2400 • Fort Smith, AR 72902-2400 U.S.A.
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Appendix B:
Discussion for Second Observation Point,
Alton Coal Tract Night Sky Aesthetic Analysis

Appendix B. Discussion of second observation point, Alton Coal Tract night sky aesthetic analysis

9/26/2008

TO: Ben Gaddis, SWCA Environmental Consultants, and discussion group

FM: Chad Moore, NPS Night Sky Program Manager

RE: Discussion of second observation point, Alton Coal Mine night sky aesthetic analysis

Three National Park Service sites have the potential to be impacted by the proposed Alton Coal Mine— Bryce Canyon National Park, Cedar Breaks National Monument, and Zion National Park. Bryce Canyon has the most pristine night skies of the three, and is the closest to the Alton project site. Clearly that is the most important park to analyze impacts to, and there appears to be agreement that Yovimpa Point near the southern end of the park is appropriate for an observation point. This observation point will be modeled by Dark Sky Partners LLC in order to assess night sky aesthetic impacts.

The NPS Night Sky Program recommended today during a teleconference that a second observation point be established. Of the other two parks, Cedar Breaks is more likely to be impacted than Zion. Zion National Park has a slightly brighter (ie. More light polluted) night sky than Cedar Breaks and the majority of the park is at a lower elevation. This lower elevation will minimize potential light pollution from the Alton site due to terrain shielding, and any perceived impact will be proportionally less as compared to the existing sky. Night sky brightness data does exist at two potentially useful sites within Zion— at Lava Point and near the east entrance; so if desired, Zion National Park could be included in Dark Sky Partner's analysis.

Cedar Breaks has several panoramas along the rim, though none of them offer 360 degree views. Because of this, the NPS Night Sky Program chose Brianhead Peak as a representative site. Brianhead allows the NPS system to capture the entire 360 degree panorama from one location, but it is located on Dixie National Forest land approximately 1 mile away from and 1000' above the park boundary. If the modeling by Dark Sky Partners was based on a second observation point at Brianhead, there was concern that results might not be representative of conditions at Cedar Breaks.

The difficulty with using a site within Cedar Breaks is that no all-sky brightness data exists there. With winter approaching, it is unlikely that suitable data could be acquired there before June 2009. While models produced from an observation point within the park (as opposed to at Brianhead Peak) would be slightly more accurate, the portion of the impact to the current condition would be less accurate since no data exists.

To further the discussion, a rough map and sight profile was created for the proposed observation points. Comparing Brianhead with Point Sublime within Cedar Breaks shows that Brianhead has an elevation above the proposed Alton Coal Mine of 4407', while Point Sublime is 3450'. Higher elevation observation points tend to be more exposed to

light pollution, though the difference is relatively minor. Brianhead peak has a slightly higher angle of view to the project site, 1.8 degrees vs. 1.6 degrees from Sublime Point. This is a very small difference and unlikely to have an impact on the modeled sky brightness in my opinion. The third difference is that Brianhead peak is further away, roughly 26.5 miles vs. 24 miles. Using the approximation of Walkers Law, this should result in Brianhead having 22% greater attenuation in light from the project site than Sublime Point; in other words showing less impact. Keep in mind that Cedar Breaks covers a area that ranges from 23 miles to 27 miles distant, so no single observation point will be representative of the entire park. Fourth difference is that Brianhead has slightly less terrain blocking than the Sublime Point observation site. The exact difference between the two will require a far more detailed analysis than is provided here. However, at 1000' above the project site, both sites have a clear view. Since the model employed by Dark Sky Partners begins at the horizon extending upward, I suspect that the terrain blocking issue is moot (though it is certainly a parameter that should be adequately modeled at the Yovimpa Point site at Bryce Canyon). A fifth and final difference between the two sites is that the Brianhead site is likely to have more light pollution than the Cedar Breaks site due to the proximity of the small town of Brian Head. This should result in any analysis at Brianhead showing proportionally less impact to the entire sky.

Either approach has some drawbacks. However, I do not believe that an analysis at Brianhead would overestimate impacts at the nearby park. It appears with this cursory analysis to be more likely to underestimate impacts. The preference of the National Park Service is to exercise the model at a point where we have data and then to be as transparent as possible about how this is extrapolated to represent conditions across a park.

See the graphic attachment (Fig. B-1).

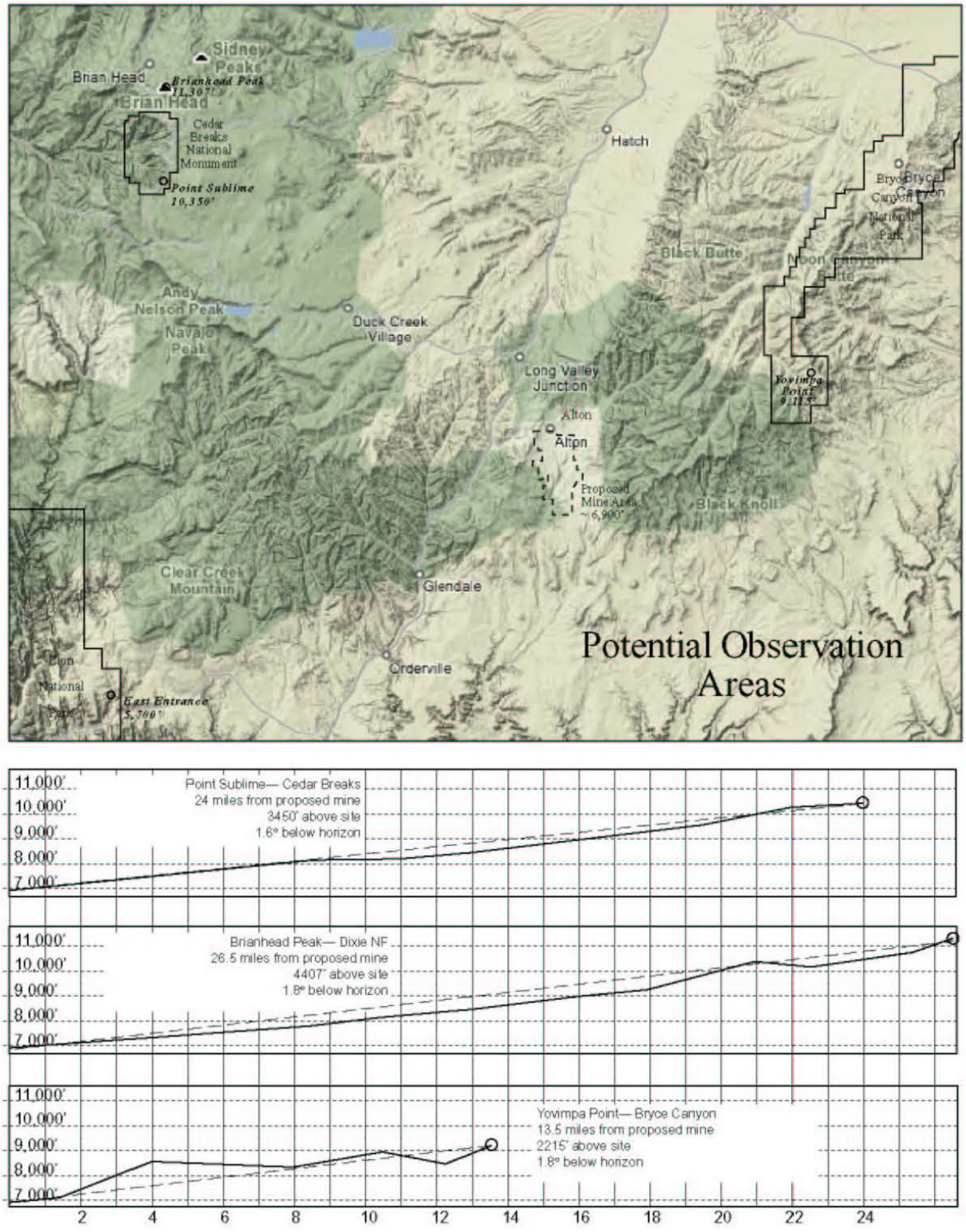

Figure B-1. Observation points and lines-of-site

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Appendix C:
Viewshed Analysis

Appendix C. Viewshed Analysis

The following viewshed analysis is provided by SWCA.

Methods

The viewshed analyses were performed on a mosaic of 5-meter Digital Elevation Model (DEM) datasets using the Spatial Analyst tool within ESRI ArcGIS Desktop. The DEM has a vertical Root Mean Square Error (RMSE) of 4 meters. To account for this potential error plus the height of an observer, the observation points were offset above the DEM by 6 meters. The model accounts for the curvature of Earth, but not tree-cover/obstruction or atmospheric conditions. This provides a conservative estimate of visibility.

One analysis was conducted to model a viewshed as "seen" from 11 observation points within the tract (Figures C-1 and C-3). It indicates any area that may be visible from at least 1 of the 11 points. Ten of the points are within the pit disturbance areas, each representing a location with the greatest local elevation or a location at/near the perimeter of the potential disturbance area. One point represents the center of the area proposed for the facilities location. The extent of the analysis includes both Bryce Canyon National Park and Brian Head Peak.

A separate analysis was conducted to model the viewshed from the highest point of Brian Head Peak, and indicates areas that may be visible from that 1 observation point (Figures C-2 and C-4).

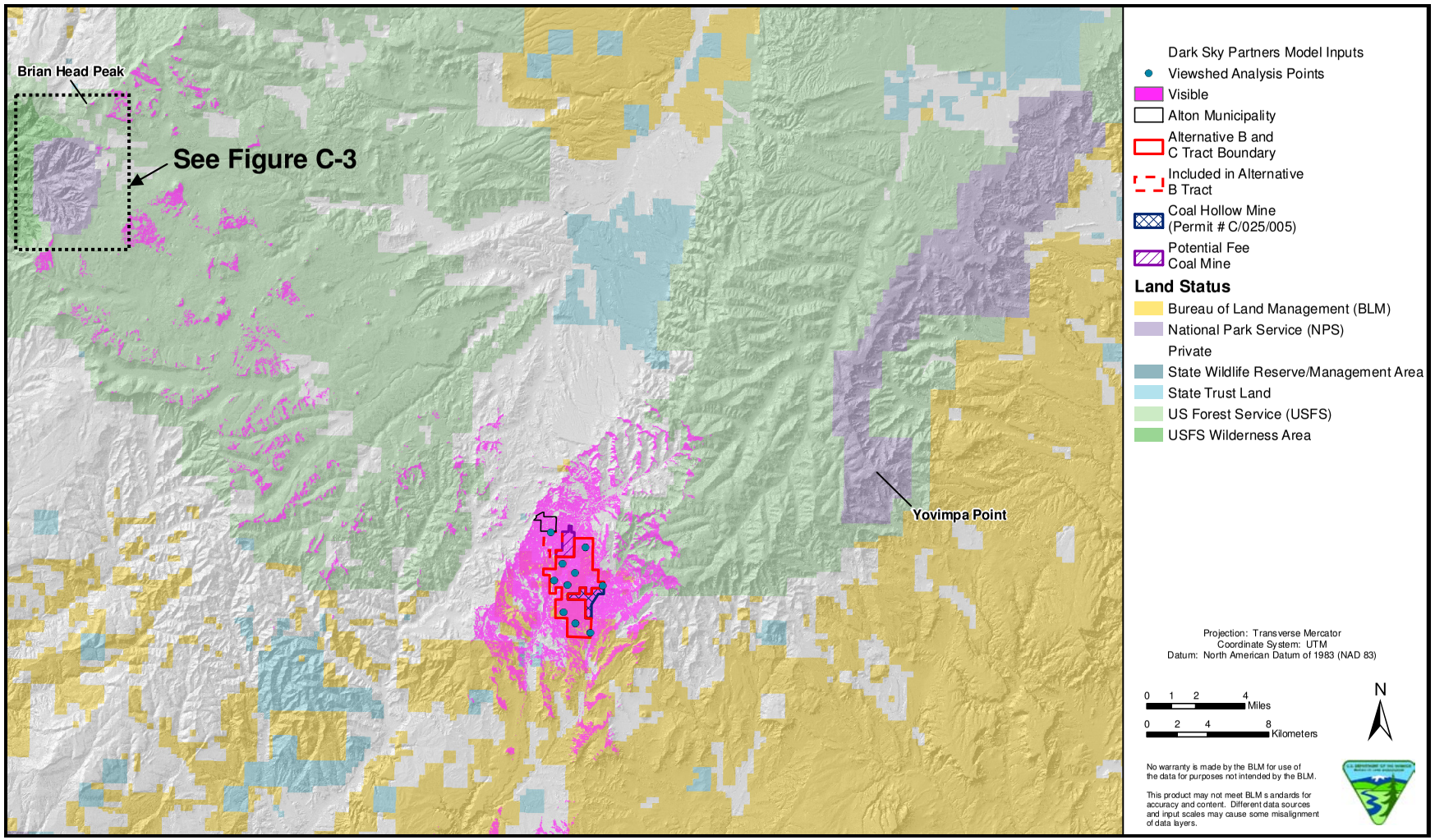

Figure C-1. Points visible (line of sight) from select locations within the Alton Coal Tract (indicated in pink). For detail within Cedar Breaks National Monument see Figure C-3.

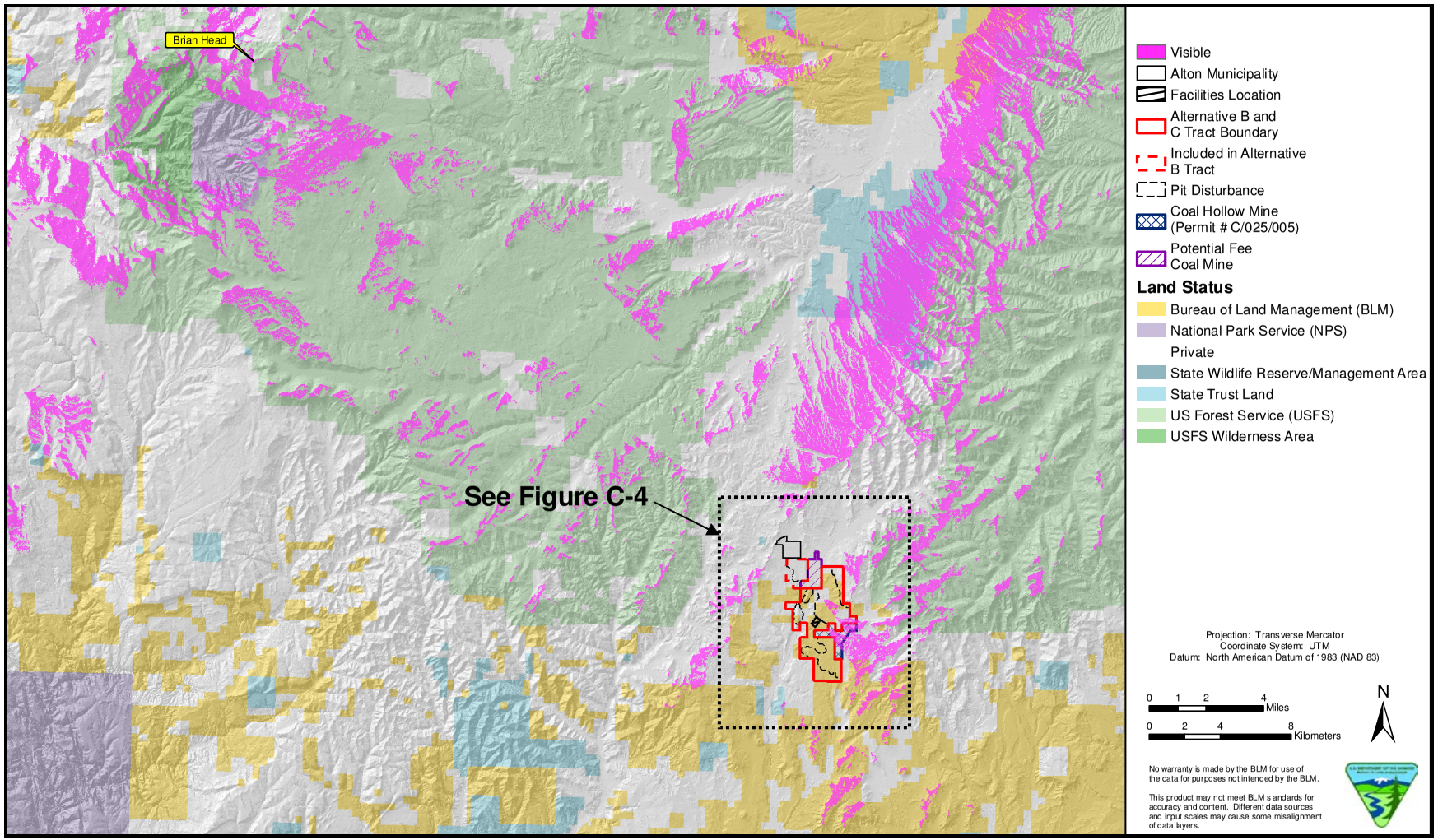

Figure C-2. Points visible (line of sight) from Brianhead Peak (indicated in pink). For detail within the Alton Coal Tract see Figure C-4.

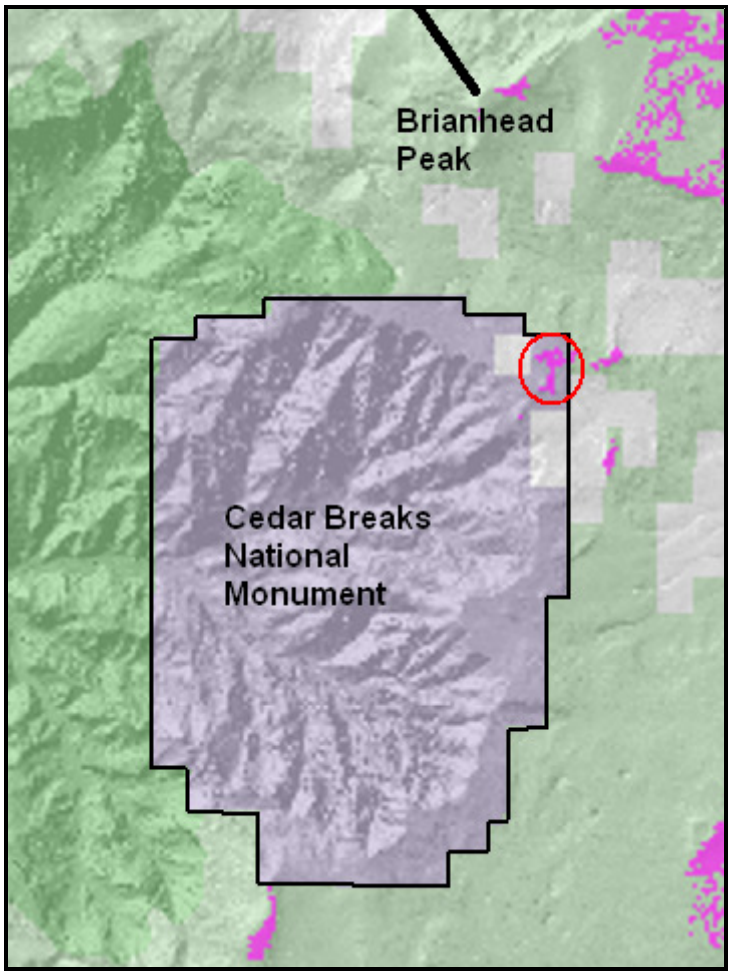

Figure C-3. Portion of Figure C-1 showing Cedar Breaks National Monument (CBNM). The red circle shows a portion of the Markagunt Plateau within CBNM that potentially has direct line-of-sight to portions of the Alton Coal Tract.

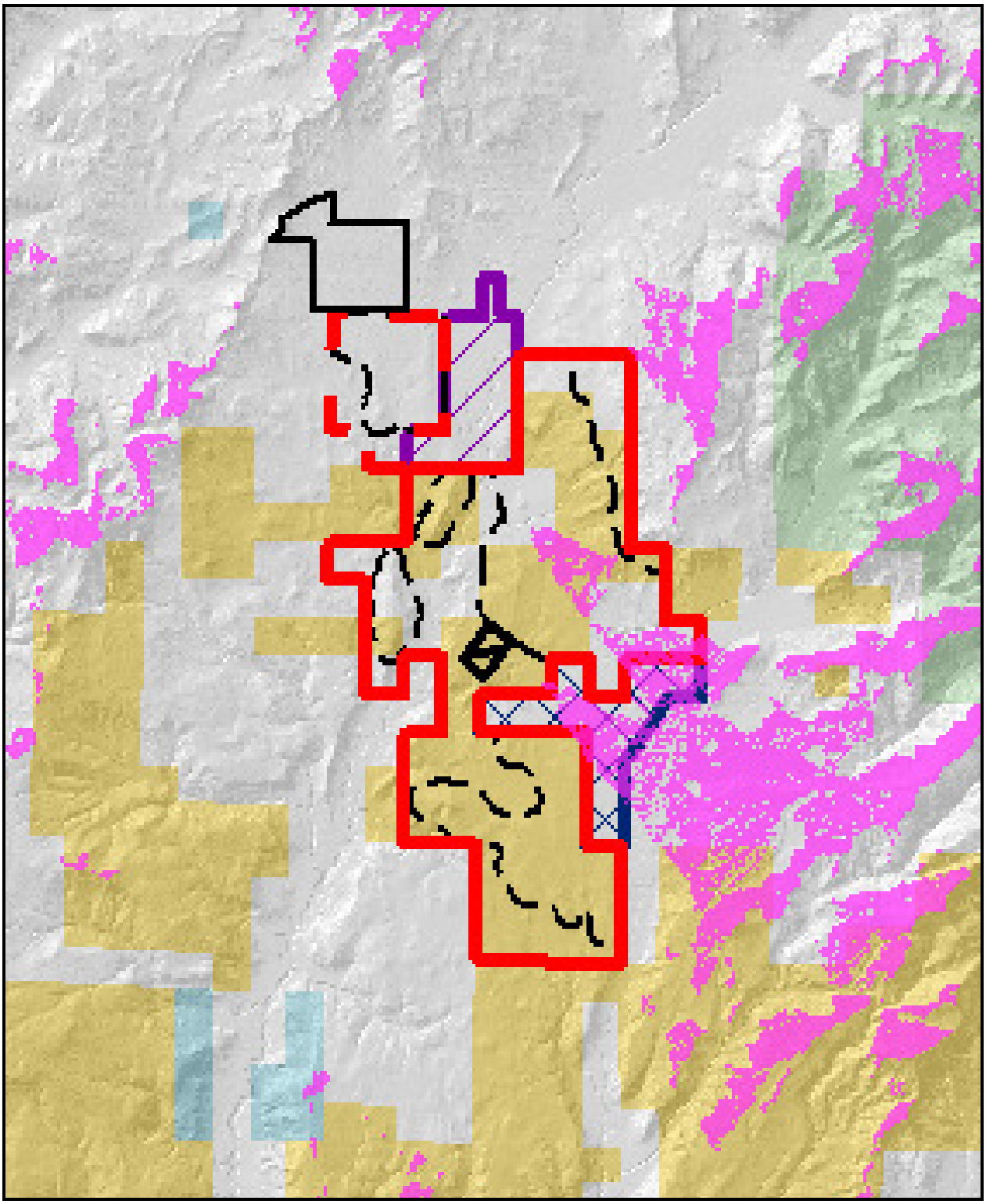

Figure C-4. Detail of Figure C-2 covering Alton Town and the Alton Coal Tract.

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Appendix D:
Shielded Floodlight Fixtures

Appendix D. Shielded floodlight fixtures

MUSCO Lighting
100 1st Avenue West
P.O. Box 808
Oskaloosa, Iowa 52577

800/825-6030
641/673-0411
Fax: 641/673-4852

LSG product

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ATTACHMENT 1.

3/26/2008 MEMO FROM NATIONAL PARK SERVICE NIGHT SKY PROGRAM MANAGER TO SWCA PROJECT MANAGER: DISCUSSION OF SECOND OBSERVATION POINT, ALTON COAL MINE NIGHT SKY AESTHETIC ANALYSIS, AND GRAPHIC ATTACHMENT ACCOMPANYING MEMO

9/26/2008

TO: Ben Gaddis, SWCA Environmental Consultants, and discussion group

FM: Chad Moore, NPS Night Sky Program Manager

RE: Discussion of second observation point, Alton Coal Mine night sky aesthetic analysis

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The difficulty with using a site within Cedar Breaks is that no all-sky brightness data exists there. With winter approaching, it is unlikely that suitable data could be acquired there before June 2009. While models produced from an observation point within the park (as opposed to at Brianhead Peak) would be slightly more accurate, the portion of the impact to the current condition would be less accurate since no data exists.

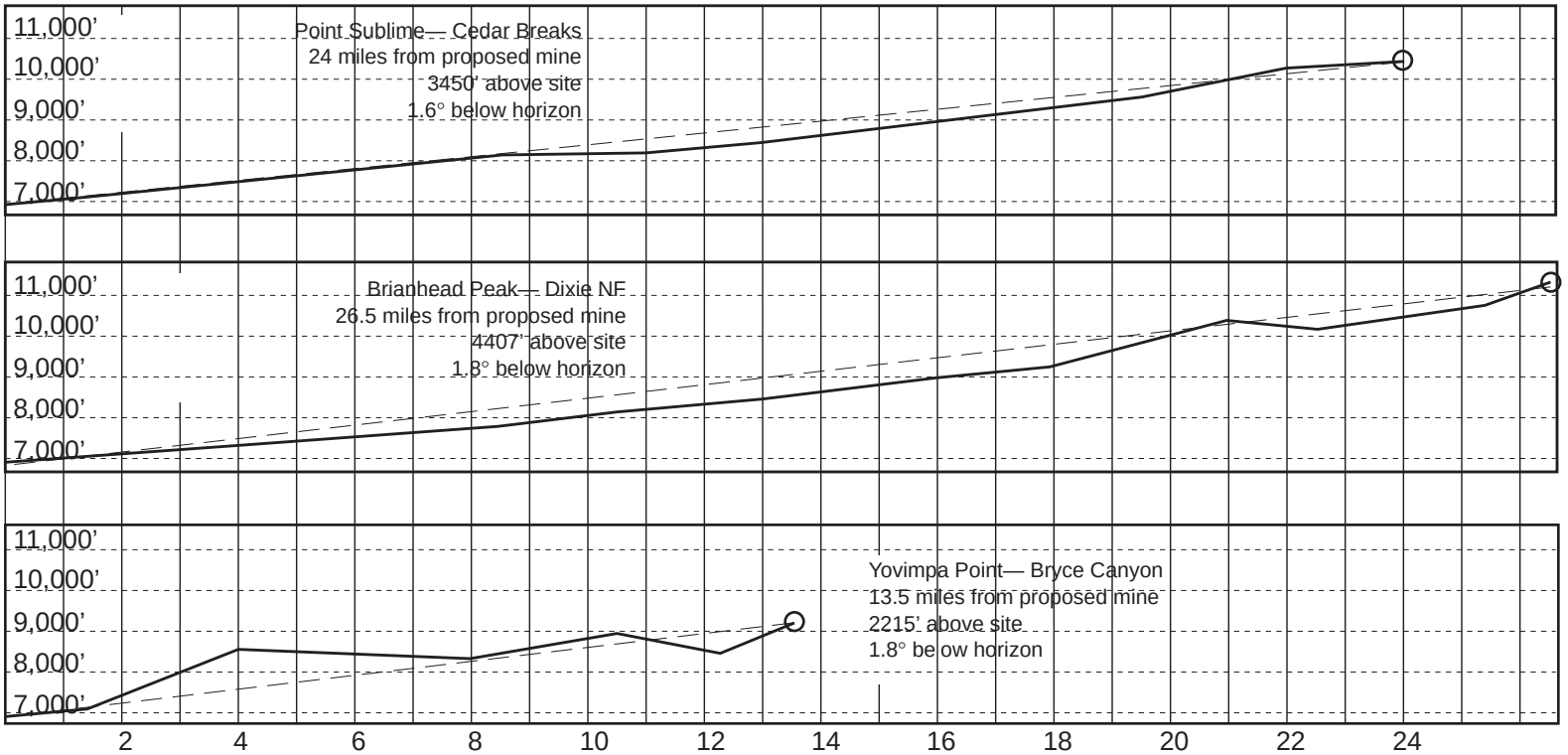
To further the discussion, a rough map and sight profile was created for the proposed observation points. Comparing Brianhead with Point Sublime within Cedar Breaks shows that Brianhead has an elevation above the proposed Alton Coal Mine of 4407', while Point Sublime is 3450'. Higher elevation observation points tend to be more exposed to light pollution, though the difference is relatively minor. Brianhead peak has a slightly higher angle of view to the project site, 1.8 degrees vs. 1.6 degrees from Sublime Point. This is a very small difference and unlikely to have an impact on the modeled sky brightness in my opinion. The third difference is that Brianhead peak is further away,

roughly 26.5 miles vs. 24 miles. Using the approximation of Walkers Law, this should result in Brianhead having 22% greater attenuation in light from the project site than Sublime Point; in other words showing less impact. Keep in mind that Cedar Breaks covers a area that ranges from 23 miles to 27 miles distant, so no single observation point will be representative of the entire park. Fourth difference is that Brianhead has slightly less terrain blocking than the Sublime Point observation site. The exact difference between the two will require a far more detailed analysis than is provided here. However, at 1000' above the project site, both sites have a clear view. Since the model employed by Dark Sky Partners begins at the horizon extending upward, I suspect that the terrain blocking issue is moot (though it is certainly a parameter that should be adequately modeled at the Yovimpa Point site at Bryce Canyon). A fifth and final difference between the two sites is that the Brianhead site is likely to have more light pollution than the Cedar Breaks site due to the proximity of the small town of Brian Head. This should result in any analysis at Brianhead showing proportionally less impact to the entire sky.

Either approach has some drawbacks. However, I do not believe that an analysis at Brianhead would overestimate impacts at the nearby park. It appears with this cursory analysis to be more likely to underestimate impacts. The preference of the National Park Service is to exercise the model at a point where we have data and then to be as transparent as possible about how this is extrapolated to represent conditions across a park.

See the graphic attachment

Sidney Peaks
Brian Head
Brianhead Peak 11,307'
Brian Head
Cedar Breaks National Monument
Point Sublime 10,350'
Hatch
Bryce Canyon National Park
Black Butte
Andy Nelson Peak
Navajo Peak
Duck Creek Village
Long Valley Junction
Yovimpa Point 9,115'
Alton
Proposed Mine Area ~ 6,900'
Black Knoll
Clear Creek Mountain
Glendale
Orderville
Zion National Park
East Entrance 5,700'
Potential Observation Areas


11,000'
10,000'
9,000'
8,000'
7,000'
Point Sublime— Cedar Breaks
24 miles from proposed mine
3450' above site
1.6° below horizon
Brianhead Peak— Dixie NF
26.5 miles from proposed mine
4407' above site
1.8° below horizon
Yovimpa Point— Bryce Canyon
13.5 miles from proposed mine
2215' above site
1.8° be ow horizon
2
4
6
8
10
12
14
16
18
20
22
24

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ATTACHMENT 2.

4/28/2009 CORRESPONDENCE BETWEEN NATIONAL PARK SERVICE AIR RESOURCES DIVISION AND BLM PROJECT MANAGER RE: ALTON COAL MINE LIGHTSCAPE ANALYSIS

United States Department of the Interior
NATIONAL PARK SERVICE
Air Resources Division
P.O. Box 25287
Denver, Colorado 80225

4/28/2009

Keith Rigtrup
BLM Project Manager, Alton Coal LBA EIS
BLM Color Country District
176 East DL Sargent Drive
Cedar City, UT 84721

Subject: Alton Coal Mine Lightscape Analysis

Keith,
The mission of the National Park Service includes the mandate to protect scenery. The protection of scenery extends across both day and night, horizontally as viewed from within parks, as well as upward to the sky. Natural Lightscapes are important to national park visitors and are also an element of a natural ecosystem. Such lightscapes are under substantial threat and modification by outdoor lighting. If not properly contained and controlled, light can impact lightscapes up to 300 kilometers away, as has been observed with the impact of large cities on remote parks. Even a small number of lights can potential cause an impact if they are proximal to natural areas.

Through discussion with the BLM and SWCA Environmental Consultants, it was determined that the proposed development of the Alton Coal Mine had the potential to impact natural lightscapes at three national park units— Bryce Canyon National Park, Cedar Breaks National Monument, and Zion National Park. Bryce Canyon has the most pristine night skies of the three, is the closest to the Alton project site, and this resource is highly valued by park visitors and park management. It was decided that Zion would be omitted from the technical analysis since impacts were expected to be the least among the three parks and impacts could likely be extrapolated from Cedar Breaks and Bryce Canyon data. Midway through the technical analysis process, it was determined that both the indirect impact to the night sky (skyglow) and the direct impact to the nighttime viewshed (glare) should be considered. The National Park Service coordinated with Dark Sky Partners LLC (DSP) who were contracted to produce a computer model predicting the impact of the proposed mine lighting. The following is a response to the modeling report "An Assessment of the Impact of Potential Mining Operations at the Alton Coal Tract on the Dark Skies of Bryce Canyon National Park and Cedar Breaks National Monument" and suggested impact findings.

The National Park Service worked with DSP to verify the model input parameters, particularly the atmospheric clarity or "K" factor. The assumptions about light fixture output, position, and pointing appear to be reasonable and the NPS has confidence in the computer model performance based on past collaborations.

The NPS Night Sky Program is working toward a comprehensive and peer-reviewed framework for assessing lightscape impacts, however this product is not yet available and likely more than a year away from fruition. We present here a simple method of weighting the impact of the proposed mine lighting.

Bryce Canyon

Yovimpa Point at the southern end of Bryce Canyon National Park was chosen for the analysis. This site is important from a visitor perspective, and has several night sky brightness data sets collected from there. From this location, given the typical pit location within the mining tract, the light pollution generated by the proposed project is superimposed in the sky against the existing glow from St. George. For this impact analysis, we considered the impact as if the mine skyglow was shifted to the side of the existing St. George glow. This was done for four reasons. 1) The NPS guidance on environmental impact analysis directs us to measure against natural background conditions, 2) small changes in the viewing location from within the park would shift the light dome left or right, 3) changes in the light source within the mine complex would have a similar directional shift, and 4) other light pollution sources have the potential to reduce their light pollution and thus their impact on the parks. In fact, many suburbs of St. George are in the process of changing streetlights to become more night-sky friendly.

The *typical* scenario as modeled by DSP shows that the brightness ratio would only exceed 10% over natural conditions in the lowermost 2 degrees of sky. In the experience of the Night Sky Program and in relative comparison to the other small population centers brightness ratios, such a change to the natural lightscape is unlikely to be noticed by a casual observer, but would likely be noticeable to a keen or trained observer. The extent of the light dome would be well restricted to the lowermost section of sky, and would be less than the glow from almost all small towns surrounding the park. These factors lead us to conclude that the impact prescribed to the mine lighting would not be annoying or measurably reduce the perceived aesthetic quality of the night sky. As such, the impact of the *typical* lighting scenario should be **negligible**.

The *brightest* scenario shows that the brightness would exceed 10% over natural condition in the lowermost 5 degrees of sky. The glow would be comparable to Page, and somewhat less than the combined glow of Kanab and Fredonia. These towns are easily visible to a dark-adapted visitor at Yovimpa Point, and in several other locations in the park as well. Such city glows impact a small fraction of the sky— a much smaller fraction than the light domes from either St. George or Cedar City, and thus have relatively smaller impact. The impact upon the zenith or any area above 20 degrees angular elevation is likely to be unmeasureable and is certainly not noticeable at those higher angles. As pointed out in the analysis by DSP and discussions through the modeling process, the exact impact is highly dependent on very small variations of the placement of the mine lights and their aiming. These factors lead us to conclude that the impact prescribed to the mine lighting would be intermittently and infrequently noticeable and measurable, and would have a perceived impact upon the aesthetic quality of the night sky. As such, we suggest that under the *brightest* scenario, there would be an occasional **minor** impact, which would usually fall below the threshold of **negligible** at most times.

The mine would not be directly visible from Yovimpa Point nor any other area from within the park boundary. Thus, there should be no impact of direct glare from the proposed mine. If future expansions of the mine are proposed that are within the viewshed of the park, the impact of direct glare must be reconsidered and may become a substantial lightscape impact.

Cedar Breaks

Night Sky Brightness data for Cedar Breaks was collected just outside the park boundary atop Brianhead Peak. Using off-site locations is often practiced by the NPS Night Sky Program in order to get a better view of light sources near the horizon. When most light sources are distant, this

approach makes sense and introduces fairly little bias. Thus for assessing the impact of the Alton Mine lighting, Brianhead Peak was chosen.

Cedar Breaks and Brianhead Peak are further from the mine site than Yovimpa Point, and the modeling results show that the skyglow impact produced by both the *typical* and *brightest* scenarios are small. Based on comparisons with other light sources around the park, and the experience of NPS field personnel, a trained observer would likely be unable to detect the *typical* scenario, which of course would be invisible to a casual visitor. Both keen and casual observers would be likely to see the *brightest* scenario, but the impact would be restricted to the lowermost degree of sky and it is not likely to be perceived as annoying even if the light from Cedar City and St. George were removed. In almost all locations within the park, except for the NE corner which is open meadowland and slopes toward the Alton Mine, this skyglow would be obscured by trees or terrain. We suggest that the combination of the limited skyglow and infrequent spatial and temporal visibility combine to render both the *typical* and *brightest* scenarios as **negligible**.

The question of direct glare at Cedar Breaks was also assessed. When by chance pointed directly toward the park, the Alton Mine lights would be very bright. A rough calculation, assuming that 2 of the 4 lights on the portable stanchion were aimed at the park, they would appear as bright as a negative 4.3 magnitude star. This is roughly as bright as the planet Venus and would dominate the nocturnal landscape when looking SE, and is also likely to cast a faint shadow. If considered in isolation, this would be a worrisome impact, however, this lightscape change is only under the infrequent and intermittent *brightest* scenario. Additionally, only one small location within the park would be subject to this lightscape impact. This is the meadow area near the road junction of highways 143 and 148. This section is traveled by visitors at night, but it is not an area where visitors are likely to be seeking natural lightscapes among the occasionally headlights of oncoming cars. During infrequent occurrences at this one location the impact is likely to be **minor to moderate**, though the sum total impact to the park averaged over time and space should be **negligible**.

We would also like to point out that the direct glare from the Alton Mine lighting would often be visible (to varying degrees) from Brianhead Peak and from numerous other locations within the Dixie National Forest. Because the scope of the DSP report and this letter includes only NPS administered lands, this impact was not assessed.

Zion

Though not analyzed, we can interpolate the lightscape impact to Zion national park based on the model runs from Yovimpa Point and Brianhead Peak. In both scenarios, and considering both skyglow and direct glare, the impact to Zion is expected to be **negligible**.

Mitigation

The conditions above where impacts to national parks are not negligible can be effectively mitigated. The National Park Service concurs with the mitigations suggested in the report by Dark Sky Partners. Assuming that reducing hours of operation at night is impractical for the mine operators, reducing lamp intensities and shielding fixtures would in combination sharply reduce both skyglow and direct glare. Retrofitting the proposed portable lighting unit with shielded fixture heads is recommended (see Appendix D), as well as addressing fixed lighting throughout the site.

Conclusions

As presented, lightscape impacts to national parks will be negligible to minor. The intervening terrain blocks much light that would otherwise be a substantial problem for these two parks. The report by Dark Sky Partners has lowered our initial concern over the impact to the outstanding natural lightscapes found in Bryce Canyon, Cedar Breaks, and Zion national parks. However, the report also underscores the necessity to this kind of analysis, especially when in close proximity to parks and where terrain does not fortuitously block stray light. Though the environmental impact is relatively small, we encourage simple and relatively low initial cost mitigations that will sensibly reduce this project's environmental impact.

cc:
Benjamin Gaddis
SWCA Environmental Consultants

Eddie Lopez
Bryce Canyon National Park

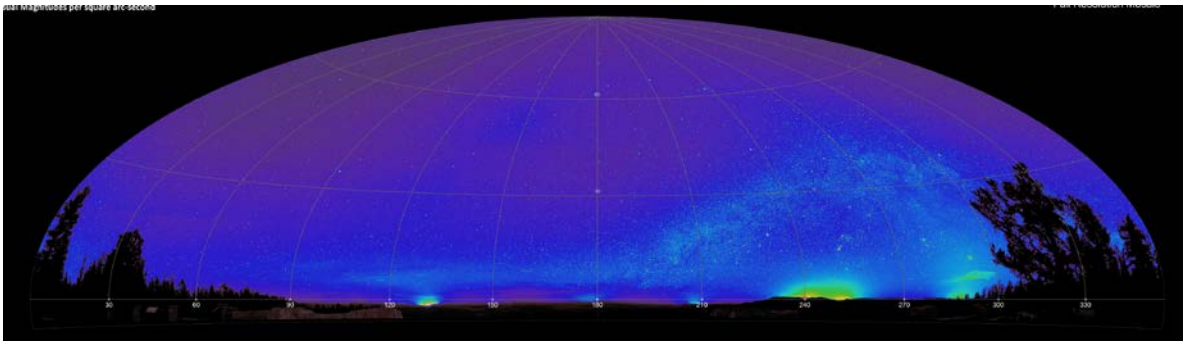
Paul Roelant
Cedar Breaks National Park

Jock Whitworth
Zion National Park

J.2. An Assessment of the Impact of Potential Mining Operations at the Alton Coal Tract on the Dark Skies of Bryce Canyon National Park and Cedar Breaks National Monument
Part II. An Additional Lighting Scenario, Dust Effects, Projected Future Increases in Skyglow due to Growth, and the Average Sky Luminance Parameter

An Assessment of the Impact of Potential Mining Operations at the Alton Coal Tract on the Dark Skies of Bryce Canyon National Park and Cedar Breaks National Monument

Part II. An Additional Lighting Scenario, Dust Effects, Projected Future Increases in Skyglow due to Growth, and the Average Sky Luminance Parameter



NIGHT SKY FROM YOVIMPA POINT, BRYCE CANYON NATIONAL PARK
(NPS NIGHT SKIES PROGRAM)

FINAL REPORT

REVISED

Prepared by Dark Sky Partners, LLC
for
SWCA Environmental Consultants

February 2014

EXECUTIVE SUMMARY

This report presents additional results from computer calculations of the sky brightness due to mining operations in the Alton Coal Tract when viewed from Yovimpa Point in Bryce Canyon National Park. This report is a follow-up report to the 2009 report *An Assessment Of The Impact Of Potential Mining Operations At The Alton Coal Tract On The Dark Skies Of Bryce Canyon National Park And Cedar Breaks National Monument*. The present work adds a third proposed lighting scenario to the two proposed Alton Coal Tract lighting scenarios used in the 2009 study, and analyzes the impact of mine-generated dust on skyglow as seen from Yovimpa Point. It also includes projections of the increased skyglow from population growth in the region through the year 2040. Finally, a new measure, the average sky luminance, is calculated; this measure can be compared with the value measured by the National Park Service Night Sky Team.

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I. INTRODUCTION

The 2009 Dark Sky Partners (DSP) report A*n Assessment Of The Impact Of Potential Mining Operations At The Alton Coal Tract On The Dark Skies Of Bryce Canyon National Park And Cedar Breaks National Monument* (hereafter DSP 2009) describes the impact of proposed mining operations at the Alton Coal Tract (ACT or tract) on the night sky as seen from Bryce Canyon National Park (BCNP) and Cedar Breaks National Monument (DSP 2009). In the public comment period on the draft environmental impact statement (DEIS), issues were raised as to

- the impact on skyglow from dust generated by mining activities on the tract;
- increased skyglow over time as a result of projected population growth in the region; and
- the effects on the overall sky brightness as measured using the average sky luminance (ASL) measure.

These issues are addressed in this report. An Alton Coal Tract EIS Night Sky Working Group (NSWG) was formed, consisting of representatives from the Bureau of Land Management, National Park Service (NPS), SWCA Environmental Consultants, and DSP to address the above issues and to provide guidance on any further modeling work needed for the EIS. The reader is referred to DSP 2009 for a description of the study methodology and the details of the tract lighting.

In this supplementary report, predicted sky brightness is calculated for three ACT lighting scenarios. The DSP 2009 report analyzed two ACT lighting scenarios, called *typical* and *brightest*. To these scenarios this report adds a third scenario to describe an even brighter scenario. The three scenarios analyzed here are summarized as:

1. Scenario 1 (*typical* in DSP 2009) assumes the least lighting with one portable light tower (4 lamps), four fixed-position light towers, and 20 lamps from mobile light sources.

2. Scenario 2 (*brightest* in DSP 2009) assumes a mid-range of lighting with three portable light towers (12 lamps), six fixed-position light towers, and 36 lamps from mobile light sources.

3. Scenario 3 (not analyzed in DSP 2009) assumes the most lighting with six portable light towers (24 lamps), six fixed-position light towers, and 36 lamps from mobile light sources. Other than the increase in numbers of lamps, the characteristics of the sources in this new scenario are the same as for scenarios in DSP 2009.

II. DUST IMPACTS

The methodology and lighting described in DSP 2009 are used to address the impact of mine-generated dust on skyglow. To investigate the impact of dust over the mine site, DSP modified the computer code to model the mine-generated dust as being in a cylinder over the mine pit, increasing the particulate component of the atmosphere within this cylinder relative to the surrounding atmosphere. The cylinder was assumed to be 1 kilometer in radius, reaching to 200 meters over the ground, and centered over the mine pit.

The parameter that describes the amount of aerosol (particulates) in the atmosphere, K, was set to 0.05throughout the region, including the mine site, in the DSP 2009 report. This value is representative of very clear air in the region, not the typical or average; an average western atmosphere is characterized with a K of approximately 0.3–0.5. The reasoning behind this choice of an atypical K value are discussed in DSP 2009. To determine a K value that characterizes the tract dust, data from the *Air Resources Impact*

Assessment Technical Report for the Alton Coal Lease By Application Draft Environmental Impact Statement (Appendix K in the DEIS) were used to provide the particulate mass loading (micrograms/m^3) for mining activities under the action alternatives. The last column of Table 1 gives the factor by which K should be increased to account for the increased mine-generated dust. Because the values listed under "background" describe average conditions in the region (i.e., K = 0.5, not K = 0.05 used in the DSP 2009 study), to be conservative, DSP adopted a K value of 4 × 0.5 = 2 within the cylinder, leaving K = 0.05 in the atmosphere outside of the cylinder.

Table 1. Mine Dust and Background Dust, in mcg/m^3, for the Alton Coal Tract used to Model Dust Impacts on Skyglow

Scenario	Background	Mine Dust	Total	Ratio Total/ Background
PM_{10}, 200 feet, Alternative B and K1	72	83	150	2.1
PM_{10}, 200 feet, Alternative C	72	84	160	2.2
PM_{10}, 300 feet*, Alternatives B and K1	72	86	160	2.2
PM_{10}, 300 feet*, Alternative C	72	93	160	2.2
$PM_{2.5}$, 200 feet, Alternatives B and K1	8.6	19.3	30	3.5
$PM_{2.5}$, 200 feet, Alternative C	8.6	21.1	28	3.3
$PM_{2.5}$, 300 feet*, Alternatives B and K1	8.6	22.7	31	3.6
$PM_{2.5}$, 300 feet*, Alternative C	8.6	24.5	33	3.8

Notes: PM_{10} = particulate mass density of particles > 10 microns; $PM_{2.5}$ = particulate mass density for particles > 2.5 microns. For the $PM_{2.5}$, the 24-hour average as reported in Table 3.6 of the air resources report was used. "200-feet" and "300-feet"* indicate the amount of overburden removed.

*The 300-foot overburden removal scenario was eliminated from detailed analysis in the SDEIS. By lease stipulation, the successful bidder would not be permitted to surface mine at overburden depths greater than approximately 200 feet. The 300-foot overburden scenario is included here for completeness.

Figure 1 shows the predicted sky brightness (in nanoLamberts[1] [nL]) as seen from Yovimpa Point in BCNP for ACT lighting Scenarios 1 through 3 as described above. It also compares the skyglow with and without enhanced dust over the ACT. Figure 2 gives the predicted fractional change in sky brightness from mine dust. As seen from these figures, the addition of dust over the tract causes a slight decrease in the predicted sky brightness when viewing the sky slightly above the mine site, compared to the predicted increase without dust enhancement. This change is very small for all zenith angles (ZAs), reaching approximately 0.3–2% decrease at ZA 89º. The addition of dust results in a predicted reduction in the sky brightness increase at a zenith angle of 89º toward the tract from 10% to 9.7% (a decrease of 0.3%) for lighting Scenario 1, from 31% to 30% (a decrease of 1%) for Scenario 2 (cf. to DSP 2009 Table 5), and from 64% to 62% (a decrease of 2%) for Scenario 3.

[1] A nanoLambert (nL) is a unit of luminance or surface brightness. 1 Lambert = 1 lumen/square centimeter for a uniformly diffusing surface. A naturally dark sky has a brightness of approximately 54 nL at the zenith, rising (due to natural causes) to approximately 100 nL 10° above the horizon.

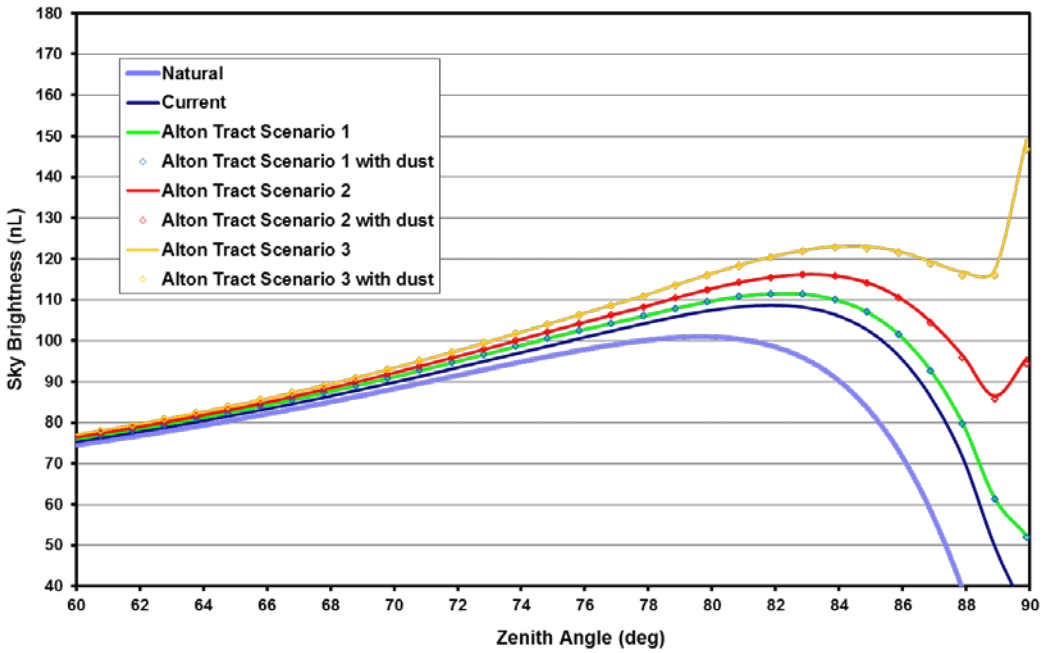

Figure 1. Predicted sky brightness in nano-Lamberts (nL) as observed from Yovimpa Point toward the ACT, with and without enhanced dust over the ACT, for the three lighting scenarios considered for the ACT. Zenith Angle (ZA) in all figures refers to the angle between the zenith and the observation direction: 0º < ZA < 90º are at azimuth 256º, i.e. toward the ACT as observed from Yovimpa Point, and 0º > ZA > –90º refer to azimuth 76º, directly opposite the ACT.

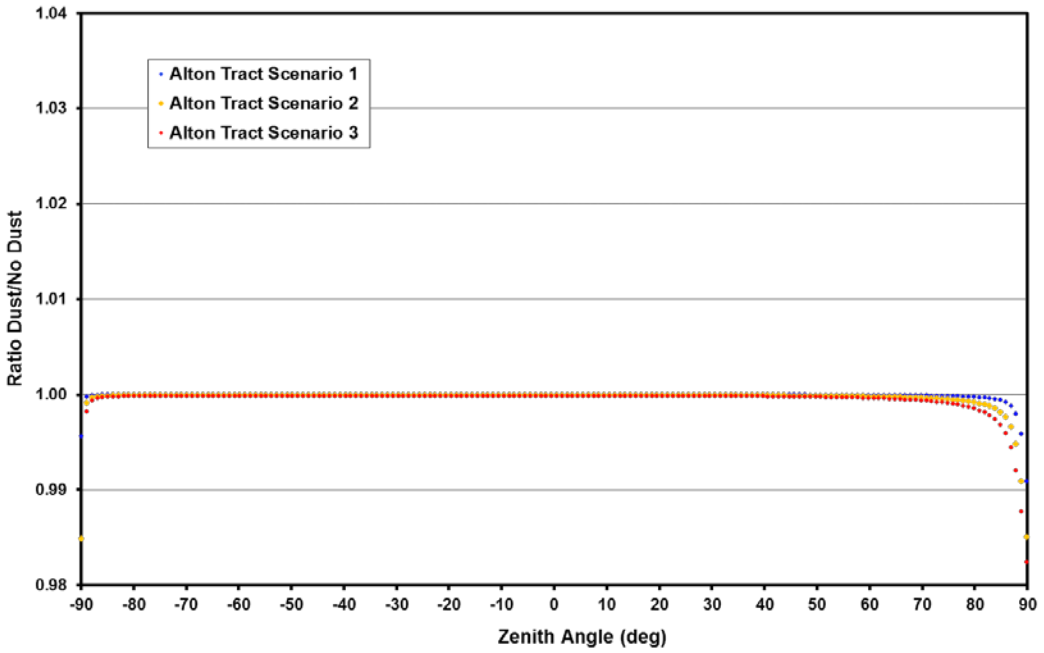

Figure 2. Ratio of predicted Yovimpa Point sky brightness with enhanced (K=2) dust over ACT to brightness without enhancement for lighting scenarios 1 and 3.

It is important to note that the tract appears 1.5º below the geometric horizon as viewed from Yovimpa Point, or at ZA 91.5º. Though DSP models do not provide predictions for ZA > 90º, it is to be expected that the dust over the mine site would increase the brightness of the site to observers at Yovimpa Point looking below the geometric horizon and into the dust layer directly over the mine site, due to increased scattering of light from dust generated by tract operations.

III. CUMULATIVE IMPACTS

In DSP 2009, the predicted skyglow profiles toward the ACT are compared to the artificial sky brightening predicted toward each of the 11 nearby towns and cities. Fractional brightness increases for all town calculations are compared against the natural condition, i.e., to the sky with no towns present. The fractional brightness increases for all ACT calculations are compared with the current condition, i.e., including any towns or cities where skyglow may overlap with that produced by the ACT lighting. This is the most appropriate way to judge the impacts, because the skyglow arising from towns is viewed against a (generally) unpolluted horizon, whereas the skyglow produced by lighting installed in the ACT would be added to that already present.

The NSWG requested a calculation of the fractional brightness increase due to ACT lighting in 2040, the expected end date for ACT mining operations. To assess this impact, DSP projected the increase in skyglow due to growth in the 11 towns included in the DSP 2009 calculation of the current sky brightness. Two lighting conditions for 2040 were considered. The first used the same 10% direct uplight assumed in calculating the current sky brightness. The second assumed that the direct uplight fraction would be cut in half (to 5%) to account for possible improvements in lighting technology and codes/ordinances (in terms of limiting light pollution) over time. Both used the same 2,500 lumens/capita used in DSP 2009. Table 2 gives the projected 2040 population and lumens used to calculate the 2040 sky brightness.

Table 2. Projected Population in 2040 and the Associated Lumens Generated for the Cities and Towns used in the Cumulative Impact Analysis

Town/City	Population	Lumens
Alton town	268	670,000
Brian Head	299	747,500
Cedar City	65,165	162,912,500
Fredonia	1,403	3,508,504
Glendale	669	1,672,500
Kanab	7,177	17,942,500
Orderville	1,156	2,890,000
Page	8,303	20,758,575
Panguitch	2,383	5,957,500
St. George	280,507	701,266,510
Tropic	752	1,880,000
Total	**368,082**	**920,206,089**

Source: GOPB (2012).

For comparison, the 2010 total population used in DSP 2009 was 164,086 and the total lumens were 410,215,000.

Brightness profiles as viewed from Yovimpa Point toward the ACT were calculated for the three ACT lighting scenarios with 2010 populations, as well as for ACT scenario 3 under both 2040 lighting conditions as described above. Results are shown in Figures 3 – 5.

After the cumulative impact figures were generated for this report, updated population projections were made available by the State of Utah. The revised population projections show a reduced growth rate in the region, particularly for St. George and Cedar City (See Section 4.19.2.1.4 of the SDEIS). The total population projected in 2040 was reduced to 272,964 from the previous estimate of 386,080 used in this analysis (GOPB 2013). Therefore, the results presented here are conservative compared to those that would be predicted using the more recent population projections, because the figures presented here are brighter overall, with the ACT therefore contributing a smaller fraction.

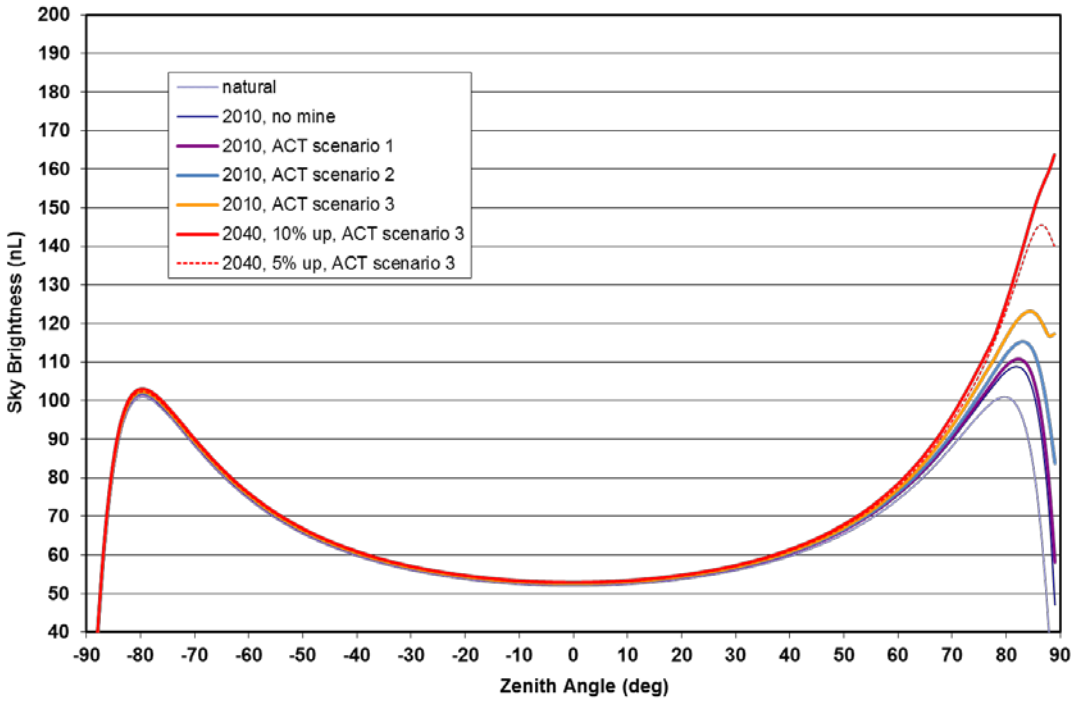

Figure 3. Sky brightness as observed from Yovimpa Point at azimuth 256º toward the ACT (0º < ZA < 90º), comparing 2010 values with those using 2040 population projections and lighting scenario 3.

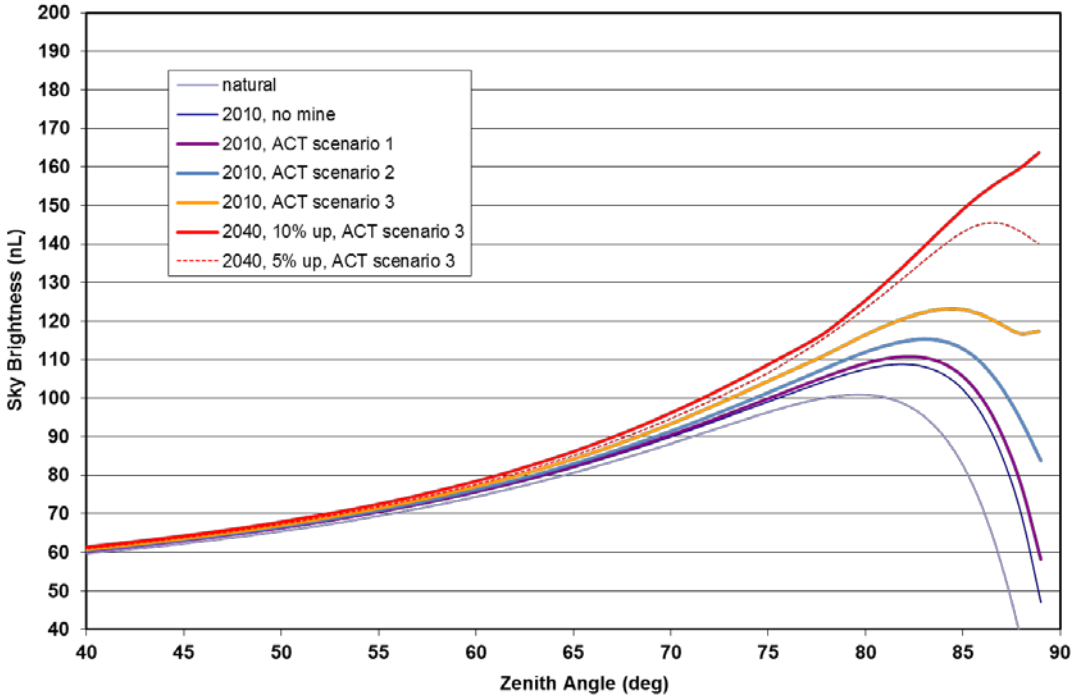

Figure 4. Enlargement of the right part of Figure 3 showing the sky brightness for zenith angles from 40º to 89º in the direction of the ACT.

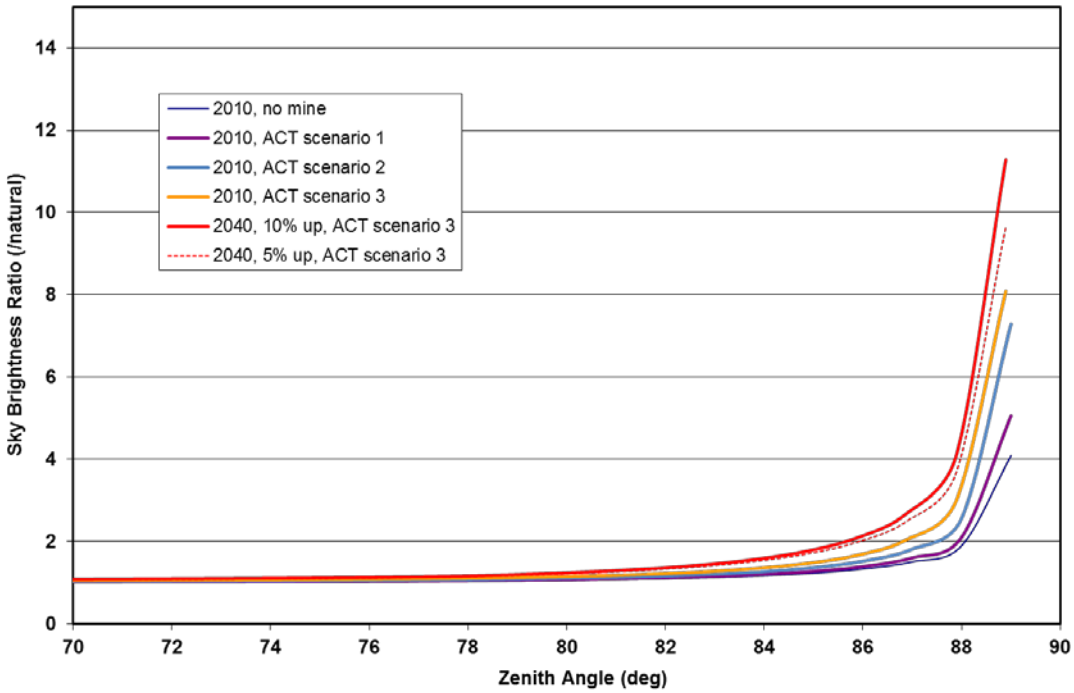

Figure 5. The sky brightness ratio (Scenario/Natural) as viewed from Yovimpa Point close to the horizon toward the ACT for the five cases in Figure 3.

IV. AVERAGE SKY LUMINANCE

The NSWG requested that DSP provide a calculation of the predicted average sky luminance (ASL), both for total skyglow and artificial skyglow only. The ASL is the average luminance (or sky brightness) of the sky as seen from the observer's location. This parameter is useful as a single value describing the quality of the entire hemisphere of the sky instead of in a particular direction.

DSP developed new computer code based on the modeling algorithms described in DSP 2009 to calculate the ASL by calculating sky luminance on a grid of positions covering the hemisphere of the sky. A separate calculation then integrates over the grid to find the average sky luminance, the ASL. For the Alton (Yovimpa Point) calculations, the grid was set with 80 points uniformly spaced in azimuth (0–360 degrees) and 20 points in elevation (0–90 degrees), for a total of 80 × 20 = 1,600 points. The calculated ASL can be compared with one derived from measurements made by the NPS Night Sky Team as shown in Table 4. The results are shown in Table 3.

Table 3. Average Sky Luminance in nanoLamberts for 2010 Conditions (no mine), Three Cases with Mine Lighting using 2010 Population Numbers, and Two Future (2040) Cases showing both Standard and Optimistic Parameters for 2040 Town Lighting.

Scenario and Parameters	Natural Lighting	Mine Lighting	Lighting from Towns	Total Artificial Lighting	Total Present Lighting	Total Percent Lighting Increase over Present	Total Percent Lighting Increase over Natural
2010, no mine	71.19	0.00	1.92	1.92	73.11	0.0%	2.7%
2010, ACT Scenario 1	71.19	0.14	1.92	2.06	73.25	0.2%	2.9%
2010, ACT Scenario 2	71.19	0.52	1.92	2.44	73.63	0.7%	3.4%
2010, ACT Scenario 3	71.19	0.99	1.92	2.91	74.10	1.4%	4.1%
2040, ACT Scenario 2, standard parameters	71.19	0.52	4.01	4.53	75.72	3.6%	6.4%
2040, ACT Scenario 2 optimistic parameters	71.19	0.52	2.91	3.43	74.62	2.1%	4.8%
2040, ACT Scenario 3, standard parameters	71.19	0.99	4.01	5.00	76.19	4.2%	7.0%
2040, ACT Scenario 3 optimistic parameters	71.19	0.99	2.91	3.90	75.09	2.7%	5.5%

The NPS estimate of the ASL due to artificial lighting at Yovimpa Point, made with the NPS camera system (Duriscoe et al., 2007), shows significant uncertainty due primarily to uncertainty in the natural sky glow (indicated by the range of values for the zenith air glow in column 3 of Table 4), which varies both temporally and spatially. Subtracting the natural sky glow model developed by the NPS from their Yovimpa Point observations to find the ASL contribution from towns gives values ranging from 1.13 nL to 5.24 nL, depending the estimate used for the natural airglow. These figures are summarized in Table 4. Hence, the DSP modeled value of 1.92 nL for the 2010 towns' contribution is within the range of the NPS estimate.

Table 4. The Average Sky Luminance, in nanoLamberts, measured by NPS from Yovimpa Point (NPS, 2014).

Observation Date	Total ASL	Zenith Air Glow	Natural ASL	Artificial ASL
14 March 2007	67	13 – 17	62 – 66	1.13 – 5.24

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APPENDIX K

AIR RESOURCES IMPACT ASSESSMENT TECHNICAL REPORT FOR THE ALTON COAL LEASE BY APPLICATION DRAFT ENVIRONMENTAL IMPACT STATEMENT (2010) AND SUPPLEMENTAL REPORT (2014)

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K.1. Air Resources Impact Assessment Technical Report for the
Alton Coal Lease by Application, Draft Environmental Impact Statement

K.2. Supplement to Air Resources Impact Assessment Technical Report for the Alton Coal Lease by Application, Supplemental Draft Environmental Impact Statement

K.1. Air Resources Impact Assessment Technical Report for the Alton Coal Lease by Application, Draft Environmental Impact Statement

AIR RESOURCES IMPACT ASSESSMENT TECHNICAL REPORT FOR THE ALTON COAL LEASE BY APPLICATION

DRAFT ENVIRONMENTAL IMPACT STATEMENT

Prepared for

Bureau of Land Management
Kanab Field Office
Kanab, Utah

Bureau of Land Management
Utah State Office
Salt Lake City, Utah

Prepared by

Marquez Environmental Services, Inc.
Golden, Colorado

September 2010

In coordination with

SWCA Environmental Consultants
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SWCA Project 12033

September 2010

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Appendix B: Mining Emission Inventory Results
Appendix C: AP-42 Emission Factor Sections
Appendix D: Cumulative Emission Sources

ABBREVIATIONS

ACD	Alton Coal Development, L.L.C.
ANC	Acid neutralizing capacity
AQRV	Air quality related value
ARS	Air resource specialists
BACT	Best achievable control technology
BLM	Bureau of Land Management
CFR	Code of Federal Regulations
CO	Carbon monoxide
DAT	Deposition analysis threshold
Dv	Deciview
EIS	Environmental impact statement
EPA	Environmental Protection Agency
FLAG	Federal Land Managers' Air Quality Related Values Workgroup
FLM	Federal land managers
HAP	Hazardous air pollutant
HNO_3	Nitric acid
IDLH	Immediately Dangerous to Life or Health
IWAQM	Interagency Workgroup on Air Quality Modeling
kg/ha/yr	Kilograms per hectare per year
LAC	Level of acceptable change
LBA	Lease by Application
LNCM	Lands necessary to conduct mining
LOP	Life of project
MEI	Maximally exposed individual
MEQ	Microequivalents per liter

MLA	Mineral Leasing Act of 1920
MLE	Most likely exposure
N	Nitrogen
NAAQS	National ambient air quality standards
NEPA	National Environmental Policy Act
NIOSH	National Institute for Occupational Safety and Health
NO_2	Nitrogen dioxide
NO_3	Nitrate
NO_x	Oxides of nitrogen
NH_4	Ammonia
NSR	New Source Review
OSM	Office of Surface Mining Reclamation and Enforcement
O_3	Ozone
PAP	Permit application package
PM_{10}	Particulate matter less than or equal to a nominal 10 microns in aerodynamic size
$PM_{2.5}$	Particulate matter less than or equal to a nominal 2.5 microns in aerodynamic size
ppb	Parts per billion
Protocol	Air resources impact assessment protocol
PSD	Prevention of significant deterioration
QA/QC	Quality assurance/quality control
REL	Reference exposure level
RfC	Reference concentrations for chronic inhalation
RFD	Reasonably foreseeable development
RFFA	Reasonably foreseeable future actions
RMP	Resource management plan
S	Sulfur
SO_2	Sulfur dioxide

SO_4	Sulfate
TSP	Total suspended particulate
UAAQS	Utah ambient air quality standards
UDNR-DOGM	Utah Department of Natural Resources – Division of Oil, Gas, and Mining
$\mu g/m^3$	Micrograms per cubic meter
URF	Unit risk factor
USGS	U.S. Geological Survey
VOC	Volatile organic compound

1 INTRODUCTION

Marquez Environmental Services, Inc. (MESI) has prepared this Air Resources Impact Assessment Technical Report to quantify potential air resource impacts from mining operations on and related to the Alton Coal Lease by Application Tract (the Alton Coal Tract or tract). The analysis provided herein was performed in accordance with the Air Resources Impact Assessment Protocol (Protocol) prepared by SWCA Environmental Consultants (SWCA) in partnership with MESI, with exceptions and justifications for changes noted herein. The methodologies in the protocol were provided prior to study initiation to ensure that the approach, input data, and computation methods are acceptable to the Bureau of Land Management (BLM). Air resource stakeholders had the opportunity to review the Protocol and provide input before the study was initiated. The tract location in southwestern Utah requires the examination of mining and cumulative source impacts within the proposed air resources modeling domain shown on Map 1.1 from emission sources in southwestern Utah (all maps are contained in Appendix A).

The analysis was based on a conceptual mine design and a set of planned and known mitigation strategies. The analysis is intended to be conservative to accommodate foreseeable emissions under a various mining scenarios. A detailed mine plan has not yet been developed. An approved detailed mine plan would be subject to state permitting requirements and would be subject to appropriate dispersion modeling at that time, as well as detailed operation and mitigation strategies.

The modeling domain was dimensioned in accordance with guidance provided by an interagency air resources stakeholder group. The modeling area covers nearly 40 million acres of land including sensitive areas such as Bryce Canyon National Park, Capitol Reef National Park, Great Basin National Park, Grand Canyon National Park, and Zion National Park, and various other public lands surrounding the tract (see Map 1.1). The air impact assessment used the EPA's recommended guideline model, AERMOD, to analyze potential near-field impacts of mining operations on the tract on ambient levels of criteria pollutants near the Alton Coal Tract. In addition to the near-field analysis, potential impacts from mining operations on the tract on air quality related values (AQRV) at more distant, sensitive locations were analyzed. This far-field modeling analysis used the CALMET/CALPUFF modeling systems.

1.1 Work Tasks

The air resources analysis addressed the impacts to ambient air quality and AQRVs from (1) potential air emissions from coal mining on the tract; (2) potential air emissions from transporting mined coal from the mine site to the reasonably foreseeable loadout location (see Map 1.5); and (3) air emissions from other documented regional emission sources in the modeling domain (cumulative air resource impacts). Ambient air quality impacts were quantified and compared to applicable state and federal standards, and AQRV impacts (impacts on visibility [regional haze], acid deposition, and potential increases in acidification to acid sensitive lakes) were quantified and compared to applicable thresholds as defined in the Federal Land Managers' (FLMs') Air Quality Related Values Workgroup (FLAG), IWAQM guidance documents (FLAG 2000; IWAQM 1998), and other state and federal agency guidance. Carbon dioxide emissions resulting from mining and transporting coal and from coal combustion were estimated and are included in the EIS greenhouse gas analysis. Impact assessment criteria are discussed further in Section 5.0.

The assessment of impacts included completion of the following tasks:

- Generate emission inventories for mining operations on the tract and coal haul transportation operations on the reasonably foreseeable coal haul transportation route (see Section 2.0);
- Compile a regional emission inventory including specified permitted sources, reasonably foreseeable development (RFD), and reasonably foreseeable future actions (RFFA) (see Section 2.0);
- Assess near-field ambient impacts from emissions resulting from mining operations on the tract and coal haul transportation operations on the reasonably foreseeable coal haul transportation route (see Sections 3.0 and 5.0);
- Assess far-field ambient direct and cumulative impacts including pollutant concentration, visibility and acid deposition impacts at Class I areas and at selected Class II areas within the modeling domain (see Sections 4.0 and 5.0);
- Estimate carbon dioxide emissions resulting from mining and transporting coal, and coal combustion.

2 EMISSION INVENTORY

The project emission inventory considered emissions of oxides of nitrogen (NO_x), sulfur dioxide (SO_2), carbon monoxide (CO), particulate matter less a nominal 10 micrometers in aerodynamic diameter (PM_{10}), particulate matter less a nominal 2.5 micrometers in aerodynamic diameter ($PM_{2.5}$), volatile organic compounds (VOCs), hazardous air pollutants (HAPs) (i.e., acetaldehyde, acrolein, benzene, formaldehyde, toluene, and xylenes for generators), and carbon dioxide (CO_2). Emission estimates were compiled for mining and related operations and for other existing and reasonably foreseeable future sources.

Although it is recognized that secondarily formed $PM_{2.5}$ and ozone emissions will be generated, only primary pollutant emissions were included as part of the emissions inventory. The $NO_{x,,}$ SO_x, and VOC gases emitted have the potential to secondarily form $PM_{2.5}$ particles. $PM_{2.5}$ formation from these precursors is highly uncertain, and varies both regionally and seasonally due to atmospheric conditions. Typically, emission inventory calculations lead to higher values than those derived from receptor models, and there is no consensus on differences in $PM_{2.5}$ emission estimates from re-entrained dust (FHA, 2010). Ozone formed secondarily from photochemical reactions occurs away from a source and is therefore, not regarded as a near field pollutant.

The pollutants considered in the impacts analysis are discussed in Sections 3.0 and 4.0. Results of the mining emission inventory are included in Appendix B.

2.1 Project Emissions

Emissions from construction activities and coal production activities were considered as project emissions. Primary sources are related either to fuel use in internal combustion engines or to dust emitted into the air from various sources. Both of these sources are described in detail below. For coal production emissions the maximum development year was considered as representative of all years of mining. This approach results in a more conservative estimate of yearly emissions and a more conservative analysis. However, most years of mining would result in fewer emissions than the maximum development year.

2.1.1 *Construction Emissions*

The initial construction activities would include development of the access road, site preparation for the fixed facilities (e.g., crushers, conveyors, generators, office and maintenance buildings, etc.), development of the main haul road, delivery of materials and equipment to the mine, and other construction vehicle activity. Because detailed construction plans have not been developed, the construction emission inventory focused exclusively on particulate matter. The total suspended particulate (TSP) emission factor for heavy-construction operations from Section 13.2.3 of *Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Areas Sources* (AP-42) (EPA 2008) is E = 1.2 tons/acre/month. Based on the emission factors for unpaved roads (AP-42, Section 13.2.2), the PM_{10} emission factor is 30% of the TSP factor, and the $PM_{2.5}$ emission factor is 10% of the PM_{10} factor. For the purpose of this inventory, it was assumed that 36 acres would be disturbed by construction activities. Six acres would be disturbed each month for six months. For a copy of AP-42 Sections 13.2.2, Unpaved Roads, and 13.2.3, see Appendix C.

2.1.2 *Production Emissions*

Sources of pollutant emissions during coal production include particulate matter emissions and fuel-combustion emissions. Both surface and underground mining were considered. For surface mining, both a 200-foot and 300-foot overburden thickness was evaluated for Alternatives B and C. Emissions were calculated for 24 hours per day, 7 days per week, 52 weeks per year. The total number of operating days per year was assumed to be 365.

Particulate matter emissions from surface mining (fugitive dust) can come from

- topsoil loading, unloading, and hauling (two options: scrapers or front-end loader and trucks);
- overburden blasting, overburden truck loading, unloading, and hauling;
- coal loading, unloading, hauling, crushing, screening, conveying, and storage;
- vehicle traffic on improved and unimproved gravel or dirt roads as well as paved roads;
- wind erosion of disturbed areas;
- train loading;
- bulldozer and front-end loading activities; and
- underground mining operations.

Emissions were calculated for 200-foot and 300-foot overburden removal thickness for Alternatives B and C. Dust mitigation measures such as watering and chemical spraying were considered in the emissions inventory. The fugitive dust emission factors for particulate sources were taken from AP-42 Sections 13.2.1 and 13.2.2 as well as Section 11.9 – Western Surface Coal Mining (see Appendix C) (EPA 2008). Use of these emission factors requires detailed specifications for production activities and equation variables. Because no detailed mine plan has been developed, a list of assumptions was established for the reasonable maximum year of mining activities. These assumptions are provided in tabular form in Appendix B along with the results of the emission inventory. On-road motor vehicle emissions for employee vehicles and haul trucks were calculated using Utah Department of Environmental Quality, Division of Air Quality (DAQ) mobile source emission factors.

Particulate emissions from underground mining were estimated for additional coal handling, loading, and hauling. Because no detailed conceptual underground mining plan exists, it is assumed that the auger mining method would be used. The auger mining assumption is conservative. Other methods could be used, but auger mining would probably result in the most coal dust emissions. Coal haul trucks and coal loading for the underground operations were assumed to be the same as the surface mining operations. The train loading emission factor from AP-42 11.9-4 was used to estimate emissions from coal dumping from two highwall miners.

Fuel-combustion emissions (NO_x, SO_2, CO, PM_{10}, $PM_{2.5}$, VOCs, HAPs, and CO_2) can come from generators and vehicles. Generating capacity requirements for the surface mining operations were assumed to be 2,000 kW, and the underground mining operations were assumed to require an additional 3,000 kW of power. New Source Performance Standards (NSPS) required by 40 CFR 60 Subpart IIII were applied to the generators; however, the regulation requires the use of Tier 4 emission standards developed by the Environmental Protection Agency (EPA 2004) for nonroad diesel engines. The Tier 4 standards were used for the generators and the nonroad diesel engines. Use of ultra-low-sulfur diesel fuel for vehicles and generators was also considered in the inventory. Vehicle and generator emission factors were derived from the above referenced rules as well as manufacturer information for specific vehicles and equipment that match the assumptions in Appendix B.

From a modeling perspective and in line with the logistics of auger or highwall mining, the generators would be located outside the underground workings.

On-road vehicles would include coal haul trucks (see Appendix B) and employee vehicles. The coal haul trucks would travel 110 miles each way. The average employee would travel 30 miles each way. On-road motor vehicle emissions were calculated using the Utah Division of Environmental Quality (UDEQ) 2005 mobile source (Mobile 6) emission factors for Kane County. These data were the most recent available. The Mobile 6 sulfur dioxide emission factors were adjusted to account for a more restrictive gasoline sulfur standard than was assumed in the state's analysis. The Mobile 6 data did not include emission factors for HAPs.

2.2 Cumulative Emission Inventory

The cumulative emission inventory is composed of 1) an inventory of the currently planned coal haul transportation route emissions; and 2) an inventory of proposed emission sources within a 300 × 300–km area (see Map 1.1). The cumulative inventory includes the identification/evaluation of permitted source changes (increases or decreases), RFFA, and RFD. A summary of the cumulative emission inventory is presented in Appendix D.

2.2.1 *Existing Source Modifications Inventory/Reasonably Foreseeable Future Actions Inventory*

It is assumed that all existing permitted emission sources are included in the background concentrations estimates presented in Table 3.1. There will be some reasonable emission variations over time for these sources. Unless information obtained from the state(s) shows that a source went through a permit modification, the emission changes are assumed to be part of expected variation and are not included in the inventory of changed or added sources.

As such, the emission inventory was developed for Title V major modifications and new minor or major source permits that occurred after September 1, 2008. The data were obtained from the state air quality regulators (e.g., Utah, Nevada, and Arizona) within the emission inventory domain shown in Map 1.1.

2.2.2 *Reasonable Future Development Sources*

RFD sources are proposed sources and include new sources expected from BLM- and USFS-related activity such as oil and gas development and mining. Oil and gas commissions in the various states and other state agencies also provided information on planned new emission-producing sources. Due to the uncertainty in projected traffic increases on the existing road network, only project related transportation increases were considered. RFFA and RFD data sources are listed in Table 2.1.

Table 2.1. Sources of Information for Potential Reasonably Foreseeable Future Actions and Reasonably Foreseeable Development in the Modeling domain

NEPA Documents, Land Use Plans, and Personnel	Disposition	Notes	Reference
Oil and Gas Leasing on Lands Administered by the Dixie National Forest DEIS	Dixie and Fishlake NF oil field development are included as point sources in cumulative modeling. Tables in Appendix D (see Tables for Dixie Point Sources, Volume Sources, and Area Sources; Fishlake Point Sources, Volume Sources, and Area Sources).		USFS 2008.
BLM Kanab Field Office RMP	90 new production wells over 20 years (4.5 wells per year); no production or drilling of coalbed methane wells; no oil wells.	In addition to Oil and Gas, the following sources are included in the Kanab report:	BLM 2006.
BLM Kanab Field Office Mineral Potential Report	**Use highest projected pollutant emissions for oil and gas + area sources listed below; incorporate as an area source (2631 acres ~4 square miles=total area disturbed by new wildcat drilling, O and G development wells, and seismic data in KPA); Tables in Appendix D.**	Coal Mining: the projected mine is Alton	BLM 2006.
	- Will include Lands and Realty, Livestock grazing, off-hwy vehicles, resource roads, saleable minerals, vegetation	Lands and Realty, Livestock Grazing: small area source, Off highway vehicles	
	- Eliminated coal mining (projected mine is Alton)	Resource Roads, Saleable Minerals, Vegetation	
	- Eliminated prescribed burning because it is intermittent and regulated such that it occurs during favorable met conditions.	Prescribed burns: 103,000 cumulative acres	
	See Kanab Tables in Appendix D		

Table 2.1. Sources of Information for Potential Reasonably Foreseeable Future Actions and Reasonably Foreseeable Development in the Modeling domain

NEPA Documents, Land Use Plans, and Personnel	Disposition	Notes	Reference
BLM Richfield Field Office RMP	Oil Well and non- oil well activities, Alt A and B have the same emissions; 30 wells per year; Disturbance area not available so ratioed from Kanab - 6X as big as Kanab.	In addition to Oil and Gas, the following sources are included in the Richfield report:	BLM 2008b.
	Use highest projected pollutant emissions for oil and gas + area sources listed below; incorporate as an area source (24 square miles); Tables in Appendix D.	Coal: Appears these are the coal mines north of I70 that are not in our domain	
	- Will include Lands and Realty, Livestock grazing, off-hwy vehicles, resource roads, saleable minerals, vegetation	Lands and Realty, Livestock Grazing: small area source, Off highway vehicles	
	- Eliminated coal mining (outside domain)	Resource Roads, Saleable Minerals, Vegetation	
	See Richfield Tables in Appendix D		
BLM Cedar City Field Office Personnel	No sources to add: Geothermal activity is not included for the following reasons: Emissions from geothermal are from short term drilling. Area has been developed for geothermal so activity is a continuation of an on-going development pattern, therefore should be considered part of baseline.	Four new geothermal wells annually in Sulfurdale Area	BLM 2009.
BLM St. George Field Office Personnel	No sources to add	Kanab data and Utah DEQ (St George turbines) represent activity in this area. Lorraine Christian did not provide additional data.	BLM 2009a.
BLM Ely Field Office	No sources to add	No contact; very edge of domain; narrow eastern part of Nevada; indications from other Nevada research indicate there is little if any activity in this area; therefore this was not pursued further.	
BLM Las Vegas Field Office	No sources to add	Lisa Christiansen did not provide additional data.	BLM 2009a.
BLM Arizona Strip Field Office	No sources to add: EIS for the Arizona Strip did not consider Air Quality	Lorraine Christian did not provide additional data.	BLM 2007; 2009b.
Utah DEQ: Permit Actions	Two new gas turbines at St George City Power; Table attached (see Utah Tab)	Stack height and diameter estimated; other stack parameters available	UDAQ 2009.

Table 2.1. Sources of Information for Potential Reasonably Foreseeable Future Actions and Reasonably Foreseeable Development in the Modeling domain

NEPA Documents, Land Use Plans, and Personnel	Disposition	Notes	Reference
Arizona DEQ: Permit Actions	EPA PSD permit: Modification to Navajo Generating Station carbon monoxide increase 36,750 TPY, NOx decrease 22,386 TPY; Three emission units: each 775 feet tall, 34.75 feet in diameter, 122 deg F, exhaust, 2,130,000 ACFM, 106 ft/sec; Coordinates of the center stack are: UTM Zone 12, 465346 E, 4084322 N. no new Title V sources	AZ DEQ did not provide additional data.	EPA 2009; ADEQ 2009.
Nevada DEQ: Permit Actions	No sources to add	Have list of Mesquite/Bunkerville sources; Clark City sources existed prior to cut-off date; no new sources in Lincoln City portion of domain; Toquop Energy Project is outside domain.	CCN 2009; NDEP 2009.
Utah DOT	No Sources to add	Studies are primarily for the northern corridors. Exceptions: St George Dixie Drive Interchange EA had a Finding of No Significant Impact (8/25/2009). The project is not expected to have air quality impacts.	

3 CRITERIA POLLUTANT NEAR-FIELD MODELING

Near-field analysis, as used here, means the airshed within a 50 × 50–km area with the Alton Coal Tract in the center. Near-field analysis was conducted to assess impacts to public health and welfare and to estimate potential impacts to lakes and viewsheds in nearby (near-field) national parks.

To disclose the environmental consequences of the development of the Alton Coal Lease, a detailed analysis of the potential near-field impacts of the applicable pollutants was required. In particular, a near-field ambient air quality impact assessment was performed to quantify maximum-modeled pollutant impacts near the tract. To demonstrate that air quality–related standards and parameters are protected requires the development of short-term (hourly and daily) and long-term emission rates of regulated pollutants, application of regulatory-approved models to quantify predicted concentrations, and a comparison of predicted impacts plus applicable background concentrations (RFD/RFFA sources) with applicable standards.

The EPA's guideline model, AERMOD (version 09292), was the refined air dispersion model used to assess these near-field impacts and to verify compliance with the applicable NAAQS in the ambient airshed that encloses the Alton Coal Lease Tract. As development of the lease spans a 19–23-year window with varying degrees of surface disturbance and associated air emissions, the modeling analysis focused on the reasonable maximum development year (therefore, the reasonable maximum emission year) for the mine. Using this anticipated maximum potential emission year, the AERMOD dispersion model was used to analyze potential near-field impacts from direct emissions of PM_{10}, $PM_{2.5}$, nitrogen dioxide (NO_2), carbon monoxide, and sulfur dioxide. Regulatory changes to the NAAQS NO_2 and SO_2 standards occurred during the project analysis. Due to the timing of these regulatory changes in relation to the project analysis, assessment of the new 1-hour NO_2 and SO_2 standards was not incorporated in the draft EIS. Photochemical conversion of NO_x and VOCs to O_3 and the secondary formation of $PM_{2.5}$ concentrations from NO_x and SO_2 emissions were not included in the analysis. These chemical reactions are not considered to be near-field impacts, and they cannot be simulated with the recommended near-field model (AERMOD).

For each modeled pollutant, a significant impact analysis was conducted to help assess the areal extent of the potential impact of emissions associated with the development of the Alton Coal Lease Tract. The AERMOD predicted concentrations were used to verify compliance/non-compliance with the applicable NAAQS, Class II PSD increments, and other standards deemed applicable such as visibility parameters defined by the FLAG. The analysis considered existing regional sources using background ambient pollutant concentrations and RFD sources. An inventory of representative background pollutant concentrations was compiled from the involved agencies (e.g., UDAQ and BLM) to represent cumulative near-field impacts from the existing regional sources surrounding the proposed tract (see Table 3.1). In addition, a proposed inventory of RFD sources was incorporated into the final cumulative dispersion modeling analysis. The following paragraphs outline our proposed approach in detail.

3.1 Modeling Methodology

The most recent version of the EPA-promulgated AERMOD dispersion model (version 09292) was used for this analysis. AERMOD was run in regulatory default mode and deposition was only considered for assessing the final PM_{10} modeled ambient air impacts. Deposition was not considered for any other pollutants, including $PM_{2.5}$. The BEEST (Oris Solutions, version 9.82a) graphical modeling interface was used to set up the near-field modeling runs, including the source layout of the overburden removal areas,

coal pits, reclamation area, facilities area, and onsite road layouts. However, for the final cumulative near-field model runs it was necessary to utilize the BEEST generated input files and run AERMOD on machines equipped with multi-core processors to complete all of the runs. The same source locations in the near-field analysis were incorporated into the far-field CALPUFF modeling. Base elevations for all sources associated with the Alton Coal Tract were determined using the AERMAP terrain processor. Thus, for consistency, the modeled receptor grid and modeled mine source elevations were determined using the same method by utilizing the seamless National Elevation Data (NED) terrain files downloaded from the USGS as derived from satellite data.

Appropriate surface characteristics representative of the terrain surrounding the surface meteorological station, Cedar City, were provided by Mr. Dave Prey of UDAQ (UDAQ 2009) as part of the AERMOD-ready dataset. No changes were made to any of the meteorological files provided by UDAQ. Given the expansive nature of the surface-mining operations that may occur on the Alton Coal Tract, building downwash was not a factor in determining reasonable maximum development year potential impacts at the lands necessary to conduct mining (LNCM) boundaries (for Maximum Development Year Layout see Map 1.6).

3.1.1 *Receptors*

As part of this near-field modeling analysis, a defined Cartesian receptor grid and reasonable estimate of the proposed facility boundary was established to ascertain the potential impacts in publicly accessible areas surrounding the Alton Coal Tract. Receptors were placed along the proposed LNCM boundary. Because the primary pollutants of concern are fugitive dust, including PM_{10} and $PM_{2.5}$, maximum impacts from the proposed mining sources would be along or near the LNCM boundary. Nested receptor grids were used beyond the fence line, centered on the Alton Coal Tract LNCM. A fine grid using 100-m spacing was used out to 1 km from the LNCM boundary, and a coarse grid using 500-m spacing was employed from 1 km out to 10 km from the applicable LNCM. Finally, an outer grid with 1,000-m spacing from 10 km out to 25 km and 2,500-m spacing out to 50km was used. Individual discrete receptors were placed within each Class I area and selected Class II area. Specifically, receptors from the NPS website were used for modeling potential impacts at Class I areas. Furthermore, additional receptors with 500-m spacing were placed along the western boundary of the Bryce Canyon National Park, as this is the closest aspect to the Alton Coal Tract of all of the Class I areas of concern.

Receptors were placed along the SR-136 road, which will have to be relocated during the lifetime of the mine and will still be open to public use. This road will run through the tract and will remain at least 100 feet from the right-of-way (ROW). Modeled receptors were placed at 100-m intervals along the proposed relocated road in the tract and extend up to the intersection with Main Street in the Town of Alton. Potential receptors along the road were assumed to be a minimum of 25 m from the edge of the road.

Receptor elevations were determined utilizing the seamless National Elevation Data (NED) terrain files downloaded from the USGS website. Terrain data were processed with the AERMAP terrain processor utilizing the NED files in GeoTIFF format as required in the most recent version of AERMAP. This processor assigns an actual satellite-derived elevation to each receptor.

3.1.2 *Meteorological Data*

Based on correspondence with Mr. David Prey of the UDAQ, the surface meteorological data most representative for this site are from Cedar City, Utah (UDAQ 2008). These surface data were processed with upper air data collected at Desert Rock, Nevada, which is the closest upper air station to Cedar City. For this near-field analysis, a four-year meteorological dataset (from 2005–2008) was utilized. These data

were processed by the air group at UDAQ and received via email in August of 2009 (UDAQ 2009). No additional processing had to be completed and the data were model-ready for use in AERMOD.

The AERMET system uses both surface and upper air measurements to estimate profiles of wind, turbulence, and temperature in the planetary boundary layer. Minimum meteorological data requirements to run AERMET generally include horizontal wind speed, horizontal wind direction, ambient temperature, surface characteristics (albedo, Bowen ratio, and surface roughness), solar radiation and temperature change with height or cloud cover, and a morning upper air sounding. The surface characteristics determinations were made by UDAQ as part of their processing of the four-year meteorological dataset. These surface characteristics are representative of the area around Cedar City, the surface meteorological station. A representative windrose from Cedar City (Figure 3.1) indicates that prevailing winds are from the south-southwest. A distinct bimodal trend is not apparent at this location.

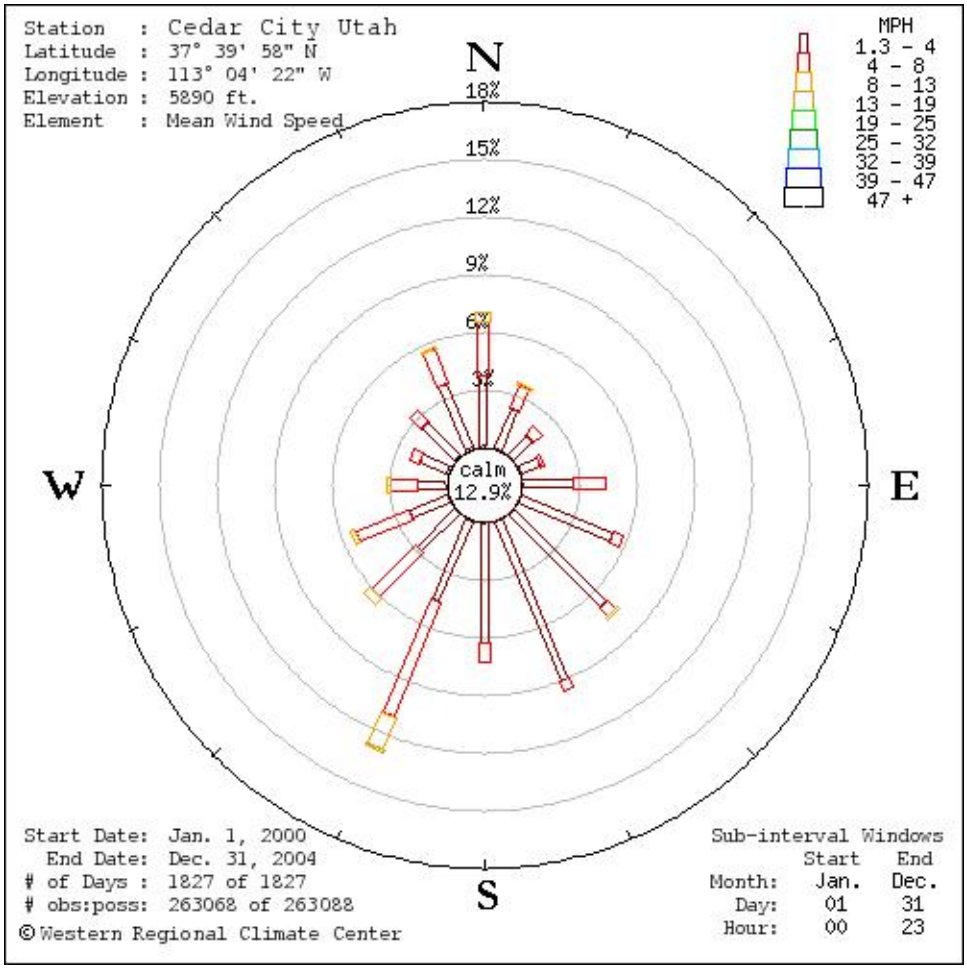

Figure 3.1. Windrose generated from Cedar City meteorological data.

3.1.3 *Alton Coal Lease Emission Inventory*

The proposed emission inventory development for the reasonable maximum development year of mining operations on the Alton Coal Tract is provided in Chapter 2 and Appendix B. Based on proposed development projections, the model year chosen for the emission inventory is the reasonable maximum

development year of mine progression. It is anticipated that the maximum development year would occur near the end of overall mine development. However, the reasonable maximum development year of mine progression is intended to be representative of the potential emissions associated with any single year of mining.

Because the exact location of fugitive dust and tailpipe emissions from project traffic and coal removal is impossible to pinpoint, a series of area or volume sources was used to estimate emissions from these sources. The total annual fugitive dust and tailpipe emissions were apportioned equally to be representative of area sources in the tract. Travel distances were based on the assumptions in the inventory development. For the purpose of modeling the coal loading and overburden removal activities areas, the open pit source option in AERMOD was utilized, given that both of these activities will occur well below grade in the main pit.

It was anticipated that some blasting will occur as part of the overburden and coal removal process. These emissions represent short-term sources of nitrogen oxides and PM_{10} that were modeled as area sources in this near-field analysis.

Electrical power generation for mining operations will be supplied through a combination of diesel generators as described in Section 2. The two generators were modeled as point sources at the anticipated location within the facilities area.

Base elevations for all sources associated with the Alton Coal Tract were determined using the AERMAP terrain processor. Thus, the modeled receptor grid and modeled mine source elevations were determined using the same method and most recent NED data available from the USGS website for consistency.

3.1.4 *Cumulative Sources (RFD, RFFA, and existing source modifications)*

The cumulative impacts modeling analysis considered both the maximum development year from the proposed Alton tract development sources as well as an inventory of proposed emission sources. These sources were described in Section 2. For the purpose of this analysis, it is assumed that all existing permitted emission sources are included in the background concentration estimates presented in Table 3.1.

For the near-field analysis, emissions from hauling coal along the circuitous route from the town of Alton to the rail loadout facility near Cedar City were not explicitly modeled, given the vast number of additional volumes sources that needed to be added to the model. Any impacts from the offsite coal haul road are remote and will not impact the modeled concentrations around the proposed Alton mine. However, the potential impacts from coal hauling on this long road were assessed by modeling an individual segment of road as a means of verifying that the coal haul truck traffic would not pose any NAAQS issues (see Section 3.1.6). Refer to Section 4.0 for a discussion of the planned coal haul transportation route and how it was handled in the far-field modeling.

Table 3.1. Near-field Analysis Background Ambient Air Quality Concentrations (µg/m^3)

Pollutant	Averaging Period	Measured Background Concentration
Carbon monoxide[1]	1-hour	1 ppm (1,150 µg/m^3)
	8-hour	1 ppm (1,150 µg/m^3)
NO_2[1]	Annual	17 µg/m^3
PM_{10}[2]	24-hour	72 µg/m^3
$PM_{2.5}$[3]	24-hour	8.6 µg/m^3
	Annual	3.6 µg/m^3
SO_2[1]	3-hour	20 µg/m^3
	24-hour	10 µg/m^3
	Annual	5 µg/m^3

[1] UDAQ 2008. Data based on estimates from the UDAQ.

[2] UDAQ 2010. PM_{10} data from UDAQ used for private Alton Mine.

[3] Measured $PM_{2.5}$ data obtained from NPS website for Bryce Canyon National Park.

3.1.5 *Criteria Pollutant NAAQS Analysis – AERMOD Results*

Background pollutant concentrations were used as an indicator of existing conditions in the region, and were assumed to include those from industrial emission sources in operation and from mobile, urban, biogenic, and other non-industrial emission sources. These background concentrations were added to modeled near-field mining–related impacts to calculate total ambient air quality impacts.

The primary pollutants of concern for this analysis are PM_{10}, $PM_{2.5}$, carbon monoxide, nitrogen dioxide, and sulfur dioxide. Model-predicted concentrations resulting from emissions due to mining operations on the tract were added to the currently acceptable background levels, and the resulting cumulative concentrations were compared to the relevant NAAQS to determine potential health impacts at nearby receptors. For this air resources assessment, modeled concentrations are compared to the PSD increments. These comparisons are made for informational purposes only, and the analyses described herein are not intended to be, nor should be interpreted as a regulatory increment consumption analysis. Modeled concentrations using the indicated averaging periods were compared to the following applicable thresholds.

Table 3.2. Applicable Ambient Air Quality Criteria

Pollutant	Averaging Period	NAAQS ($\mu g/m^3$)[1]	PSD Class II increment ($\mu g/m^3$) [2]
NO_2 [3]	Annual	100	25
PM_{10}	24-hour (highest fifth high)	150	30
$PM_{2.5}$	Annual	15	N/A
	24-hour (average of highest 1st high)	35	N/A
CO	8-hour (highest second high)	10,000	N/A
	1-hour (highest second high)	40,000	N/A
SO_2 [3]	Annual	80	20
	24-hour (highest second high)	365	91
	3-hour (highest second high)	1,300	512

[1] National Ambient Air Quality Standards from 40 CFR Part 50

[2] PSD increments from 40 CFR Part 51.166

[3] The impacts assessment does not include the recently promulgated 1-hour NO2 and SO2 standards due to their promulgation dates.

Compliance with the respective annual standards was based on the highest modeled value for each year of the four-year meteorological dataset. Demonstration of compliance with the short-term NAAQS (24-hour, 8-hour, 3-hour, and 1-hour) for carbon monoxide, nitrogen dioxide, and sulfur dioxide was based on the highest second-high modeled concentration for each year of the four-year meteorological period, added to the respective background concentrations listed above. Per an EPA memo from March 23, 2010, *Modeling Procedures for Demonstrating Compliance with $PM_{2.5}$ NAAQS*, compliance demonstrations with the 24-hour $PM_{2.5}$ standard can use the average of the first highest 24-hour concentration in each year over the length of the meteorological data period. This approach is a conservative surrogate for comparison to the highest second-high modeled concentration for each modeled year. Finally, compliance with the 24-hour PM_{10} standard was verified against the highest fifth-high modeled concentration over the 4-year period (as documented in EPA 40 CFR Part 51, Appendix W). Only four years of meteorological data were available for the modeling. Based on UDAQ recommendations, the highest fifth high concentration was used for the comparison to the NAAQS, rather than the highest sixth high associated with five years of meteorological data. All modeled concentrations were rounded to match the form of the appropriate NAAQS. A detailed description of the modeling results for each pollutant follows.

3.1.5.1 PM_{10} AERMOD RESULTS

The modeled PM_{10} concentrations associated with the maximum development year are summarized here. Both the 200-foot overburden and 300-foot overburden removal scenarios were modeled for compliance under each action alternative. Alternative B is based on the assumption that one primary pit would be used for the coal extraction, whereas Alternative C is based on the assumption that there would two pits used for the coal extraction. Results are presented in the tables below for the 24-hour highest fifth-high PM_{10} concentration over the four-year modeled dataset for both 200-foot and 300-foot scenarios.

Table 3.3. Highest Fifth-high PM_{10} Modeling Results

200-foot Overburden Removal Scenario, Alternative B							
Pollutant	**Modeled Years**	**Receptor Location**		**Modeled ($\mu g/m^3$)**	**Background ($\mu g/m^3$)**	**Total ($\mu g/m^3$)**	**NAAQS ($\mu g/m^3$)**
		UTME	**UTMN**				
PM_{10}	2005-2008	368000	4142900	82.7	72	150	150
200-foot Overburden Removal Scenario, Alternative C							
Pollutant	**Modeled Years**	**Receptor Location**		**Modeled ($\mu g/m^3$)**	**Background ($\mu g/m^3$)**	**Total ($\mu g/m^3$)**	**NAAQS ($\mu g/m^3$)**
		UTME	**UTMN**				
PM_{10}	2005-2008	368000	4142900	83.6	72	160	150

Table 3.4. Highest Fifth-high PM_{10} Modeling Results

300-foot Overburden Removal Scenario, Alternative B							
Pollutant	**Modeled Years**	**Receptor Location**		**Modeled ($\mu g/m^3$)**	**Background ($\mu g/m^3$)**	**Total ($\mu g/m^3$)**	**NAAQS ($\mu g/m^3$)**
		UTME	**UTMN**				
PM_{10}	2005-2008	368000	4142900	86.3	72	160	150
300-foot Overburden Removal Scenario, Alternative C							
Pollutant	**Modeled Years**	**Receptor Location**		**Modeled ($\mu g/m^3$)**	**Background ($\mu g/m^3$)**	**Total ($\mu g/m^3$)**	**NAAQS ($\mu g/m^3$)**
		UTME	**UTMN**				
PM_{10}	2005-2008	368000	4142900	92.9	72	160	150

The 200-foot overburden scenario under Alternative B complies with the NAAQS at all modeled receptors. However, under the dual pit Alternative C, there is a modeled exceedance off of the northwest side of the LNCM. Similarly, the 300-foot modeling results indicate modeled exceedances at a few receptors off of the northwest side of the LNCM.

3.1.5.2 $PM_{2.5}$ AERMOD RESULTS

Modeled $PM_{2.5}$ concentrations associated with the maximum development year are summarized here. Both the 200-foot overburden and 300-foot overburden removal scenarios were modeled for compliance under each action alternative. Alternative B is based on the assumption that one primary pit would be used for the coal extraction, whereas Alternative C is based on the assumption that there would be two pits used for the coal extraction. Model results in the tables below for the 24-hour averaging period indicate the highest first-high for each modeled year for both 200-foot and 300-foot scenarios. For

comparison to the NAAQS, the average of the high first-high 24-hour values is compared to the standard of 35 µg/m^3.

Table 3.5. $PM_{2.5}$ Modeling Results

200-foot Overburden Removal Scenario, Alternative B

Pollutant	Model Year	Average Period	Receptor Location UTME	Receptor Location UTMN	Modeled (µg/m^3)	Backgroun d (µg/m^3)	Total (µg/m^3)	NAAQS (µg/m^3)
$PM_{2.5}$	2005	24-hour	370466	4142644	17.2	8.6	26	35
		Annual	370466	4142644	4.2	3.6	8	15
	2006	24-hour	370466	4142644	21.0	8.6	30	35
		Annual	370466	4142644	4.4	3.6	8	15
	2007	24-hour	370466	4142644	17.3	8.6	26	35
		Annual	370466	4142644	4.7	3.6	8	15
	2008	24-hour	370466	4142644	21.8	8.6	30	35
		Annual	370466	4142644	4.2	3.6	8	15
	Average	24-hour			19.3	8.6	28	35

200-foot Overburden Removal Scenario, Alternative C

Pollutant	Model Year	Average Period	Receptor Location UTME	Receptor Location UTMN	Modeled (µg/m^3)	Backgroun d (µg/m^3)	Total (µg/m^3)	NAAQS (µg/m^3)
$PM_{2.5}$	2005	24-hour	370466	4142644	18.8	8.6	27	35
		Annual	370466	4142644	4.5	3.6	8	15
	2006	24-hour	370466	4142644	22.9	8.6	32	35
		Annual	370466	4142644	4.8	3.6	8	15
	2007	24-hour	370466	4142644	18.9	8.6	28	35
		Annual	370466	4142644	5.1	3.6	9	15
	2008	24-hour	370466	4142644	23.7	8.6	32	35
		Annual	370466	4142644	4.6	3.6	8	15
	Average	24-hour			21.1	8.6	30	35

Table 3.6. $PM_{2.5}$ Modeling Results

300-foot Overburden Removal Scenario, Alternative B

Pollutant	Model Year	Average Period	Receptor Location		Modeled ($\mu g/m^3$)	Backgroun d ($\mu g/m^3$)	Total ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)
			UTME	UTMN				
$PM_{2.5}$	2005	24-hour	370494	4143467	21.5	8.6	30	35
		Annual	370478	4142741	5.0	3.6	9	15
	2006	24-hour	370465	4142595	23.8	8.6	32	35
		Annual	370470	4142741	5.5	3.6	9	15
	2007	24-hour	370470	4142741	20.4	8.6	29	35
		Annual	370470	4142741	6.0	3.6	10	15
	2008	24-hour	370600	4143660	25.1	8.6	34	35
		Annual	370470	4142741	5.8	3.6	9	15
	Average	24-hour			22.7	8.6	31	35

300-foot Overburden Removal Scenario, Alternative C

Pollutant	Model Year	Average Period	Receptor Location		Modeled ($\mu g/m^3$)	Backgroun d ($\mu g/m^3$)	Total ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)
			UTME	UTMN				
$PM_{2.5}$	2005	24-hour	370494	4143467	23.3	8.6	32	35
		Annual	370478	4142741	5.4	3.6	9	15
	2006	24-hour	370465	4142595	25.7	8.6	34	35
		Annual	370470	4142741	6.0	3.6	10	15
	2007	24-hour	370470	4142741	22.1	8.6	31	35
		Annual	370470	4142741	6.5	3.6	10	15
	2008	24-hour	370600	4143660	27.0	8.6	36	35
		Annual	370470	4142741	6.2	3.6	10	15
	Average	24-hour			24.5	8.6	33	35

Both the 200-foot and 300-foot modeled concentrations comply with the NAAQS at all modeled receptors and for both action alternatives.

3.1.5.3 NITROGEN DIOXIDE AERMOD RESULTS

The modeled nitrogen dioxide concentrations associated with the maximum development year are summarized below in Table 3.7 and 3.8. Both the 200-foot overburden and 300-foot overburden removal scenarios were modeled for compliance. Because the estimated nitrogen oxide emissions for Alternative B and C are the same, separate model runs were not necessary within each of the overburden scenarios. A 75% ozone correction was applied to all annual nitrogen oxide modeling results in accordance with EPA's Ambient Ratio Method as a way to estimate ambient annual nitrogen dioxide concentrations from

modeled nitrogen oxides emission rates. For comparison to the annual NAAQS, the highest annual concentration from each modeled year was compared to the standard of 100 µg/m^3.

Table 3.7. Annual Maximum Nitrogen Dioxide Modeling Results

200-foot Overburden Removal Scenario

Pollutant	Model Year	Receptor Location		Modeled (µg/m^3)	Background (µg/m^3)	Total (µg/m^3)	NAAQS (µg/m^3)
		UTME	UTMN				
NO_2	2005	370466	4142644	27.8	17	45	100
	2006	370466	4142644	29.6	17	47	
	2007	370466	4142644	31.6	17	49	
	2008	371610	4140400	30.2	17	47	

Table 3.8. Annual Maximum Nitrogen Dioxide Modeling Results

300-foot Overburden Removal Scenario

Pollutant	Model Year	Receptor Location		Modeled (µg/m^3)	Background (µg/m^3)	Total (µg/m^3)	NAAQS (µg/m^3)
		UTME	UTMN				
NO_2	2005	370473	4142837	83.9	17	101	100
	2006	370471	4142789	92.7	17	110	
	2007	370471	4142789	99.9	17	117	
	2008	370471	4142789	97.4	17	114	

The 200-foot modeled concentrations indicate compliance with the annual NAAQS at all modeled receptors. However, under the 300-foot overburden removal scenario, there are a few exceedances of the annual NAAQS along the northwest side of the LNCM just west of the primary pit activity area.

3.1.5.4 CARBON MONOXIDE AERMOD RESULTS

The modeled carbon monoxide concentrations associated with the maximum development year are summarized below. Both the 200-foot overburden and 300-foot overburden removal scenarios were modeled for compliance. Because the estimated carbon monoxide emissions for Alternative B and C are the same, separate model runs were not necessary within each of the overburden scenarios. The applicable averaging periods for comparison to the carbon monoxide NAAQS include the 1-hour and 8-hour averaging periods.

Table 3.9. Carbon Monoxide Modeling Results

200-foot Overburden Removal Scenario

Pollutant	Model Year	Average Period	Receptor Location		Modeled (µg/m^3)	Background (µg/m^3)	Total (µg/m^3)	NAAQS (µg/m^3)
			UTME	UTMN				
CO	2005	1-hour	370487	4143273	2,283	1,150	3,433	40,000
		8-hour	370471	4142789	582	1,150	1,732	10,000
	2006	1-hour	370484	4143176	2,567	1,150	3,717	40,000
		8-hour	370466	4142644	485	1,150	1,635	10,000
	2007	1-hour	370481	4143079	2,639	1,150	3,789	40,000
		8-hour	371610	4140400	519	1,150	1,669	10,000
	2008	1-hour	370479	4143031	2,416	1,150	3,566	40,000
		8-hour	370466	4142644	486	1,150	1,636	10,000

Table 3.10. Carbon Monoxide Modeling Results

300-foot Overburden Removal Scenario

Pollutant	Model Year	Average Period	Receptor Location		Modeled (µg/m^3)	Background (µg/m^3)	Total (µg/m^3)	NAAQS (µg/m^3)
			UTME	UTMN				
CO	2005	1-hour	370700	4143660	5,358	1,150	6,508	40,000
		8-hour	370474	4142789	1,383	1,150	2,533	10,000
	2006	1-hour	370700	4143660	5,643	1,150	6,793	40,000
		8-hour	370700	4143660	1,060	1,150	2,210	10,000
	2007	1-hour	370650	4143660	4,980	1,150	6,130	40,000
		8-hour	370473	4142837	1,047	1,150	2,197	10,000
	2008	1-hour	370650	4143660	5,249	1,150	6,399	40,000
		8-hour	370700	4143660	939	1,150	2,089	10,000

Both 200-foot and 300-foot modeled concentrations indicate compliance with the 1-hour and 8-hour NAAQS at all modeled receptors.

3.1.5.5 SULFUR DIOXIDE AERMOD RESULTS

The modeled sulfur dioxide concentrations associated with the maximum development year are summarized below. The potential sulfur dioxide emissions associated with the mining activities are nominal but modeling was still completed. Both the 200-foot overburden and 300-foot overburden removal scenarios were modeled for compliance. Because the estimated sulfur dioxide emissions for Alternative B and C are the same, separate model runs were not necessary within each of the overburden scenarios. The applicable averaging periods for comparison to the sulfur dioxide NAAQS include the 3-hour, 24-hour, and annual averaging periods.

Table 3.11. Sulfur Dioxide Modeling Results

200-foot Overburden Removal Scenario

Pollutant	Model Year	Average Period	Receptor Location		Modeled ($\mu g/m^3$)	Background ($\mu g/m^3$)	Total ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)
			UTME	UTMN				
SO_2	2005	3-hour	370479	4143031	1.49	20	21	1,300
		24-hour	370466	4142644	0.41	10	10	365
		Annual	370466	4142644	0.09	5	5	80
	2006	3-hour	370484	4143176	1.51	20	22	1,300
		24-hour	370466	4142644	0.41	10	10	365
		Annual	370466	4142644	0.09	5	5	80
	2007	3-hour	370481	4143079	1.64	20	22	1,300
		24-hour	370466	4142644	0.41	10	10	365
		Annual	370466	4142644	0.10	5	5	80
	2008	3-hour	370478	4142983	1.47	20	21	1,300
		24-hour	370468	4142692	0.47	10	10	365
		Annual	371610	4140400	0.09	5	5	80

Table 3.12. Sulfur Dioxide Modeling Results

300-foot Overburden Removal Scenario

Pollutant	Model Year	Average Period	Receptor Location		Modeled ($\mu g/m^3$)	Background ($\mu g/m^3$)	Total ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)
			UTME	UTMN				
SO_2	2005	3-hour	370700	4143660	1.71	20	22	1,300
		24-hour	370473	4142837	0.45	10	10	365
		Annual	370471	4142789	0.11	5	5	80
	2006	3-hour	370700	4143660	1.90	20	22	1,300

Table 3.12. Sulfur Dioxide Modeling Results

300-foot Overburden Removal Scenario

Pollutant	Model Year	Average Period	Receptor Location		Modeled ($\mu g/m^3$)	Background ($\mu g/m^3$)	Total ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)
			UTME	UTMN				
		24-hour	370471	4142789	0.47	10	10	365
		Annual	370471	4142789	0.13	5	5	80
	2007	3-hour	370600	4143660	1.84	20	22	1,300
		24-hour	370650	4143660	0.47	10	10	365
		Annual	370471	4142789	0.14	5	5	80
	2008	3-hour	370700	4143700	1.76	20	22	1,300
		24-hour	370494	4143467	0.46	10	10	365
		Annual	370471	4142789	0.13	5	5	80

Both 200-foot and 300-foot modeled concentrations indicate compliance with the respective 3-hour, 24-hour and annual NAAQS at all modeled receptors.

3.1.6 *Assessing Coal Haul Road Impacts*

The haul roads within the mine and the access road were included in the mine modeling. Due to model limitations, the entire long haul road could not be incorporated into the model. Impacts associated with the circuitous, offsite coal haul road were assessed using two methods. First, the long haul road was incorporated in the near-field modeling by attaching 39 volume sources depicting a segment of the long haul road starting from the intersection of the access road and long haul road. This segment of the long haul road extended into the less densely spaced receptors and was included to assure that impacts from the long haul road were incorporated at the high receptor locations during the maximum emissions year.

In addition, to assess potential impacts from this paved coal haul road in areas well removed from the proposed mining activity area, another method was used to determining maximum potential impacts at receptors along the road. In particular, a 1 km segment of theoretical road, using emissions determined in the inventory, was modeled using receptors spaced at 25-m intervals out to 250 m from the edge of the road. It was assumed that the closest potential receptor to the paved roadway used for coal transport would not be any closer than 25 m from the edge of the road to account for roadway easements. Also, a few different source-receptor elevation couplings were used to verify that the impacts from the coal truck traffic would not pose any violations of the applicable NAAQS. Per the AERMOD users manual guidance (EPA 2004b), in the case of long and narrow volume sources such as a haul road, the spacing between individual volume sources should not be greater than twice the width of the volume source. Given the modeled haul road width of up to 30 m, the 1 km segment of road was broken up into 50-m segments, for a total of 20 volume sources. The total emissions for the length of the road were then apportioned accordingly down to 1 km segments and then down to 50-m segments. The 1 km road segment was modeled at the same elevation as the receptors, 25 m above and below the receptors, and both 50 m above and below the receptors. Given the relatively hilly nature of the haul road route close to Alton, an assumed hill height of 300 m was used as input to AERMOD, which requires this parameter. In addition, both a north-south and east-west road orientations were modeled to verify that any juxtaposition of the road and receptors would be captured.

The modeled PM_{10}, $PM_{2.5}$, nitrogen dioxide and carbon monoxide impacts associated with the coal haul road truck traffic do not contribute to offsite NAAQS compliance concerns. The apportioned modeled emission rates from each 50 m spaced volume source along the 1 km road are the same for all coal removal scenarios and are as follows:

- 0.00914 g/s PM_{10}
- 0.000365 g/s $PM_{2.5}$
- 0.001449 g/s nitrogen dioxide
- 0.001582 g/s carbon monoxide

The highest modeled concentrations occurred when the source-receptor elevations were set to the same elevation, assumed flat terrain. In addition, of the two modeled orientations of the road (north-south and east-west), the maximum impacts were associated with the theoretically placed north-south oriented road, which was expected based on the Cedar City windrose. The maximum modeled concentrations always occurred at a the closest row of receptors located 25 m from the edge of the haul road and when the source-receptor pairings were all at the same elevation. Table 3.13 lists the maximum modeled concentrations for each pollutant and applicable averaging period, all of which comply with the NAAQS.

Table 3.13. Haul Road Only (representative segment) Maximum Modeling Results

Pollutant	Modeled Years	Averaging Period	Modeled (µg/m^3)	Background (µg/m^3)	Total (µg/m^3)	NAAQS (µg/m^3)
PM_{10}	2005-2008	24-hour	55.1	72	127	150
$PM_{2.5}$	2005-2008	24-hour	1.8	8.6	10	35
		Annual	0.7	3.6	4	15
NO_2	2005-2008	Annual	3.2	17	20	100
CO	2005-2008	1-hour	53	1,150	1,181	40,000
		8-hour	17	1,150	1,166	10,000

* All max modeled values occur when source-receptors are at same elevation

sulfur dioxide emissions from the additional coal truck traffic on the paved haul road were not modeled as they were deemed insignificant. This analysis verifies that there should be no NAAQS concerns associated with the long, paved haul road and it also alleviates the issue of having to model a 100-mile long volume source, which severely impacts the AERMOD model iteration time by orders of magnitude.

3.1.7 *HAP Impact Assessment*

Hazardous air pollutants can cause various adverse health effects. They are not part of the NAAQS, but high levels at the property boundary could indicate the need for further analysis and/or mitigation strategies. Therefore, HAPs have been included in the emission inventory and were modeled in the AERMOD near-field analysis. The modeled concentrations have been compared with known health exposure levels as a means of assessing potential impacts. The Reference Exposure Levels (RELs) are for assessing acute inhalation exposures (i.e. one-hour average) and represent the concentration at or below which no adverse health effects are expected. The Reference Concentrations (RfC) represent an estimate of the chronic inhalation exposure (i.e. annual average) rate to humans, including sensitive subgroups (children and elderly), without an appreciable risk of harmful effects. Both the RfC and REL guideline values listed below are for non-cancer effects.

Table 3.14. Acute RELs

HAP	Averaging Period	REL (µg/m^3)
Benzene	1-hour	1,300 [1]
Toluene	1-hour	37,000 [1]
Xylene	1-hour	22,000 [1]
n-Hexane	1-hour	390,000 [2]
Formaldehyde	1-hour	94 1

[1] EPA Air Toxics Database, Table 2 (EPA 2007).

[2] No REL available for these HAPs. Values shown are from Immediately Dangerous to Life or Health (IDLH/10), EPA Air Toxics Database, Table 2 (EPA 2007).

Table 3.15. Non-carcinogenic HAP RfCs

HAP	Averaging Period	Non-carcinogenic RfC 1 (µg/m^3)
Benzene	Annual	30
Toluene	Annual	5,000
Xylenes	Annual	100
n-Hexane	Annual	700
Formaldehyde	Annual	9.8

EPA Air Toxics Database, Table 1 (EPA 2007).

In addition to the RfC and REL, the State of Utah has adopted Toxic Screening Levels (TSLs), which are applied during the air permitting process to assist in the evaluation of potential HAP emissions. The TSLs are derived from Threshold Limit Values (TLVs) published in the American Conference of Government Industrial Hygienists (ACGIH) – "Threshold Limit Values for Chemical Substances and Physical Agents." These TLVs are based on exposure limits to a healthy adult in the work place. The TSLs adopted by UDAQ are more stringent and represent screening levels that, if exceeded, would suggest that additional information is needed to substantiate that the model-predicted concentrations would not expose sensitive individuals to potential health risks. Thus, the TSLs in Table 3.16 were compared against modeled concentrations for each HAP in the emissions inventory.

Table 3.16. Utah Toxic Screening Levels (TSLs)

HAP	Averaging Period	Toxic Screening Levels [1] (µg/m^3)
Benzene	24-hour	53
Toluene	24-hour	2,512
Xylene	24-hour	14,473
n-Hexane	24-hour	5,875
Formaldehyde	1-hour	37

[1] Utah Department of Environmental Quality (2007).

To assess long-term exposure from carcinogenic HAP emissions, traditional risk assessment methods were used and the risk for the maximally exposed individual (MEI) and most likely exposure (MLE) were compared to the significance criterion of one additional cancer per one million exposed persons (1x10-6). For the MEI risk, it is assumed that a person is exposed continuously for the life of the mine, assumed to be up to 23 years in this case. For the MLE risk, an exposure adjustment is made to assess the amount of time that a family stays away from the home (64% of the day) and how long a family lives at a given residence (nine years) (EPA 2007). Exposure adjustment factors of 0.33 for the MEI (23/70) and 0.095 for the MLE [(9/70)*((0.64*1)+(0.36*0.25))] were applied to the estimated cancer risk to account for the actual time that an individual could be exposed during a 70-year lifetime. Table 3.17 lists the applicable chronic inhalation cancer risk factors for benzene and formaldehyde.

Table 3.17. Carcinogenic HAP RfCs and Exposure Adjustment Factors

Analysis[1]	HAP Constituent	Carcinogenic Annual RfC (Risk Factor) [2] 1/(µg/m^3)	Exposure Adjustment Factor
MLE	Benzene	7.8 × 10-6	0.0949
MLE	Formaldehyde	1.3 × 10-5	0.0949
MEI	Benzene	7.8 × 10-6	0.33
MEI	Formaldehyde	1.3 × 10-5	0.33

[1] MLE = most likely exposure; MEI = maximally exposed individual.

[2] EPA Air Toxics Database, Table 1 (EPA 2007).

3.1.8 *HAP AERMOD Results*

The potential emissions of HAPs associated with this project are relatively insignificant. The only quantifiable source of HAPs from the Alton Coal lease in the emissions inventory is the proposed generators. The potential HAP emissions are the same for the 200-foot and 300-foot overburden scenarios, as well as the Alternative B and C pit layouts. As such, only one model iteration was completed for each HAP to estimate potential impacts in the immediate vicinity of the mine. No additional background sources were modeled given the localized nature of the mine impacts. As seen in Tables 3.18a and 3.18b, no adverse impacts associated specifically with the Alton sources are anticipated.

Table 3.18a. HAPs AERMOD Modeling Results

Pollutant	Model Years	Average Period	Receptor Location		Modeled ($\mu g/m^3$)	Threshold ($\mu g/m^3$)
			UTME	UTMN		
Benzene	2005-2008	1-hour	371800	4140300	0.440	1,300 (REL)
		24-hour	368400	4142500	0.046	53 (TSL)
		Annual	370060	4140000	0.003	30 (RfC)
Toluene	2005-2008	1-hour	371800	4140300	0.160	37,000 (REL)
		24-hour	368400	4142500	0.017	2,512 (TSL)
		Annual	370060	4140000	0.001	5,000 (RfC)
Xylenes	2005-2008	1-hour	371800	4140300	0.110	22,000 (REL)
		24-hour	368400	4142500	0.011	14,473 (TSL)
		Annual	370060	4140000	0.001	100 (RfC)
Formaldehyde	2005-2008	1-hour	371800	4140300	0.045	37 (TSL)
		Annual	370060	4140000	0.0003	9.8 (RfC)

Table 3.18b. HAPs Risk Analysis

Analysis[1]	HAP Constituent	Carcinogenic Annual RfC (Risk Factor)[2] $1/(\mu g/m^3)$	Exposure Adjustment Factor	Modeled ($\mu g/m^3$)	Calculated Risk	Significance Criterion
MLE	Benzene	7.80E-06	0.0949	0.003	2.2E-09	1.00E-06
MLE	Formaldehyde	5.50E-09	0.0949	0.0003	1.6E-13	1.00E-06
MEI	Benzene	7.80E-06	0.33	0.003	7.7E-09	1.00E-06
MEI	Formaldehyde	5.50E-09	0.33	0.0003	5.4E-13	1.00E-06

[1] MLE = most likely exposure; MEI = maximally exposed individual.

[2] EPA Air Toxics Database, Table 1 (EPA 2007).

3.2 Near-field VISCREEN Analysis

The VISCREEN model was designed to determine whether a plume from a facility may be visible from a given vantage point. The primary variables that affect whether a plume is visible or not at a given location include the quantity of emissions, type of emissions, relative location of the emission source and the observer, and the background visibility range. Typically, VISCREEN is used for analyzing plume impacts from point sources. However, it can also be applied to virtual point sources, such as mining operations.

Specifically, VISCREEN was used to assess potential visibility impacts within the near-field modeling grid at Bryce Canyon National Park. The closest distance to Bryce Canyon National Park is approximately 18 km east-northeast of the proposed Alton mine. Two levels of VISCREEN were used for

this analysis of the of the visibility impacts from the proposed mining of the Alton Coal Tract. The primary pollutants of concern that impact visibility in the near-field are particulate matter and nitrogen oxide.

3.2.1 *Level-1 Analysis*

The Level-1 screening used the maximum hourly emission rates of PM_{10} and nitrogen oxide as determined in the emission inventory section, a default particle size and density, and conservative meteorological conditions to assess potential plume impacts on visibility in Bryce Canyon National Park. The most conservative meteorological conditions are assumed to be category F stability and a wind speed of 1.0 m/s. The default thresholds used to determine if Level-1 screening results are favorable, include the following:

- A Delta E value of <= 2, and
- A green contrast value of <= absolute value of 0.05.

The Delta E value is the color difference parameter and was developed to specify the perceived magnitude of color and brightness changes. The Delta E value is used as the basis for determining the perceptibility of plume visual impacts. The green contrast value is the contrast at a given wavelength of two colored objects such as plume/sky or plume/terrain. If all Delta E and green contrast values are below the respective thresholds within the Bryce Canyon National Park Class I area, then the visibility impacts are not expected to be significant.

The PM_{10} and nitrogen oxide emission rates used for this analysis are 152 tpy and 209 tpy, respectively, which correspond to the emissions under the 200-foot overburden scenario under Alternative B. A second screening was performed for the 300-foot overburden scenario under Alternative B, which utilized PM_{10} and nitrogen oxide emission rates used of 200 tpy and 550 tpy, respectively. The default Level-1 screening criteria were used. In addition, a background visibility range of 200 km was used for the VISCREEN analysis based on typical annual background visibility at Bryce Canyon per FLAG guidance. The default background ozone concentration of 40 ppb was utilized. The results of the Level-1 analysis indicate potential visibility impacts above the significance thresholds within the Bryce Canyon National Park Class I area. As a result, a Level-2 analysis was conducted as described below for both the 200-foot overburden removal and the 300-foot overburden removal Alternative B scenarios.

3.2.2 *Level-2 Analysis*

The Bryce Canyon National Park is located approximately 18 km northeast of the proposed Alton mine and also several hundred meters higher than the mine location. Because the Level-1 analysis indicates potential visibility impacts inside of Bryce Canyon National Park, an additional Level-2 screening is warranted. The Level-2 screening allows the use of user-specified particle size, density, and the most conservative meteorological conditions specific to the proposed Alton Coal tract development area. Specifically for Level-2 screening, the VISCREEN model is used to find the maximum wind speed during the daytime (D stability) where delta-E and contrast in the park could potentially be exceeded.

Meteorological data for the Level-2 screening were based on the four years of hourly surface data from the Cedar City, Utah airport for the 2005-2008 met dataset used in the near-field modeling. The hourly data were extracted and summarized for each of the sixteen wind directions and a joint frequency and cumulative frequency developed to summarize the most conservative meteorological combinations of stability, wind direction and wind speed. These calculations were performed using the CEMP website that allows the user to query data and obtain frequency distributions. The worst-case 1-percentile meteorology (occurs on approximately 4 days a year) is assumed to be indicative of worst-day plume visual impacts. In

accordance with EPA guidance, dispersion conditions with transport times of more than 12 hours to reach the Class I areas of concern were not considered in the cumulative frequency. In this case, given the short distance to Bryce Canyon National Park, all wind speeds of 1 mph or greater are capable of transporting plume impacts to the park. Also, the meteorological wind direction that could potentially transport the plume to the park ranges from approximately 210 degrees to approximately 260 degrees. For the Level-2 analysis, only daylight hours from 6am to 6pm are considered as potential periods when plume visual impacts could occur within the Class I area. It should be noted that the most stable daytime stability class is considered to be slightly stable, or category D.

Using this screening, the 1-percentile atmospheric stability and wind speed are determined to be Stability D with wind speed of 2 m/sec. However, because Bryce Canyon National Park has an elevation more than 500 m above the Alton Coal Tract, when determining most conservative dispersion characteristics, the most conservative stability class should be shifted one class less stable (VISCREEN Users Manual, EPA 1992). This shift is applicable when considering an observer located on terrain at least 500 m above the emission source under stable conditions. This adjustment is made to account for the existence of complex terrain and try to simulate conditions that could facilitate transport of a relatively stable plume to a sensitive area (e.g., Bryce Canyon National Park), which must be lifted over or around elevated terrain. Thus, for the Level-2 most conservative meteorology a stability class of C with wind speed of 2 m/second was utilized. The Level-2 VISCREEN visual impacts using this most conservative dispersion category inside of Bryce Canyon National Park are summarized below:

Table 3.19a. Visual Impacts inside of Bryce Canyon National Park, 200-foot Overburden Results

Background	Theta	Azimuth	Distance from Alton (km)	Alpha	Delta E		Contrast	
					Criteria	Plume	Criteria	Plume
SKY	10	157	35	11	6.21	0.267	0.13	0.005
SKY	140	157	35	11	3.41	0.074	0.13	-0.002
TERRAIN	10	84	18	84	6.8	0.691	0.28	0.003
TERRAIN	140	84	18	84	4.05	0.029	0.28	0.00

These results demonstrate that the maximum impacts inside of Bryce Canyon National Park from a potential Alton mine plume under the 200-foot overburden removal scenario will be less than the VISCREEN acceptance criteria for both color change (Delta E) and contrast.

A similar Level-2 screening analysis was performed for the 300-foot overburden removal scenario under Alternative B. Emissions are substantially higher under this scenario with potential PM_{10} and nitrogen oxide emission rates of 200 tpy and 550 tpy, respectively. Again, a stability class of C and wind speed of 2 m/s was utilized as representative of the most conservative meteorology, as described above. The Level-2 VISCREEN visual impacts inside of Bryce Canyon National Park are summarized below.

Table 3.19b. Visual Impacts inside of Bryce Canyon National Park, 300-foot Overburden Results

Background	Theta	Azimuth	Distance from Alton (km)	Alpha	Delta E		Contrast	
					Criteria	Plume	Criteria	Plume
SKY	10	157	35	11	6.21	0.372	0.13	0.006
SKY	140	157	35	11	3.41	0.149	0.13	-0.003
TERRAIN	10	84	18	84	6.8	0.904	0.28	0.004
TERRAIN	140	84	18	84	4.05	0.041	0.28	0.000

These results demonstrate that the maximum impacts inside of Bryce Canyon National Park from a potential Alton mine plume under the 300-foot overburden removal scenario will be less than the VISCREEN acceptance criteria for both color change (Delta E) and contrast.

3.3 Near-field Class I and Class II Area Impacts

AERMOD was also used to model impacts at the Class I and sensitive Class II areas within the 50 km near-field domain. Bryce Canyon National Park is a Class I area approximately 18 km to the northeast of the Alton Tract, whereas Grand Staircase-Escalante National Monument is a sensitive Class II area that lies farther to the east. The following tables (3.20 and 3.21) summarize the Alton source only impacts under the 200-foot overburden scenario for both action alternatives. None of the increment levels are exceeded.

Table 3.20. Alton Tract Near-Field Class I and Class II Impacts, 200-foot Overburden, Alternative B

High First-Highs

Pollutant	Averaging Period	Bryce Canyon National Park			
		2005 ($\mu g/m^3$)	2006 ($\mu g/m^3$)	2007 ($\mu g/m^3$)	2008 ($\mu g/m^3$)
PM_{10}	Annual	0.01	0.017	0.01	0.00
	24-hour	0.27	0.368	0.34	0.41
SO_2	Annual	0.00	0.00	0.00	0.00
	24-hour	0.00	0.00	0.00	0.00
	3-hour	0.01	0.02	0.01	0.03
NO_x	Annual	0.02	0.01	0.01	0.01
$PM_{2.5}$	Annual	0.00	0.00	0.00	0.00
	24-hour	0.06	0.08	0.07	0.09
CO	8-hour	2.9	3.9	4.1	4.6
	1-hour	18	27	25	31

Table 3.20. Alton Tract Near-Field Class I and Class II Impacts, 200-foot Overburden, Alternative B

Class I Increment, High First (Annual), Second-Highs

Pollutant	Averaging Period	Bryce Canyon National Park				Class I Increment	Exceed Increment?
		2005 (µg/m^3)	2006 (µg/m^3)	2007 (µg/m^3)	2008 (µg/m^3)		
PM_{10}	Annual	0.01	0.02	0.01	0.01	4	N
	24-hour	0.15	0.18	0.21	0.23	8	N
SO_2	Annual	0.00	0.00	0.00	0.00	2	N
	24-hour	0.00	0.00	0.00	0.00	5	N
	3-hour	0.00	0.01	0.01	0.01	25	N
NO_x	Annual	0.03	0.01	0.01	0.01	2.5	N
$PM_{2.5}$	Annual	0.00	0.00	0.00	0.00	NA	NA
	24-hour	0.03	0.04	0.04	0.05	NA	NA
CO	8-hour	1.3	1.5	1.8	2.7	NA	NA
	1-hour	7.7	12	14	16	NA	NA

Class II Increment, High First (Annual), Second-Highs

Pollutant	Averaging Period	Grand Staircase-Escalante NM				Class II Increment	Exceed Increment?
		2005 (µg/m^3)	2006 (µg/m^3)	2007 (µg/m^3)	2008 (µg/m^3)		
PM_{10}	Annual	0.22	0.26	0.23	0.31	17	N
	24-hour	1.70	2.14	1.99	2.02	30	N
SO_2	Annual	0.00	0.00	0.00	0.00	20	N
	24-hour	0.02	0.02	0.02	0.02	91	N
	3-hour	0.10	0.12	0.09	0.12	512	N
NO_x	Annual	0.55	0.65	0.53	0.71	25	N
$PM_{2.5}$	Annual	0.06	0.07	0.06	0.07	NA	NA
	24-hour	0.58	0.84	0.61	0.67	NA	NA
CO	8-hour	28	27	25	33	NA	N
	1-hour	169	207	160	226	NA	N

Table 3.21. Alton Tract Near-Field Class I and Class II Impacts, 200-foot Overburden, Alternative C

High First-Highs

Pollutant	Averaging Period	Bryce Canyon National Park			
		2005 (µg/m^3)	2006 (µg/m^3)	2007 (µg/m^3)	2008 (µg/m^3)
PM_{10}	Annual	0.01	0.01	0.01	0.01
	24-hour	0.29	0.39	0.37	0.45
SO_2	Annual	0.00	0.00	0.00	0.00
	24-hour	0.00	0.00	0.00	0.00
	3-hour	0.00	0.02	0.01	0.02
NO_x	Annual	0.02	0.03	0.01	0.01
$PM_{2.5}$	Annual	0.00	0.00	0.00	0.00
	24-hour	0.06	0.08	0.08	0.10
CO	8-hour	2.9	3.9	4.1	4.6
	1-hour	18	27	25	31

Class I Increment, High First (Annual), Second-Highs

Pollutant	Averaging Period	Bryce Canyon National Park				Class I Increment	Exceed Increment?
		2005 (µg/m^3)	2006 (µg/m^3)	2007 (µg/m^3)	2008 (µg/m^3)		
PM_{10}	Annual	0.01	0.01	0.01	0.01	4	N
	24-hour	0.16	0.20	0.23	0.21	8	N
SO_2	Annual	0.00	0.00	0.00	0.00	2	N
	24-hour	0.00	0.00	0.00	0.00	5	N
	3-hour	0.00	0.01	0.01	0.01	25	N
NO_x	Annual	0.02	0.01	0.03	0.01	2.5	N
$PM_{2.5}$	Annual	0.00	0.00	0.00	0.00	NA	NA
	24-hour	0.03	0.04	0.05	0.05	NA	NA
CO	8-hour	1.3	1.5	1.8	2.7	NA	NA
	1-hour	7.7	12	14	16	NA	NA

Table 3.21. Alton Tract Near-Field Class I and Class II Impacts, 200-foot Overburden, Alternative C

Class II Increment, High First (Annual), Second-Highs (carbon monoxide comparison to significance levels)							
Pollutant	**Averaging Period**	**Grand Staircase-Escalante NM**				**Class II Increment**	**Exceed Increment?**
		2005 (µg/m^3)	**2006 (µg/m^3)**	**2007 (µg/m^3)**	**2008 (µg/m^3)**		
PM_{10}	Annual	0.24	0.28	0.25	0.33	17	N
	24-hour	1.87	2.34	2.17	2.23	30	N
SO_2	Annual	0.00	0.00	0.00	0.00	20	N
	24-hour	0.02	0.02	0.02	0.02	91	N
	3-hour	0.10	0.12	0.09	0.12	512	N
NO_x	Annual	0.55	0.65	0.53	0.71	25	N
$PM_{2.5}$	Annual	0.07	0.08	0.07	0.10	NA	NA
	24-hour	0.84	1.15	0.89	0.94	NA	NA
CO	8-hour	28	27	25	33	NA	N
	1-hour	169	207	160	226	NA	N

The following tables (3.22 and 3.23) summarize the Alton source only impacts under the 300-foot overburden scenario for both action alternatives. None of the increment levels are exceeded.

Table 3.22. Alton Tract Near-Field Class I and Class II Impacts, 300-foot Overburden, Alternative B

High First-Highs					
Pollutant	**Averaging Period**	**Bryce Canyon National Park**			
		2005 (µg/m^3)	**2006 (µg/m^3)**	**2007 (µg/m^3)**	**2008 (µg/m^3)**
PM_{10}	Annual	0.01	0.01	0.01	0.01
	24-hour	0.39	0.51	0.49	0.59
SO_2	Annual	0.00	0.00	0.00	0.00
	24-hour	0.00	0.00	0.00	0.00
	3-hour	0.01	0.02	0.02	0.02
NO_x	Annual	0.04	0.03	0.03	0.04
$PM_{2.5}$	Annual	0.00	0.00	0.00	0.00
	24-hour	0.08	0.10	0.10	0.12
CO	8-hour	5.9	7.8	8.8	9.6
	1-hour	36	55	53	67

Table 3.22. Alton Tract Near-Field Class I and Class II Impacts, 300-foot Overburden, Alternative B

Class I Increment, High First (Annual), Second-Highs

Pollutant	Averaging Period	Bryce Canyon National Park				Class I Increment	Exceed Increment?
		2005 (µg/m^3)	2006 (µg/m^3)	2007 (µg/m^3)	2008 (µg/m^3)		
PM_{10}	Annual	0.01	0.01	0.01	0.010	4	N
	24-hour	0.21	0.274	0.29	0.347	8	N
SO_2	Annual	0.00	0.00	0.00	0.000	2	N
	24-hour	0.00	0.00	0.00	0.002	5	N
	3-hour	0.01	0.01	0.01	0.010	25	N
NO_x	Annual	0.04	0.03	0.03	0.035	2.5	N
$PM_{2.5}$	Annual	0.00	0.00	0.00	0.002	NA	NA
	24-hour	0.04	0.05	0.06	0.066	NA	NA
CO	8-hour	2.7	3.7	3.4	5.3	NA	NA
	1-hour	16	26	27	32	NA	NA

Class II Increment, High First (Annual), Second-Highs (carbon monoxide comparison to significant levels)

Pollutant	Averaging Period	Grand Staircase-Escalante NM				Class II Increment	Exceed Increment?
		2005 (µg/m^3)	2006 (µg/m^3)	2007 (µg/m^3)	2008 (µg/m^3)		
PM_{10}	Annual	0.29	0.33	0.29	0.39	17	N
	24-hour	2.43	2.90	2.88	2.81	30	N
SO_2	Annual	0.00	0.00	0.00	0.00	20	N
	24-hour	0.02	0.02	0.02	0.02	91	N
	3-hour	0.12	0.13	0.11	0.15	512	N
NO_x	Annual	1.36	1.57	1.26	1.73	25	N
$PM_{2.5}$	Annual	0.07	0.08	0.07	0.09	NA	NA
	24-hour	0.79	1.07	0.83	0.87	NA	NA
CO	8-hour	65	57	51	67	NA	N
	1-hour	387	441	361	497	NA	N

Table 3.23. Alton Tract Near-Field Class I and Class II Impacts, 300-foot Overburden, Alternative C

Class I High First-Highs

Pollutant	Averaging Period	Bryce Canyon National Park			
		2005 (µg/m^3)	2006 (µg/m^3)	2007 (µg/m^3)	2008 (µg/m^3)
PM_{10}	Annual	0.01	0.01	0.01	0.01
	24-hour	0.41	0.54	0.52	0.62
SO_2	Annual	0.00	0.00	0.00	0.00
	24-hour	0.00	0.00	0.00	0.00
	3-hour	0.01	0.02	0.02	0.02
NO_x	Annual	0.04	0.03	0.03	0.04
$PM_{2.5}$	Annual	0.00	0.00	0.00	0.00
	24-hour	0.08	0.11	0.11	0.13
CO	8-hour	5.9	7.8	8.8	9.61
	1-hour	36	55	53	67

Class I Increment, High First (Annual), Second-Highs

Pollutant	Averaging Period	Bryce Canyon National Park				Class I Increment	Exceed Increment?
		2005 (µg/m^3)	2006 (µg/m^3)	2007 (µg/m^3)	2008 (µg/m^3)		
PM_{10}	Annual	0.01	0.01	0.00	0.01	4	N
	24-hour	0.22	0.29	0.31	0.36	8	N
SO_2	Annual	0.00	0.00	0.00	0.00	2	N
	24-hour	0.00	0.00	0.00	0.00	5	N
	3-hour	0.01	0.01	0.01	0.01	25	N
NO_x	Annual	0.04	0.03	0.03	0.04	2.5	N
$PM_{2.5}$	Annual	0.00	0.00	0.00	0.00	NA	NA
	24-hour	0.04	0.06	0.06	0.07	NA	NA
CO	8-hour	2.8	3.7	3.5	5.3	NA	NA
	1-hour	16	26	27	32	NA	NA

Table 3.23. Alton Tract Near-Field Class I and Class II Impacts, 300-foot Overburden, Alternative C

Class II Increment, High First (Annual), Second-Highs (carbon monoxide comparison to significance levels)

Pollutant	Averaging Period	Grand Staircase-Escalante NM				Class II Increment	Exceed Increment?
		2005 (µg/m^3)	2006 (µg/m^3)	2007 (µg/m^3)	2008 (µg/m^3)		
PM_{10}	Annual	0.31	0.35	0.31	0.42	17	N
	24-hour	2.60	3.11	3.11	3.05	30	N
SO_2	Annual	0.00	0.00	0.00	0.00	20	N
	24-hour	0.02	0.02	0.02	0.02	91	N
	3-hour	0.12	0.13	0.11	0.15	512	N
NO_x	Annual	1.36	1.57	1.26	1.73	25	N
$PM_{2.5}$	Annual	0.07	0.08	0.07	0.10	NA	NA
	24-hour	0.84	1.15	0.89	0.94	NA	NA
CO	8-hour	65	57	51	67	NA	N
	1-hour	387	441	361	497	NA	N

The cumulative near-field runs including the Alton sources and all regional background sources (Kanab, Richfield, Fishlake, Dixie, Navajo Generating Station, and St. George) indicate that all of the Class I and Class II increments are not exceeded. See Table 3.24 below.

Table 3.24. Alton Tract Cumulative Near-Field Class I and Class II Impacts, 300-foot Overburden, Alternative C

Class I Increment, High First (Annual), Second-Highs

Pollutant	Averaging Period	Bryce Canyon National Park				Maximum Regional Impact ($\mu g/m^3$)*	Maximum Total ($\mu g/m^3$)	Class I Increment	Exceed Increment?
		2005 ($\mu g/m^3$)	2006 ($\mu g/m^3$)	2007 ($\mu g/m^3$)	2008 ($\mu g/m^3$)				
PM_{10}	Annual	0.01	0.01	0.01	0.01	0.00	0.01	4	N
	24-hour	0.22	0.29	0.31	0.37	0.05	0.42	8	N
SO_2	Annual	0.00	0.00	0.00	0.00	0.00	0.01	2	N
	24-hour	0.00	0.00	0.00	0.00	0.01	0.01	5	N
	3-hour	0.01	0.01	0.01	0.01	0.05	0.06	25	N
NO_x	Annual	0.04	0.03	0.03	0.04	0.00	0.04	2.5	N
$PM_{2.5}$	Annual	0.00	0.00	0.00	0.00	0.00	0.00	NA	NA
	24-hour	0.04	0.06	0.06	0.07	0.02	0.09	NA	NA
CO	8-hour	3.0	3.7	3.5	6.0	25	31	NA	NA
	1-hour	19	26	27	48	43	91	NA	NA

Table 3.24. Alton Tract Cumulative Near-Field Class I and Class II Impacts, 300-foot Overburden, Alternative C

Class II Increment, High First (Annual), Second-Highs (carbon monoxide comparison to significance levels)

Pollutant	Averaging Period	Grand Staircase-Escalante NM				Maximum Regional Impact (µg/m^3)	Maximum Total (µg/m^3)	Class II Increment	Exceed Increment?
		2005 (µg/m^3)	2006 (µg/m^3)	2007 (µg/m^3)	2008 (µg/m^3)				
PM_{10}	Annual	0.31	0.36	0.31	0.42	0.00	0.42	17	N
	24-hour	2.61	3.11	3.11	3.05	0.05	3.16	30	N
SO_2	Annual	0.00	0.00	0.00	0.00	0.00	0.00	20	N
	24-hour	0.02	0.02	0.02	0.02	0.01	0.03	91	N
	3-hour	0.12	0.13	0.11	0.15	0.05	0.20	512	N
NO_x	Annual	1.37	1.58	1.26	1.73	0.00	1.73	25	N
$PM_{2.5}$	Annual	0.08	0.09	0.07	0.10	0.00	0.10	NA	NA
	24-hour	0.84	1.15	0.89	0.94	0.02	1.17	NA	NA
CO	8-hour	65	57	51	67	25	92	NA	N
	1-hour	387	441	367	497	44	541	NA	N

* - The maximum regional impact is the highest 1st-high from the 3 CALPUFF model years, 2001-2003

4 FAR-FIELD ANALYSIS

The purpose of the far-field analysis is to quantify potential air quality impacts to both ambient air concentrations and AQRVs from air pollutant emissions of nitrogen oxide, carbon monoxide, sulfur dioxide, PM_{10}, and $PM_{2.5}$ that are expected to result from mining operations on the tract. Ambient air quality impacts beyond the tract and throughout the modeling domain were analyzed, as were AQRVs at Class I areas and selected Class II areas. Cumulative impacts also were quantified by including in the analyses other documented sources of air pollutant emissions within the modeling domain (identified in Map 1.1). The analyses were performed using the EPA-recommended CALMET/CALPUFF/ CALPOST modeling system (V5.8 Level 070623) to predict air quality direct and cumulative impacts at far-field PSD Class I areas and selected Class II areas. Except where explicit reference to pre- and post-processors is necessary for clarity, in this Technical Report the term "CALPUFF" is generally used to represent the entire modeling system, including the pre- and post-processors. The PSD Class I areas and Class II areas of special interest to be analyzed are shown on Map 1.1 and include the following:

- Bryce Canyon National Park (Class I) –(See Section 4.2.3)
- Zion National Park (Class I)
- Capitol Reef National Park (Class I)
- Grand Canyon National Park (Class I)
- Grand Staircase-Escalante National Monument (Class II)
- Navajo Lake (Acid deposition on a sensitive lake)
- A 4 km spaced grid of receptors located over the near-field modeling domain (Class II) to include potential far-field impacts in the near-field cumulative results (i.e., evaluate source impacts from sources greater than 50 km from the Alton mine)

In addition, analyses were performed for one lake (Navajo Lake in Dixie National Forest, Utah) to allow for the assessment of potential lake acidification from atmospheric deposition impacts. Sulfur and nitrogen deposition on the lake surface was calculated using CALPUFF. However, there are currently no data on acid neutralizing capacity (ANC) for Navajo Lake. To assess potential lake acidification it would be necessary to gather ANC data for the lake.

CALPUFF was used to model dispersion of nitrogen oxide, carbon monoxide, sulfur dioxide, PM_{10} and $PM_{2.5}$ from mining operations on the Alton Coal Tract, associated activities such as coal haulage, and regional emissions as described in Section 2.0. Photochemical conversion of NO_x and VOCs to O_3 and the secondary formation of $PM_{2.5}$ concentrations from NO_x and SO_2 emissions were not included in the Protocol. These chemical reactions cannot be simulated with the recommended far-field model (CALPUFF). A description of the emission inventory procedures is included in Section 2.0 of this Technical Report. CALPUFF results were post-processed with CALPOST to derive

- air concentrations for comparison to ambient air standards, significance thresholds, and Class I and II increments;
- AQRV impacts due to deposition rates for comparison to sulfur (S) and nitrogen (N) deposition thresholds[1]; and

[1] For Navajo Lake, deposition rates for S and N will be calculated. However, ANC calculations will not be performed until there are sufficient data for the lake.

- AQRV impacts due to light extinction change for comparison to visibility impact thresholds in Class I and other sensitive areas.

A discussion of the post-processing methodology used is provided in Section 4.3.

4.1 Modeling Methodology

The far-field analysis used the CALPUFF modeling system, which incorporates a non-steady-state puff-model approach for simulating the dispersion of pollutants to assess potential air quality impacts. The model is best applied when assessing complex flow situations, far-field impacts, and situations where winds are calm. CALPUFF is also appropriate for estimating AQRV impacts such as degradation of visibility and deposition of inorganic compounds resulting from fuel combustion (e.g., nitrates formed from nitrogen oxide). The CALPUFF modeling system has three main components: CALMET (a diagnostic 3D meteorological model); CALPUFF (the transport and dispersion model); and CALPOST (a post-processing package). CALMET is a meteorological model that includes a diagnostic wind field generator containing objective analysis and parameterized treatments of slope flows, kinematic terrain effects, terrain blocking effects, a divergence minimization procedure, and a micrometeorological model for overland and overwater. CALPUFF is a non-steady-state Lagrangian Gaussian puff model containing modules for complex terrain effects, overwater transport, coastal interaction effects, building downwash effects, and wet and dry removal. CALPOST is a post-processing program with options for the computation of time-averaged concentrations and deposition fluxes predicted by the CALPUFF model. CALPOST computes visibility impacts in accordance with IWAQM and FLAG recommendations.

As mentioned, three consecutive years (2001–2003) of MM5 model meteorological data were used as input to the CALMET model simulations. CALPUFF then used the meteorological fields generated by CALMET to assess the far-field impacts of the pollutants of concern on the Class I areas and selected Class II areas. CALPOST was used to process the hourly concentration or deposition output files generated by CALPUFF to present the data in the desired averaging period for each pertinent pollutant or AQRV. The modeling domain is shown in Map 1.1.

The CALMET and CALPUFF models were used in this analysis following the methods described herein as well as the following guidance sources:

- *Guideline on Air Quality Models, 40 Code of Federal Regulations (CFR), Part 51*, Appendix W, November 9, 2005;
- *Interagency Work Group on Air Quality Modeling Phase 2 Summary Report and Recommendations for Modeling Long Range Transport Impacts*, EPA-454/R-98-019, Office of Air Quality Planning and Standards, December 1998 (IWAQM 1998); and
- *FLAG, Phase I Report*, December 2000 (FLAG 2000).

4.2 Model Inputs

Model inputs consisted of meteorological data and terrain data (see Section 4.2.1), estimated emissions from mining operations on the tract (see Section 4.2.2.1), cumulative emissions (see Section 4.2.2.2), receptors (see Section 4.2.3), and background data (see Section 4.2.4). Each of these is discussed below.

4.2.1 *Meteorological Data Selection and Settings*

The Arizona-New Mexico CALMET dataset developed by the Western Regional Air Partnership (WRAP) was used to produce three years of CALMET wind fields. Supplementing the WRAP data are 7 upper air stations that were used in the Navajo Generating Station (NGS) BART modeling. The original WRAP modeling did not include upper air stations, and the availability of upper air data for the Arizona-New Mexico domain was one of the primary factors for its selection.

The EPA approved version of CALMET (5.8 – Level 070623) was used to generate the meteorological data fields. The CALMET fields were reproduced exactly as they were in the NGS modeling – with identical MM5, surface, upper air, precipitation and geophysical data.

As an "initial guess" field, three years of MM5 data (2001–2003) were used. CALMET uses the MM5 (36-km resolution) data as an "initial guess" field for the fine grid (4 km) wind field simulations using a diagnostic wind field module. The CALMET methodology accounts for local terrain effects on the wind field (e.g., CALMET includes the local up- and down-valley diurnal flow that is missed by most meteorological observations and coarse grid simulations). The meteorological grid size is 288 x 225 cells (using 4-km spacing). The computational grid is a subset of the meteorological grid, due to the large areal extent of the domain and the extremely long run times that would have resulted had the entire domain been included. The computational grid begins at cell 93,126 and extends to 197,225. The computational grid extents are sufficient to cover all areas of interest, plus an additional 50 km buffer on all sides. The cell face heights (in meters) were set to 0, 20, 100, 200, 350, 500, 750, 1000, 2000, 3000, 4000, and 5000. The meteorological domain is illustrated in Map 1.7.

4.2.2 *Emissions*

Estimated emissions based on the emission inventory described in Section 2.0 were used per FLAG guidance and standard CALPUFF procedure. The sections below describe the consideration of mining-related and cumulative emissions in the modeling.

4.2.2.1 MINING-RELATED EMISSIONS

Pollutant emission rates estimated as described in Section 2.0 were input to CALPUFF to predict air quality impacts (concentrations of pollutants) from mining and related activities. Mining operations were modeled as a combination of point, area and volume sources within the tract.

Alton generators were modeled as point sources, and roads as volume sources. All other emissions associated with the mine were modeled as area sources. One slight difference from the near-field modeling is that the near-field modeling included the use of "AREAPOLY" sources - irregular shaped area sources with multiple vertices. CALPUFF has no areapoly type of input. So, in some cases several area sources were necessary to cover the same area one near-field areapoly source covered.

Coal haulage–related emissions were modeled as volume sources along the reasonably foreseeable coal haul transportation route. Volume spacing along this route was varied, with a 2 km spacing the usual, but a decreased spacing of 500 m near and between several developed areas: Panguitch, Paragonah, Parowan, Enoch and Cedar City. The increased density of receptors near these towns allowed for a more detailed appraisal of potential impacts on certain sensitive entities, such as schools and hospitals.

Several small sources located offsite from the Alton facilities were included in the far-field modeling that were not included in the near-field modeling. These include coal dumping at the loadout, coal storage at

the loadout, and train loading. These emissions were combined into a single area source and located near the end of the long haul road near Cedar City.

4.2.2.2 CUMULATIVE SOURCE EMISSIONS

Regional sources not included in the background concentrations—including new minor sources, major modifications to Title V permitted sources, RFD, and RFFA—inventoried according to the methodology described in Section 2.0, were input to the CALPUFF model as point area or volume sources, as appropriate. As part of the emission inventory, source location and stack exit parameter data were obtained.

Pollutant emissions from stacks were generally modeled as point sources in the CALPUFF model. Multiple stacks within single facilities were modeled individually with the stack parameters identified in the emission inventory compilation process. The Fishlake and Dixie oil field developments stacks were modeled differently. Because there were quite a number of stacks present at each, emissions were combined into a single, conservative stack. This approach allowed CALPUFF to treat the emissions as stack emissions, while at the same time reducing model run time issues.

Fugitive emissions (e.g., well heaters, other surface mines, gravel pits, etc.) were modeled as area sources, with emissions aggregated into single area sources. The area source locations were either source location-specific or regional, depending on the nature of the fugitive emission sources. For example, the BLM Kanab Field Office and the BLM Richfield Field Office RMPs were each modeled as single, large regional area sources. Multiple disturbed areas at the Fishlake and Dixie oil field developments (both the volume and area sources compiled in the emission inventories) were modeled as aggregate area sources situated at the development locations. The choice to model in aggregate instead of individually once again improved run time performance, and will not significantly impact concentration calculations, because the transport distances are large. The locations of area sources input to the model can be found in Appendix D.

Regional paved and unpaved roadway travel, urban, biogenic, and other non-industrial sources are considered to be included in the ambient air background concentrations described in this Technical Report. Therefore, those fugitive sources were not modeled.

4.2.3 *Receptors*

Model receptors were input to CALPUFF where concentration, deposition, and other impacts were calculated. At the selected PSD Class I, and other sensitive Class II areas, ambient air and AQRV impacts were determined. The Class I and Class II areas of special interest within the modeling domain that were modeled include:

- Bryce Canyon National Park (Class I)
- Zion National Park (Class I)
- Capitol Reef National Park (Class I)
- Grand Canyon National Park (Class I)
- Grand Staircase-Escalante National Monument (Class II)
- Navajo Lake (Acid deposition on a sensitive lake)
- A 4 km spaced grid of receptors located over the near-field modeling domain (Class II)

CALPUFF modeling used receptors provided by the National Park Service for each of the areas above, except for Navajo Lake, where a single receptor was located at its location, and the gridded receptors. In addition, the Grand Staircase-Escalante receptors included in the far-field analysis were only those ones that are greater than 50 km from the Alton project. Bryce Canyon receptors were included in the CALPUFF receptor list, but no post-processing was performed because the entire area is well within 50 km. Zion National Park has a portion of its area within 50 km, and a portion outside 50 km. For the post-processing the entire park was considered, regardless of whether the particular receptor was plus or minus 50 km. This approach was used for the simplicity of dealing with all receptors in one pass, and also because it produces conservative results.

Because there are a number of regional sources that are farther than 50 km from the Alton facility, and AERMOD is not approved for use beyond 50 km, CALPUFF was used to generate a 4 km-spaced receptor grid over the near-field modeling domain to include potential far-field impacts in the near-field cumulative results. This grid was used to calculate total cumulative impacts from all sources. The near-field cumulative modeling included only the Kanab Field Office RMP as it was the only regional source within 50 km.

4.2.4 *Background Data*

4.2.4.1 CRITERIA POLLUTANTS

Background values for criteria pollutants were used as described in Table 4.1 below.

4.2.4.2 CHEMICAL SPECIES

The CALPUFF chemistry algorithms require hourly estimates of background ozone concentrations for the conversion of sulfur dioxide and nitrogen oxide to sulfates and nitrates, respectively. An extensive hourly ozone database was developed for use in the WRAP modeling, and that data were used for model years 2001-2003.

A background ammonia concentration of 1.0 ppb, as suggested in IWAQM for "arid lands," was used.

Table 4.1. Far-field Analysis Background Ambient Air Quality Concentrations (µg/m^3)

Pollutant	Averaging Period	Measured Background Concentration
CO[1]	1-hour	1 ppm (1,150 µg/m^3)
	8-hour	1 ppm (1,150 µg/m^3)
NO_2[1]	Annual	17 µg/m^3
PM_{10}[3]	24-hour	72 µg/m^3
	Annual	36 µg/m^3
$PM_{2.5}$[2]	24-hour	8.6 µg/m^3
	Annual	3.6 µg/m^3
SO_2[1]	3-hour	20 µg/m^3
	24-hour	10 µg/m^3
	Annual	5 µg/m^3

[1] UDAQ 2008. Data based on estimates from the UDAQ.

[2] Measured $PM_{2.5}$ data obtained from NPS website for Bryce Canyon National Park.

[3] UDAQ 2010. PM_{10} data based on monitoring at St. George, Utah and used for private Alton Mine.

4.2.4.3 VISIBILITY

CALPOST was used to estimate change in light extinction from CALPUFF model concentration results. FLAG background visibility data were used for this analysis. The visibility calculation method used CALPOST visibility method 6 (MVISBK=6, i.e., method 6) for computing light extinction change in combination with FLAG background data. Method 6 uses monthly averaged humidity factors, and is not sensitive to synoptic weather events that lead to high extinction events and subsequent explanation as to why certain events should be discounted. A second visibility calculation used the FLAG background data in combination with hourly relative humidity data from the CALMET windfields (MVISBK=2; i.e., method 2).

The FLAG method 6 uses seasonal natural background visibility conditions and relative humidity factors at Class I areas. FLAG method 2 uses the seasonal natural background visibility conditions and hourly relative humidity data from surface observations in the CALMET wind field data. For the FLAG methods utilized in this analysis, estimated natural background visibility values provided in Appendix 2.B of FLAG (2000) were used. For FLAG method 6, monthly relative humidity factors provided in the *Guidance for Estimating Natural Visibility Conditions under the Regional Haze Rule* (EPA 2003b) were used. Because natural background data are provided for Federal Class I areas only, data from the nearest Federal Class I area were used for the sensitive Class II areas. In this case, the Grand Staircase-Escalante Class II receptors used Capitol Reef National Park background data. The natural background visibility data, in units of inverse megameters (Mm^{-1}), were used with the FLAG visibility analysis for each area analyzed are shown in Table 4.2

Table 4.2. FLAG Report Background Extinction Values[1]

Site	Season	Hygroscopic (Mm-1)	Non-hygroscopic (Mm-1)
Bryce Canyon National Park	Winter	0.6	4.5
	Spring	0.6	4.5
	Summer	0.6	4.5
	Fall	0.6	4.5
Zion National Park	Winter	0.6	4.5
	Spring	0.6	4.5
	Summer	0.6	4.5
	Fall	0.6	4.5
Capitol Reef National Park	Winter	0.6	4.5
	Spring	0.6	4.5
	Summer	0.6	4.5
	Fall	0.6	4.5
Grand Canyon National Park	Winter	0.6	4.5
	Spring	0.6	4.5
	Summer	0.6	4.5
	Fall	0.6	4.5

[1] FLAG (2000).

4.2.4.4 DEPOSITION

No background data were used in determining deposition impacts at either the Class I/Class II areas or at Navajo Lake. Total sulfur (S) and nitrogen (N) impacts were quantified for the tract proper and cumulative source scenarios, and compared to the minimum green line values outlined in *A Screening Procedure to Evaluate Air Pollution Effects on Class I Wilderness Areas* (Fox et al, 1989).

4.2.4.5 LAKE CHEMISTRY

Navajo Lake is the only known lake to be potentially impacted by acid deposition. This site was identified as a sensitive receptor, and acid deposition rates on the lake were calculated. There are no data on lake chemistry at Navajo Lake to assess potential impacts related to ANC.

4.3 Post-processing

For each far-field sensitive area, CALPUFF-modeled concentration impacts were post-processed with CALPOST and POSTUTIL, as necessary, to derive (1) concentrations for comparison to ambient air quality standards, and PSD Class I and II Increments; (2) deposition rates for comparison to sulfur and nitrogen deposition levels of concern; and (3) light extinction changes for comparison to visibility impact thresholds.

4.3.1 *Concentration*

CALPOST was used to process the CALPUFF concentration output files to compute appropriate concentration values for sulfur dioxide (3-hour, 24-hour, and annual average), $PM_{2.5}$ (24-hour and annual average), nitrogen dioxide (annual average), PM_{10} (24-hour and annual average) and carbon monoxide (1-hour and 8-hour averages).

The NAAQS and ambient standards adopted by state regulatory agencies set absolute upper limits for specific air pollutant concentrations (expressed in $\mu g/m^3$) at all locations with public access. Modeled concentrations occurring from construction, mining operations, and cumulative sources were added to the existing ambient air quality background concentrations shown in Table 3.1 and Table 4.2, and the total concentrations are compared to the corresponding NAAQS shown in Table 4.3. Ambient air quality standards, significance levels, and PSD Class II Increments are shown in Table 4.3.

Table 4.3. Ambient Standards, Class II PSD Increments Comparison to Near-field Analysis Results ($\mu g/m^3$)[1]

Pollutant/Averaging Time	National Ambient Air Quality Standards	PSD Class II Increments
CO		
1-hour[1]	40,000	--
8-hour[1]	10,000	--
NO_2		
Annual[2]	100	25

Table 4.3. Ambient Standards, Class II PSD Increments Comparison to Near-field Analysis Results (µg/m^3)[1]

Pollutant/Averaging Time	National Ambient Air Quality Standards	PSD Class II Increments
Ozone (O_3)		
1-hour	235	--
8-hour[3]	157	--
PM_{10}		
24-hour[1]	150	30
Annual[4]	50	17
$PM_{2.5}$		
24-hour	35	NA
Annual	15	NA
SO_2		
3-hour[1]	1,300	512
24-hour[1]	365	91
Annual[2]	80	20

[1] No more than one exceedance per year.

[2] Annual arithmetic mean.

[3] Average of annual fourth-highest daily maximum 8-hour average.

[4] Standard revoked.

Under federal and state PSD regulations, increases in ambient air concentrations in Class I areas are limited by PSD Class I Increments. Specifically, emissions associated with a particular development may increase ambient concentrations above baseline levels only within those specific increments developed for sulfur dioxide, PM_{10}, and nitrogen dioxide. PSD Class I Increments are set forth in federal and state PSD regulations, and are shown in Table 4.5. PSD Class II Increments are applicable in Class II areas and are shown in Table 4.3.

Table 4.4. PSD Class I Increments (μg/m^3)

Pollutant	**Averaging Period**	**Class I Increment**
SO_2	Annual	2
	24-hour	5
	3-hour	25
PM_{10}	Annual	4
	24-hour	8
NO_2	Annual	2.5

Modeled concentrations predicted in Federal PSD Class I areas from mining operations on the tract proper were compared to Class I Increments, and cumulative modeling results predicted within Federal PSD Class I areas were compared to Class I Increments. Project and cumulative impacts predicted at sensitive areas designated as PSD Class II areas were compared to Class II Increments.

Tables 4.5-4.8 summarize the Alton tract impact in the Class I areas and at Grand Staircase-Escalante NM. There is one table for each of the operational scenarios, i.e., 200-foot overburden removal, Alternative B; 200-foot overburden removal, Alternative C; 300-foot overburden removal, Alternative B; and 300-foot overburden removal, Alternative C. Impacts were significantly less than the Class I increments in all cases. Impacts at Grand Staircase-Escalante were far below the Class II increments.

Table 4.5a. Alton Tract Far-field Class I and Class II Impacts, 200-foot Overburden, Alternative B

Pollutant	Averaging Period	Bryce Canyon NP	Zion NP			Grand Canyon NP			Capitol Reef NP		
			2001 (ug/m^3)	2002 (ug/m^3)	2003 (ug/m^3)	2001 (ug/m^3)	2002 (ug/m^3)	2003 (ug/m^3)	2001 (ug/m^3)	2002 (ug/m^3)	2003 (ug/m^3)
PM_{10}	Annual	*	0.09	0.14	0.11	0.01	0.01	0.01	0.01	0.01	0.01
	24-hour	*	1.01	1.17	0.95	0.25	0.15	0.19	0.13	0.17	0.12
SO_2	Annual	*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	24-hour	*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3-hour	*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NO_x	Annual	*	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
$PM_{2.5}$	Annual	*	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	24-hour	*	0.04	0.05	0.04	0.02	0.01	0.02	0.01	0.01	0.01
CO	8-hour	*	1.63	1.40	1.46	0.39	0.33	0.36	0.26	0.23	0.27
	1-hour	*	4.91	5.90	5.12	2.37	1.03	1.48	0.54	0.42	0.50

Table 4.5b. Alton Tract Far-field Class I and Class II Impacts, 200-foot Overburden, Alternative B

Class I Increment, High First (Annual), Second-Highs

Pollutant	Averaging Period	Bryce Canyon NP	Zion NP			Grand Canyon NP			Capitol Reef NP			Class I Increment	Exceed Increment?
			2001 (ug/m^3)	2002 (ug/m^3)	2003 (ug/m^3)	2001 (ug/m^3)	2002 (ug/m^3)	2003 (ug/m^3)	2001 (ug/m^3)	2002 (ug/m^3)	2003 (ug/m^3)		
PM_{10}	Annual	*	0.09	0.14	0.11	0.01	0.01	0.01	0.01	0.01	0.01	4	N
	24-hour	*	0.85	1.06	0.82	0.11	0.11	0.14	0.12	0.12	0.09	8	N
SO_2	Annual	*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2	N
	24-hour	*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5	N
	3-hour	*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	25.0	N
NO_x	Annual	*	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	2.5	N
$PM_{2.5}$	Annual	*	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	NA	NA
	24-hour	*	0.03	0.04	0.03	0.01	0.01	0.01	0.01	0.01	0.01	NA	NA
CO	8-hour	*	1.12	0.86	1.21	0.28	0.25	0.25	0.16	0.18	0.20	NA	NA
	1-hour	*	3.68	2.35	2.51	1.59	0.79	1.36	0.45	0.41	0.41	NA	NA

Table 4.5c. Alton Tract Far-field Class I and Class II Impacts, 200-foot Overburden, Alternative B

Class II Increment, High First (Annual), Second-Highs (carbon monoxide comparison to significance levels)

Pollutant	Averaging Period	Grand Staircase-Escalante NM			Class II Increment	Exceed Increment?
		2001 (ug/m^3)	2002 (ug/m^3)	2003 (ug/m^3)		
PM_{10}	Annual	0.026	0.031	0.029	17	N
	24-hour	0.149	0.238	0.226	30	N
SO_2	Annual	0.000	0.000	0.000	20	N
	24-hour	0.000	0.000	0.000	91	N
	3-hour	0.001	0.001	0.001	512	N
NO_x	Annual	0.004	0.003	0.003	25	N
$PM_{2.5}$	Annual	0.002	0.002	0.002	NA	NA
	24-hour	0.012	0.015	0.017	NA	NA
CO	8-hour	0.302	0.411	0.520	500	N
	1-hour	0.745	0.831	0.960	2000	N

Table 4.6a. Alton Tract Far-field Class I and Class II Impacts, 200-foot Overburden, Alternative C

Pollutant	Averaging Period	Bryce Canyon NP	Zion NP			Grand Canyon NP			Capitol Reef NP		
			2001 (ug/m^3)	2002 (ug/m^3)	2003 (ug/m^3)	2001 (ug/m^3)	2002 (ug/m^3)	2003 (ug/m^3)	2001 (ug/m^3)	2002 (ug/m^3)	2003 (ug/m^3)
PM_{10}	Annual	*	0.09	0.14	0.11	0.01	0.01	0.01	0.01	0.01	0.01
	24-hour	*	1.01	1.17	0.95	0.25	0.15	0.19	0.14	0.17	0.12
SO_2	Annual	*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	24-hour	*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3-hour	*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NO_x	Annual	*	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
$PM_{2.5}$	Annual	*	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	24-hour	*	0.04	0.05	0.04	0.02	0.01	0.02	0.01	0.01	0.01
CO	8-hour	*	1.63	1.40	1.46	0.39	0.33	0.36	0.26	0.23	0.27
	1-hour	*	4.91	5.90	5.12	2.37	1.03	1.48	0.54	0.42	0.50

Table 4.6b. Alton Tract Far-field Class I and Class II Impacts, 200-foot Overburden, Alternative C

Class I Increment, High First (Annual), Second-Highs

Pollutant	Averaging Period	Bryce Canyon NP	Zion NP			Grand Canyon NP			Capitol Reef NP			Class I Increment	Exceed Increment?
			2001 (ug/m^3)	2002 (ug/m^3)	2003 (ug/m^3)	2001 (ug/m^3)	2002 (ug/m^3)	2003 (ug/m^3)	2001 (ug/m^3)	2002 (ug/m^3)	2003 (ug/m^3)		
PM_{10}	Annual	*	0.09	0.14	0.11	0.01	0.01	0.01	0.01	0.01	0.01	4	N
	24-hour	*	0.85	1.06	0.82	0.12	0.12	0.14	0.12	0.13	0.09	8	N
SO_2	Annual	*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2	N
	24-hour	*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5	N
	3-hour	*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	25	N
NO_x	Annual	*	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	2.5	N
$PM_{2.5}$	Annual	*	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	NA	NA
	24-hour	*	0.03	0.04	0.04	0.01	0.01	0.01	0.01	0.01	0.01	NA	NA
CO	8-hour	*	1.12	0.86	1.21	0.28	0.25	0.25	0.16	0.18	0.20	NA	NA
	1-hour	*	3.68	2.35	2.51	1.59	0.79	1.36	0.45	0.41	0.41	NA	NA

Table 4.6c. Alton Tract Far-field Class I and Class II Impacts, 200-foot Overburden, Alternative C

Class II Increment, High First (Annual), Second-Highs (carbon monoxide comparison to significance levels)

Pollutant	Averaging Period	Grand Staircase-Escalante NM			Class II Increment	Exceed Increment ?
		2001 (ug/m^3)	2002 (ug/m^3)	2003 (ug/m^3)		
PM_{10}	Annual	0.03	0.03	0.03	17	N
	24-hour	0.15	0.24	0.23	30	N
SO_2	Annual	0.00	0.00	0.00	20	N
	24-hour	0.00	0.00	0.00	91	N
	3-hour	0.00	0.00	0.00	512	N
NO_x	Annual	0.00	0.00	0.00	25	N
$PM_{2.5}$	Annual	0.00	0.00	0.00	NA	NA
	24-hour	0.01	0.02	0.02	NA	NA
CO	8-hour	0.30	0.41	0.52	500	N
	1-hour	0.74	0.83	0.96	2000	N

Table 4.7a. Alton Tract Far-field Class I and Class II Impacts, 300-foot Overburden, Alternative B

Class I High First-Highs

Pollutant	Averaging Period	Bryce Canyon NP	Zion NP			Grand Canyon NP			Capitol Reef NP		
		*	2001 (ug/m^3)	2002 (ug/m^3)	2003 (ug/m^3)	2001 (ug/m^3)	2002 (ug/m^3)	2003 (ug/m^3)	2001 (ug/m^3)	2002 (ug/m^3)	2003 (ug/m^3)
PM_{10}	Annual	*	0.09	0.14	0.11	0.01	0.01	0.01	0.01	0.01	0.01
	24-hour	*	1.01	1.17	0.95	0.29	0.16	0.21	0.14	0.18	0.13
SO_2	Annual	*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	24-hour	*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3-hour	*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NO_x	Annual	*	0.02	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00
$PM_{2.5}$	Annual	*	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	24-hour	*	0.05	0.05	0.04	0.03	0.01	0.02	0.01	0.01	0.01
CO	8-hour	*	3.00	2.49	2.65	0.79	0.58	0.63	0.44	0.39	0.49
	1-hour	*	11.16	6.23	10.31	5.04	2.02	2.89	0.92	0.98	0.89

Table 4.7b. Alton Tract Far-field Class I and Class II Impacts, 300-foot Overburden, Alternative B

Class I Increment, High First (Annual), Second-Highs

Pollutant	Averaging Period	Bryce Canyon NP	Zion NP			Grand Canyon NP			Capitol Reef NP			Class I Increment	Exceed Increment ?
		*	2001 (ug/m^3)	2002 (ug/m^3)	2003 (ug/m^3)	2001 (ug/m^3)	2002 (ug/m^3)	2003 (ug/m^3)	2001 (ug/m^3)	2002 (ug/m^3)	2003 (ug/m^3)		
PM_{10}	Annual	*	0.09	0.14	0.11	0.01	0.01	0.01	0.01	0.01	0.01	4	N
	24-hour	*	0.85	1.06	0.82	0.13	0.13	0.15	0.12	0.13	0.10	8	N
SO_2	Annual	*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2	N
	24-hour	*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5	N
	3-hour	*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	25	N
NO_x	Annual	*	0.02	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	2.5	N
$PM_{2.5}$	Annual	*	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	NA	NA
	24-hour	*	0.04	0.04	0.04	0.01	0.01	0.01	0.01	0.01	0.01	NA	NA
CO	8-hour	*	2.04	1.54	2.27	0.54	0.42	0.44	0.29	0.30	0.37	NA	NA
	1-hour	*	6.95	4.54	5.60	3.17	1.42	2.70	0.76	0.73	0.70	NA	NA

Table 4.7c. Alton Tract Far-field Class I and Class II Impacts, 300-foot Overburden, Alternative B

Class II Increment, High First (Annual), Second-Highs (carbon monoxide comparison to significance levels)

Pollutant	Averaging Period	Grand Staircase-Escalante NM			Class II Increment	Exceed Increment?
		2001 (ug/m^3)	2002 (ug/m^3)	2003 (ug/m^3)		
PM_{10}	Annual	0.03	0.03	0.03	17	N
	24-hour	0.15	0.24	0.23	30	N
SO_2	Annual	0.00	0.00	0.00	20	N
	24-hour	0.00	0.00	0.00	91	N
	3-hour	0.00	0.00	0.00	512	N
NO_x	Annual	0.01	0.01	0.01	25	N
$PM_{2.5}$	Annual	0.00	0.00	0.00	NA	NA
	24-hour	0.01	0.02	0.02	NA	NA
CO	8-hour	0.56	0.72	0.93	500	N
	1-hour	1.32	1.65	1.78	2000	N

Table 4.8a. Alton Tract Far-field Class I and Class II Impacts, 300-foot overburden, Alternative C

Class I High First-Highs

Pollutant	Averaging Period	Bryce Canyon NP	Zion NP			Grand Canyon NP			Capitol Reef NP		
		*	2001 (ug/m^3)	2002 (ug/m^3)	2003 (ug/m^3)	2001 (ug/m^3)	2002 (ug/m^3)	2003 (ug/m^3)	2001 (ug/m^3)	2002 (ug/m^3)	2003 (ug/m^3)
PM_{10}	Annual	*	0.09	0.14	0.11	0.01	0.01	0.01	0.01	0.01	0.01
	24-hour	*	1.01	1.17	0.95	0.30	0.17	0.21	0.14	0.18	0.13
SO_2	Annual	*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	24-hour	*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3-hour	*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NO_x	Annual	*	0.02	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00
$PM_{2.5}$	Annual	*	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	24-hour	*	0.05	0.05	0.05	0.03	0.01	0.02	0.01	0.01	0.01
CO	8-hour	*	3.00	2.49	2.65	0.79	0.58	0.63	0.44	0.39	0.49
	1-hour	*	11.16	6.23	10.31	5.04	2.02	2.89	0.92	0.98	0.89

Table 4.8b. Alton Tract Far-field Class I and Class II Impacts, 300-foot overburden, Alternative C

Class I Increment, High First (Annual), Second-Highs

Pollutant	Averaging Period	Bryce Canyon NP	Zion NP			Grand Canyon NP			Capitol Reef NP			Class I Increment	Exceed Increment ?
		*	2001 (ug/m^3)	2002 (ug/m^3)	2003 (ug/m^3)	2001 (ug/m^3)	2002 (ug/m^3)	2003 (ug/m^3)	2001 (ug/m^3)	2002 (ug/m^3)	2003 (ug/m^3)		
PM_{10}	Annual	*	0.09	0.14	0.11	0.01	0.01	0.01	0.01	0.01	0.01	4	N
	24-hour	*	0.85	1.06	0.82	0.13	0.13	0.15	0.12	0.13	0.10	8	N
SO_2	Annual	*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2	N
	24-hour	*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5	N
	3-hour	*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	25	N
NO_x	Annual	*	0.02	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	2.5	N
$PM_{2.5}$	Annual	*	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	NA	NA
	24-hour	*	0.04	0.04	0.04	0.01	0.01	0.01	0.01	0.01	0.01	NA	NA
CO	8-hour	*	2.04	1.54	2.27	0.54	0.42	0.44	0.29	0.30	0.37	NA	NA
	1-hour	*	6.95	4.54	5.60	3.17	1.42	2.70	0.76	0.73	0.70	NA	NA

Table 4.8c. Alton Tract Far-field Class I and Class II Impacts, 300-foot overburden, Alternative C

Class II Increment, High First (Annual), Second-Highs (carbon monoxide comparison to significance levels)

Pollutant	Averaging Period	Grand Staircase-Escalante NM			Class II Increment	Exceed Increment ?
		2001 (ug/m^3)	2002 (ug/m^3)	2003 (ug/m^3)		
PM_{10}	Annual	0.03	0.03	0.03	17	N
	24-hour	0.16	0.24	0.23	30	N
SO_2	Annual	0.00	0.00	0.00	20	N
	24-hour	0.00	0.00	0.00	91	N
	3-hour	0.00	0.00	0.00	512	N
NO_x	Annual	0.01	0.01	0.01	25	N
$PM_{2.5}$	Annual	0.00	0.00	0.00	NA	NA
	24-hour	0.02	0.02	0.02	NA	NA
CO	8-hour	0.56	0.72	0.93	500	N
	1-hour	1.32	1.65	1.78	2000	N

Because the results of the Alton alone modeling showed values far below the relevant increments, cumulative results were only produced for the maximum emission rate case (300-foot overburden removal, Alternative C) and are presented in Table 4.9. Once again the impacts are significantly below both the Class I and Class II increments.

Even though there are no increments for $PM_{2.5}$ or carbon monoxide, results are presented in the above tables so that a general impression of impact levels can be conveyed.

These demonstrations are informational only and not regulatory PSD increment consumption analyses, which would be completed as necessary during state permitting processes.

Table 4.9a. Cumulative Far-field Class I and Class II Impacts, 300-foot Overburden, Alternative C

Class I Increment, High First (Annual), Second-Highs

Pollutant	Averaging Period	Bryce Canyon NP	Zion NP			Grand Canyon NP			Capitol Reef NP			Class I Increment	Exceed Increment ?
		*	2001 (ug/m^3)	2002 (ug/m^3)	2003 (ug/m^3)	2001 (ug/m^3)	2002 (ug/m^3)	2003 (ug/m^3)	2001 (ug/m^3)	2002 (ug/m^3)	2003 (ug/m^3)		
PM_{10}	Annual	*	0.09	0.15	0.11	0.01	0.02	0.01	0.02	0.02	0.02	4	N
	24-hour	*	0.85	1.06	0.82	0.13	0.14	0.16	0.15	0.18	0.14	8	N
SO_2	Annual	*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2	N
	24-hour	*	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.02	0.02	5	N
	3-hour	*	0.01	0.01	0.00	0.01	0.01	0.01	0.06	0.06	0.04	25	N
NO_x	Annual	*	0.00	0.00	0.00	0.00	0.00	0.00	-0.01	0.00	0.01	2.5	N
$PM_{2.5}$	Annual	*	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	NA	NA
	24-hour	*	0.06	0.06	0.09	0.01	0.02	0.02	0.05	0.04	0.04	NA	NA
CO	8-hour	*	11.00	13.47	20.18	25.05	23.89	20.33	15.55	16.36	16.26	NA	NA
	1-hour	*	65.05	88.59	107.81	55.85	59.20	50.62	42.41	33.56	37.27	NA	NA

Table 4.9b. Cumulative Far-field Class I and Class II Impacts, 300-foot Overburden, Alternative C

Class II Increment, High First (Annual), Second-Highs (carbon monoxide comparison to significance levels)						
Pollutant	**Averaging Period**	**Grand Staircase-Escalante NM**			**Class II Increment**	**Exceed Increment ?**
		2001 (ug/m^3)	**2002 (ug/m^3)**	**2003 (ug/m^3)**		
PM_{10}	Annual	0.03	0.04	0.03	17	N
	24-hour	0.17	0.25	0.23	30	N
SO_2	Annual	0.00	0.00	0.00	20	N
	24-hour	0.01	0.01	0.01	91	N
	3-hour	0.07	0.04	0.06	512	N
NO_x	Annual	-0.04	-0.01	-0.02	25	N
$PM_{2.5}$	Annual	0.00	0.00	0.00	NA	NA
	24-hour	0.03	0.03	0.02	NA	NA
CO	8-hour	52.04	38.29	38.83	500	N
	1-hour	117.55	106.03	117.59	2000	N

4.3.1.1 CUMULATIVE CONCENTRATIONS IN THE NEAR FIELD

Receptors were set in the near field to assess impacts from far field cumulative sources on near field receptors near the tract. Figures 4.1 and 4.2 illustrate the results of this analysis. Maximum near field impacts due to near field cumulative sources occurred north of the Alton tract along the haul road as described in Section 3.The PM_{10} impacts near the tract from the far field cumulative sources would be 0.01 to 0.02 µg/m^3, whereas the NO_x impacts would be -0.01 to -0.02 µg/m^3. Negative NO_x values indicate an improvement due to the large reduction in NO_x emissions at the Navajo Generating Station in New Mexico. The results indicate that there would be virtually no impact in the near field due to the far field cumulative sources.

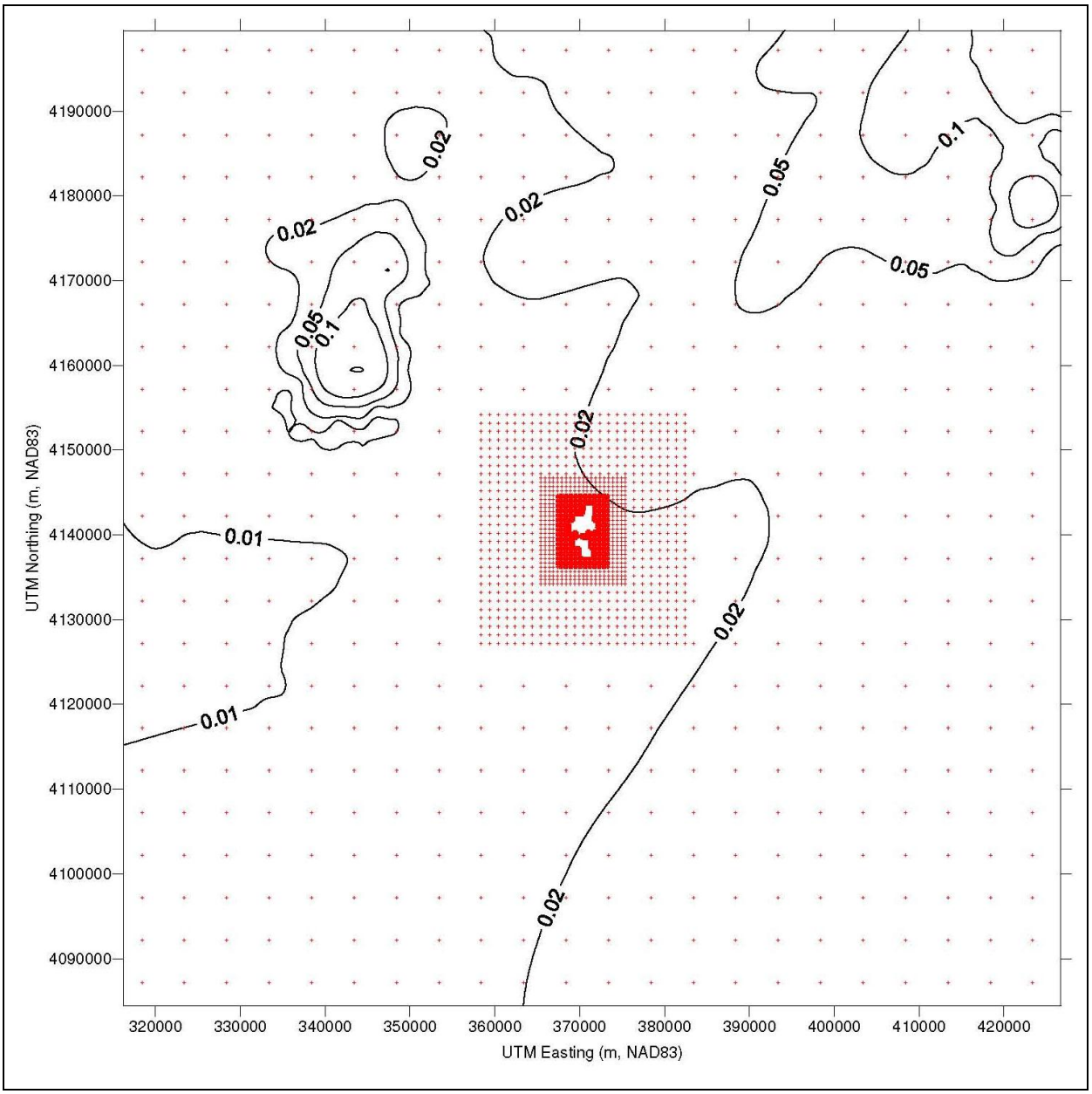

Figure 4.1. Maximum 2001-2003 PM_{10} impact ($\mu g/m^3$) from far-field sources.

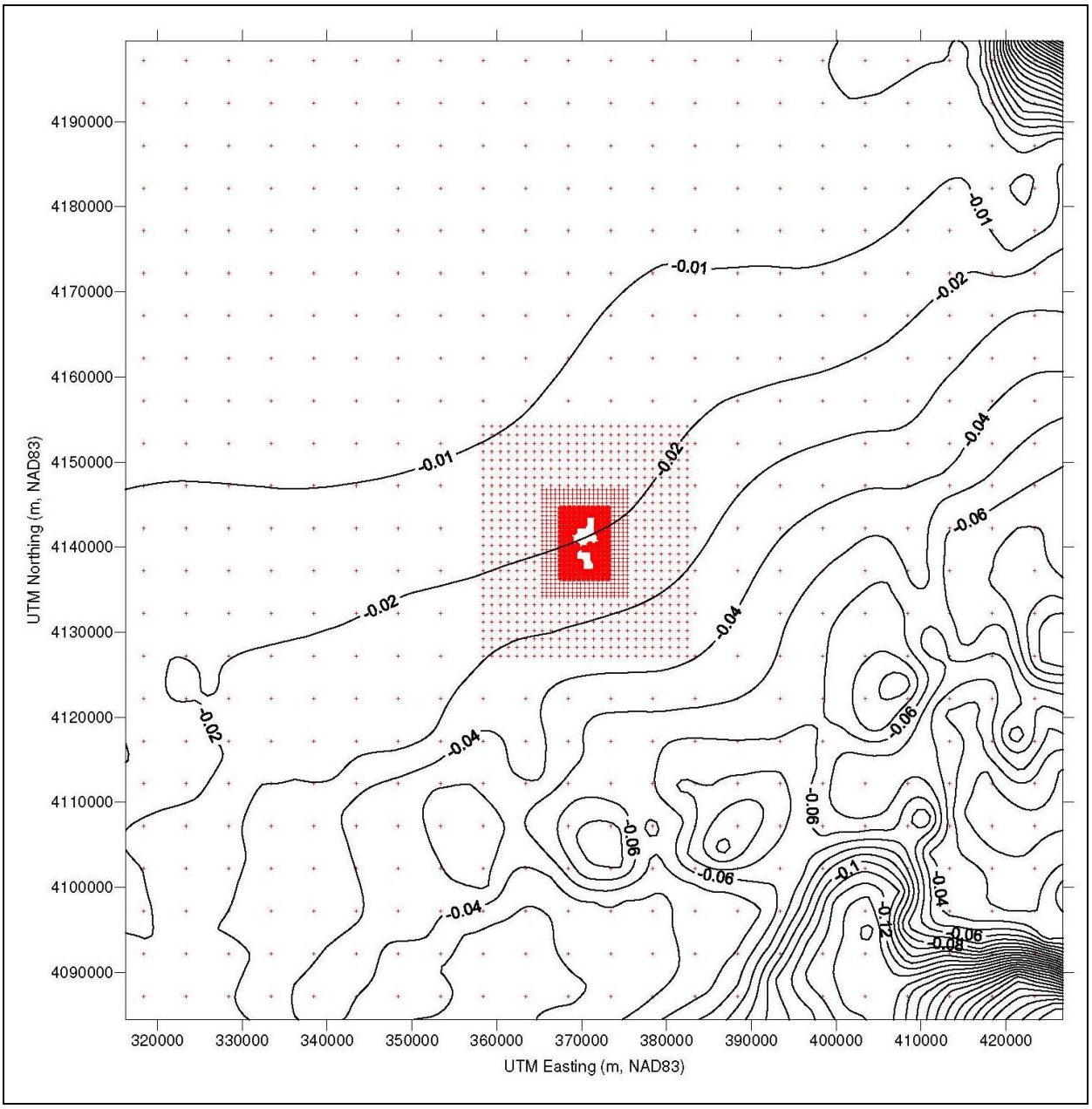

Figure 4.2. Maximum 2001–2003 NO_x impact ($\mu g/m^3$) from far-field sources.

4.3.2 *Deposition*

The POSTUTIL utility provided with the CALPUFF modeling system was used following IWAQM guidance to estimate total S and N fluxes from CALPUFF-predicted wet and dry fluxes of sulfur dioxide, SO_4, nitrogen oxide, nitrate (NO_3), and nitric acid (HNO_3). CALPOST was used to summarize the annual S and N deposition values from the POSTUTIL program.

Maximum predicted S and N deposition impacts were estimated for two direct project and cumulative source scenarios: the 200-foot overburden under Alternative B and the 300-foot overburden under Alternative C. As above, this approach gives a good representation of impacts from both the lowest and highest Alton emission scenarios.

Predicted direct project impacts were compared to the minimum "green line" deposition analysis thresholds for total N and S deposition in the western U.S., which are defined as 3.0 kilogram per hectare per year (kg/ha-year) for both N and S (Fox et al, 1989). The green line represents a value below which no significant change in the forest ecosystem will occur. These results are presented in Tables 4.10-4.29. Impacts for both S and N deposition are below the minimum green line value in all cases.

Table 4.10a. Soils and Vegetation Deposition Impacts at Bryce Canyon, 200-foot Overburden, Alternative B

1. Annual Total Sulfur (S) Deposition estimated by CALPOST from dry and wet deposition of SO_2 and $(NH_4)_2SO_4$ modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Sulfur Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual S Deposition (g/m^2-yr)	Dry and Wet Annual S Deposition (kg/ha-yr)
2001	2.32E-13	3,600	8,760	7.32E-06	7.32E-05
2002	2.55E-13	3,600	8,760	8.05E-06	8.05E-05
2003	2.68E-13	3,600	8,760	8.45E-06	8.45E-05

Table 4.10b. Soils and Vegetation Deposition Impacts at Bryce Canyon, 200-foot Overburden, Alternative B

2. Annual Total Nitrogen (N) Deposition estimated by CALPOST from dry and wet deposition of $(NH_4)_2SO_4$, NOx, and HNO_3 modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Nitrogen Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual N Deposition (g/m^2-yr)	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	3.11E-11	3,600	8,760	9.82E-04	9.82E-03
2002	3.94E-11	3,600	8,760	1.24E-03	1.24E-02
2003	3.71E-11	3,600	8,760	1.17E-03	1.17E-02

Table 4.10c. Soils and Vegetation Deposition Impacts at Bryce Canyon, 200-foot Overburden, Alternative B

3. Comparison of Maximum Total Annual Sulfur (S) and Nitrogen (N) Deposition to the Minimum Green Line Value for each element

Model Year	Dry and Wet Annual S Deposition (kg/ha-yr)	Model Year	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	7.32E-05	2001	9.82E-03
2002	8.05E-05	2002	1.24E-02
2003	8.45E-05	2003	1.17E-02
Max. Annual Dep.	8.45E-05	Max. Annual Dep.	1.24E-02
Green Line (kg/ha-yr)	3.00	Green Line (kg/ha-yr)	3.00
Above Green Line?	NO	Above Green Line?	NO

Table 4.11a. Soils And Vegetation Deposition Impacts At Bryce Canyon, 300-foot Overburden, Alternative C

1. Annual Total Sulfur (S) Deposition estimated by CALPOST from dry and wet deposition of SO_2 and $(NH_4)_2SO_4$ modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Sulfur Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual S Deposition (g/m^2-yr)	Dry and Wet Annual S Deposition (kg/ha-yr)
2001	2.57E-13	3,600	8,760	8.10E-06	8.10E-05
2002	2.81E-13	3,600	8,760	8.86E-06	8.86E-05
2003	2.95E-13	3,600	8,760	9.30E-06	9.30E-05

Table 4.11b. Soils And Vegetation Deposition Impacts At Bryce Canyon, 300-foot Overburden, Alternative C

2. Annual Total Nitrogen (N) Deposition estimated by CALPOST from dry and wet deposition of $(NH_4)_2SO_4$, NOx, and HNO_3 modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Nitrogen Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual N Deposition (g/m^2-yr)	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	6.64E-11	3,600	8,760	2.10E-03	2.10E-02
2002	8.29E-11	3,600	8,760	2.62E-03	2.62E-02
2003	7.68E-11	3,600	8,760	2.42E-03	2.42E-02

Table 4.11c. Soils And Vegetation Deposition Impacts At Bryce Canyon, 300-foot Overburden, Alternative C

3. Comparison of Maximum Total Annual Sulfur (S) and Nitrogen (N) Deposition to the Minimum Green Line Value for each element

Model Year	Dry and Wet Annual S Deposition (kg/ha-yr)	Model Year	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	8.10E-05	2001	2.10E-02
2002	8.86E-05	2002	2.62E-02
2003	9.30E-05	2003	2.42E-02
Max. Annual Dep.	9.30E-05	Max. Annual Dep.	2.62E-02
Green Line (kg/ha-yr)	3.00	Green Line (kg/ha-yr)	3.00
Above Green Line?	NO	Above Green Line?	NO

Table 4.12a. Soils And Vegetation Deposition Impacts At Capitol Reef, 200-foot Overburden, Alternative B

1. Annual Total Sulfur (S) Deposition estimated by CALPOST from dry and wet deposition of SO_2 and $(NH_4)_2SO_4$ modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Sulfur Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual S Deposition (g/m^2-yr)	Dry and Wet Annual S Deposition (kg/ha-yr)
2001	1.09E-14	3,600	8,760	3.44E-07	3.44E-06
2002	9.34E-15	3,600	8,760	2.94E-07	2.94E-06
2003	1.13E-14	3,600	8,760	3.57E-07	3.57E-06

Table 4.12b. Soils And Vegetation Deposition Impacts At Capitol Reef, 200-foot Overburden, Alternative B

2. Annual Total Nitrogen (N) Deposition estimated by CALPOST from dry and wet deposition of $(NH_4)_2SO_4$, NOx, and HNO_3 modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Nitrogen Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual N Deposition (g/m^2-yr)	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	1.33E-12	3,600	8,760	4.21E-05	4.21E-04
2002	1.13E-12	3,600	8,760	3.55E-05	3.55E-04
2003	1.37E-12	3,600	8,760	4.32E-05	4.32E-04

Table 4.12c. Soils And Vegetation Deposition Impacts At Capitol Reef, 200-foot Overburden, Alternative B

3. Comparison of Maximum Total Annual Sulfur (S) and Nitrogen (N) Deposition to the Minimum Green Line Value for each element

Model Year	Dry and Wet Annual S Deposition (kg/ha-yr)	Model Year	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	3.44E-06	2001	4.21E-04
2002	2.94E-06	2002	3.55E-04
2003	3.57E-06	2003	4.32E-04
Max. Annual Dep.	3.57E-06	Max. Annual Dep.	4.32E-04
Green Line (kg/ha-yr)	3.00	Green Line (kg/ha-yr)	3.00
Above Green Line?	NO	Above Green Line?	NO

Table 4.13a. Soils And Vegetation Deposition Impacts At Capitol Reef, 300-foot Overburden, Alternative C

1. Annual Total Sulfur (S) Deposition estimated by CALPOST from dry and wet deposition of SO_2 and $(NH_4)_2SO_4$ modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Sulfur Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual S Deposition (g/m^2-yr)	Dry and Wet Annual S Deposition (kg/ha-yr)
2001	1.21E-14	3,600	8,760	3.83E-07	3.83E-06
2002	1.03E-14	3,600	8,760	3.26E-07	3.26E-06
2003	1.26E-14	3,600	8,760	3.98E-07	3.98E-06

Table 4.13b. Soils And Vegetation Deposition Impacts At Capitol Reef, 300-foot Overburden, Alternative C

2. Annual Total Nitrogen (N) Deposition estimated by CALPOST from dry and wet deposition of $(NH_4)_2SO_4$, NOx, and HNO_3 modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Nitrogen Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual N Deposition (g/m^2-yr)	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	2.65E-12	3,600	8,760	8.35E-05	8.35E-04
2002	2.18E-12	3,600	8,760	6.88E-05	6.88E-04
2003	2.76E-12	3,600	8,760	8.72E-05	8.72E-04

Table 4.13c. Soils And Vegetation Deposition Impacts At Capitol Reef, 300-foot Overburden, Alternative C

3. Comparison of Maximum Total Annual Sulfur (S) and Nitrogen (N) Deposition to the Minimum Green Line Value for each element

Model Year	Dry and Wet Annual S Deposition (kg/ha-yr)	Model Year	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	3.83E-06	2001	8.35E-04
2002	3.26E-06	2002	6.88E-04
2003	3.98E-06	2003	8.72E-04
Max. Annual Dep.	3.98E-06	Max. Annual Dep.	8.72E-04
Green Line (kg/ha-yr)	3.00	Green Line (kg/ha-yr)	3.00
Above Green Line?	NO	Above Green Line?	NO

Table 4.14a. Soils And Vegetation Deposition Impacts At Escalante, 200-foot Overburden, Alternative B

1. Annual Total Sulfur (S) Deposition estimated by CALPOST from dry and wet deposition of SO_2 and $(NH_4)_2SO_4$ modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Sulfur Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual S Deposition (g/m^2-yr)	Dry and Wet Annual S Deposition (kg/ha-yr)
2001	2.63E-14	3,600	8,760	8.30E-07	8.30E-06
2002	2.86E-14	3,600	8,760	9.02E-07	9.02E-06
2003	3.00E-14	3,600	8,760	9.46E-07	9.46E-06

Table 4.14b. Soils And Vegetation Deposition Impacts At Escalante, 200-foot Overburden, Alternative B

2. Annual Total Nitrogen (N) Deposition estimated by CALPOST from dry and wet deposition of $(NH_4)_2SO_4$, NOx, and HNO_3 modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Nitrogen Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual N Deposition (g/m^2-yr)	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	3.832E-12	3,600	8,760	1.21E-04	1.21E-03
2002	4.038E-12	3,600	8,760	1.27E-04	1.27E-03
2003	4.115E-12	3,600	8,760	1.30E-04	1.30E-03

Table 4.14c. Soils And Vegetation Deposition Impacts At Escalante, 200-foot Overburden, Alternative B

3. Comparison of Maximum Total Annual Sulfur (S) and Nitrogen (N) Deposition to the Minimum Green Line Value for each element

Model Year	Dry and Wet Annual S Deposition (kg/ha-yr)	Model Year	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	8.30E-06	2001	1.21E-03
2002	9.02E-06	2002	1.27E-03
2003	9.46E-06	2003	1.30E-03
Max. Annual Dep.	9.46E-06	Max. Annual Dep.	1.30E-03
Green Line (kg/ha-yr)	3.00	Green Line (kg/ha-yr)	3.00
Above Green Line?	NO	Above Green Line?	NO

Table 4.15a. Soils and Vegetation Deposition Impacts at Escalante, 300-foot Overburden, Alternative C

1. Annual Total Sulfur (S) Deposition estimated by CALPOST from dry and wet deposition of SO_2 and $(NH_4)_2SO_4$ modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Sulfur Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual S Deposition (g/m^2-yr)	Dry and Wet Annual S Deposition (kg/ha-yr)
2001	2.92E-14	3,600	8,760	9.21E-07	9.21E-06
2002	3.16E-14	3,600	8,760	9.98E-07	9.98E-06
2003	3.33E-14	3,600	8,760	1.05E-06	1.05E-05

Table 4.15b. Soils and Vegetation Deposition Impacts at Escalante, 300-foot Overburden, Alternative C

2. Annual Total Nitrogen (N) Deposition estimated by CALPOST from dry and wet deposition of $(NH_4)_2SO_4$, NOx, and HNO_3 modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Nitrogen Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual N Deposition (g/m^2-yr)	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	6.95E-12	3,600	8,760	2.19E-04	2.19E-03
2002	7.45E-12	3,600	8,760	2.35E-04	2.35E-03
2003	7.62E-12	3,600	8,760	2.40E-04	2.40E-03

Table 4.15c. Soils and Vegetation Deposition Impacts at Escalante, 300-foot Overburden, Alternative C

3. Comparison of Maximum Total Annual Sulfur (S) and Nitrogen (N) Deposition to the Minimum Green Line Value for each element

Model Year	Dry and Wet Annual S Deposition (kg/ha-yr)	Model Year	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	9.21E-06	2001	2.19E-03
2002	9.98E-06	2002	2.35E-03
2003	1.05E-05	2003	2.40E-03
Max. Annual Dep.	1.05E-05	Max. Annual Dep.	2.40E-03
Green Line (kg/ha-yr)	3.00	Green Line (kg/ha-yr)	3.00
Above Green Line?	NO	Above Green Line?	NO

Table 4.16a. Soils and Vegetation Deposition Impacts at Grand Canyon, 200-foot Overburden, Alternative B

1. Annual Total Sulfur (S) Deposition estimated by CALPOST from dry and wet deposition of SO_2 and $(NH_4)_2SO_4$ modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Sulfur Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual S Deposition (g/m^2-yr)	Dry and Wet Annual S Deposition (kg/ha-yr)
2001	7.66E-15	3,600	8,760	2.42E-07	2.42E-06
2002	8.15E-15	3,600	8,760	2.57E-07	2.57E-06
2003	8.83E-15	3,600	8,760	2.79E-07	2.79E-06

Table 4.16b. Soils and Vegetation Deposition Impacts at Grand Canyon, 200-foot Overburden, Alternative B

2. Annual Total Nitrogen (N) Deposition estimated by CALPOST from dry and wet deposition of $(NH_4)_2SO_4$, NOx, and HNO_3 modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Nitrogen Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual N Deposition (g/m^2-yr)	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	8.86E-13	3,600	8,760	2.79E-05	2.79E-04
2002	8.79E-13	3,600	8,760	2.77E-05	2.77E-04
2003	9.15E-13	3,600	8,760	2.89E-05	2.89E-04

Table 4.16c. Soils and Vegetation Deposition Impacts at Grand Canyon, 200-foot Overburden, Alternative B

3. Comparison of Maximum Total Annual Sulfur (S) and Nitrogen (N) Deposition to the Minimum Green Line Value for each element

Model Year	Dry and Wet Annual S Deposition (kg/ha-yr)	Model Year	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	2.42E-06	2001	2.79E-04
2002	2.57E-06	2002	2.77E-04
2003	2.79E-06	2003	2.89E-04
Max. Annual Dep.	2.79E-06	Max. Annual Dep.	2.89E-04
Green Line (kg/ha-yr)	3.00	Green Line (kg/ha-yr)	3.00
Above Green Line?	NO	Above Green Line?	NO

Table 4.17a. Soils And Vegetation Deposition Impacts At Grand Canyon, 300-foot Overburden, Alternative C

1. Annual Total Sulfur (S) Deposition estimated by CALPOST from dry and wet deposition of SO_2 and $(NH_4)_2SO_4$ modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Sulfur Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual S Deposition (g/m^2-yr)	Dry and Wet Annual S Deposition (kg/ha-yr)
2001	8.64E-15	3,600	8,760	2.73E-07	2.73E-06
2002	9.11E-15	3,600	8,760	2.87E-07	2.87E-06
2003	9.91E-15	3,600	8,760	3.13E-07	3.13E-06

Table 4.17b. Soils And Vegetation Deposition Impacts At Grand Canyon, 300-foot Overburden, Alternative C

2. Annual Total Nitrogen (N) Deposition estimated by CALPOST from dry and wet deposition of $(NH_4)_2SO_4$, NOx, and HNO_3 modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Nitrogen Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual N Deposition (g/m^2-yr)	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	1.90E-12	3,600	8,760	5.99E-05	5.99E-04
2002	1.84E-12	3,600	8,760	5.80E-05	5.80E-04
2003	1.93E-12	3,600	8,760	6.09E-05	6.09E-04

Table 4.17c. Soils And Vegetation Deposition Impacts At Grand Canyon, 300-foot Overburden, Alternative C

3. Comparison of Maximum Total Annual Sulfur (S) and Nitrogen (N) Deposition to the Minimum Green Line Value for each element

Model Year	Dry and Wet Annual S Deposition (kg/ha-yr)	Model Year	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	2.73E-06	2001	5.99E-04
2002	2.87E-06	2002	5.80E-04
2003	3.13E-06	2003	6.09E-04
Max. Annual Dep.	3.13E-06	Max. Annual Dep.	6.09E-04
Green Line (kg/ha-yr)	3.00	Green Line (kg/ha-yr)	3.00
Above Green Line?	NO	Above Green Line?	NO

Table 4.18a. Soils And Vegetation Deposition Impacts At Zion, 200-foot Overburden, Alternative B

1. Annual Total Sulfur (S) Deposition estimated by CALPOST from dry and wet deposition of SO_2 and $(NH_4)_2SO_4$ modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Sulfur Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual S Deposition (g/m^2-yr)	Dry and Wet Annual S Deposition (kg/ha-yr)
2001	7.36E-14	3,600	8,760	2.32E-06	2.32E-05
2002	6.06E-14	3,600	8,760	1.91E-06	1.91E-05
2003	5.81E-14	3,600	8,760	1.83E-06	1.83E-05

Table 4.18b. Soils And Vegetation Deposition Impacts At Zion, 200-foot Overburden, Alternative B

2. Annual Total Nitrogen (N) Deposition estimated by CALPOST from dry and wet deposition of $(NH_4)_2SO_4$, NOx, and HNO_3 modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Nitrogen Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual N Deposition (g/m^2-yr)	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	1.21E-11	3,600	8,760	3.82E-04	3.82E-03
2002	9.51E-12	3,600	8,760	3.00E-04	3.00E-03
2003	9.10E-12	3,600	8,760	2.87E-04	2.87E-03

Table 4.18c. Soils And Vegetation Deposition Impacts At Zion, 200-foot Overburden, Alternative B

3. Comparison of Maximum Total Annual Sulfur (S) and Nitrogen (N) Deposition to the Minimum Green Line Value for each element

Model Year	Dry and Wet Annual S Deposition (kg/ha-yr)	Model Year	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	2.32E-05	2001	3.82E-03
2002	1.91E-05	2002	3.00E-03
2003	1.83E-05	2003	2.87E-03
Max. Annual Dep.	2.32E-05	Max. Annual Dep.	3.82E-03
Green Line (kg/ha-yr)	3.00	Green Line (kg/ha-yr)	3.00
Above Green Line?	NO	Above Green Line?	NO

Table 4.19a. Soils And Vegetation Deposition Impacts At Zion, 300-foot Overburden, Alternative C

1. Annual Total Sulfur (S) Deposition estimated by CALPOST from dry and wet deposition of SO_2 and $(NH_4)_2SO_4$ modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Sulfur Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual S Deposition (g/m^2-yr)	Dry and Wet Annual S Deposition (kg/ha-yr)
2001	8.40E-14	3,600	8,760	2.65E-06	2.65E-05
2002	6.77E-14	3,600	8,760	2.14E-06	2.14E-05
2003	6.49E-14	3,600	8,760	2.05E-06	2.05E-05

Table 4.19b. Soils And Vegetation Deposition Impacts At Zion, 300-foot Overburden, Alternative C

2. Annual Total Nitrogen (N) Deposition estimated by CALPOST from dry and wet deposition of $(NH_4)_2SO_4$, NOx, and HNO_3 modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Nitrogen Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual N Deposition (g/m^2-yr)	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	2.77E-11	3,600	8,760	8.73E-04	8.73E-03
2002	2.09E-11	3,600	8,760	6.58E-04	6.58E-03
2003	1.97E-11	3,600	8,760	6.22E-04	6.22E-03

Table 4.19c. Soils And Vegetation Deposition Impacts At Zion, 300-foot Overburden, Alternative C

3. Comparison of Maximum Total Annual Sulfur (S) and Nitrogen (N) Deposition to the Minimum Green Line Value for each element

Model Year	Dry and Wet Annual S Deposition (kg/ha-yr)	Model Year	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	2.65E-05	2001	8.73E-03
2002	2.14E-05	2002	6.58E-03
2003	2.05E-05	2003	6.22E-03
Max. Annual Dep.	2.65E-05	Max. Annual Dep.	8.73E-03
Green Line (kg/ha-yr)	3.00	Green Line (kg/ha-yr)	5.0000E-03
Above Green Line?	NO	Above Green Line?	NO

Table 4.20a. Soils and Vegetation Deposition Impacts at Bryce Canyon, 200-foot Overburden, Alternative B, Cumulative

1. Annual Total Sulfur (S) Deposition estimated by CALPOST from dry and wet deposition of SO_2 and $(NH_4)_2SO_4$ modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Sulfur Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual S Deposition (g/m^2-yr)	Dry and Wet Annual S Deposition (kg/ha-yr)
2001	6.06E-13	3,600	8,760	1.91E-05	1.91E-04
2002	9.22E-13	3,600	8,760	2.91E-05	2.91E-04
2003	8.19E-13	3,600	8,760	2.58E-05	2.58E-04

Table 4.20b. Soils and Vegetation Deposition Impacts at Bryce Canyon, 200-foot Overburden, Alternative B, Cumulative

2. Annual Total Nitrogen (N) Deposition estimated by CALPOST from dry and wet deposition of $(NH_4)_2SO_4$, NOx, and HNO_3 modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Nitrogen Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual N Deposition (g/m^2-yr)	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	0.0E+00	3,600	8,760	0.0E+00	0.0E+00
2002	0.0E+00	3,600	8,760	0.0E+00	0.0E+00
2003	0.0E+00	3,600	8,760	0.0E+00	0.0E+00

Table 4.20c. Soils and Vegetation Deposition Impacts at Bryce Canyon, 200-foot Overburden, Alternative B, Cumulative

3. Comparison of Maximum Total Annual Sulfur (S) and Nitrogen (N) Deposition to the Minimum Green Line Value for each element

Model Year	Dry and Wet Annual S Deposition (kg/ha-yr)	Model Year	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	1.91E-04	2001	0.0E+00
2002	2.91E-04	2002	0.0E+00
2003	2.58E-04	2003	0.0E+00
Max. Annual Dep.	2.91E-04	Max. Annual Dep.	0.0E+00
Green Line (kg/ha-yr)	3.00	Green Line (kg/ha-yr)	3.00
Above Green Line?	NO	Above Green Line?	NO

Table 4.21a. Soils and Vegetation Deposition Impacts at Bryce Canyon, 300-foot Overburden, Alternative C, Cumulative

1. Annual Total Sulfur (S) Deposition estimated by CALPOST from dry and wet deposition of SO_2 and $(NH_4)_2SO_4$ modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Sulfur Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual S Deposition (g/m^2-yr)	Dry and Wet Annual S Deposition (kg/ha-yr)
2001	6.30E-13	3,600	8,760	1.99E-05	1.99E-04
2002	9.47E-13	3,600	8,760	2.99E-05	2.99E-04
2003	8.45E-13	3,600	8,760	2.67E-05	2.67E-04

Table 4.21b. Soils and Vegetation Deposition Impacts at Bryce Canyon, 300-foot Overburden, Alternative C, Cumulative

2. Annual Total Nitrogen (N) Deposition estimated by CALPOST from dry and wet deposition of $(NH_4)_2SO_4$, NOx, and HNO_3 modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Nitrogen Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual N Deposition (g/m^2-yr)	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	0.00E+00	3,600	8,760	0.00E+00	0.00E+00
2002	3.49E-11	3,600	8,760	1.10E-03	1.10E-02
2003	1.75E-11	3,600	8,760	5.53E-04	5.53E-03

Table 4.21c. Soils and Vegetation Deposition Impacts at Bryce Canyon, 300-foot Overburden, Alternative C, Cumulative

3. Comparison of Maximum Total Annual Sulfur (S) and Nitrogen (N) Deposition to the Minimum Green Line Value for each element

Model Year	Dry and Wet Annual S Deposition (kg/ha-yr)	Model Year	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	1.99E-04	2001	0.00E+00
2002	2.99E-04	2002	1.10E-02
2003	2.67E-04	2003	5.53E-03
Max. Annual Dep.	2.99E-04	Max. Annual Dep.	1.10E-02
Green Line (kg/ha-yr)	3.00	Green Line (kg/ha-yr)	3.00
Above Green Line?	NO	Above Green Line?	NO

Table 4.22a. Soils and Vegetation Deposition Impacts at Capitol Reef, 200-foot Overburden, Alternative B, Cumulative

1. Annual Total Sulfur (S) Deposition estimated by CALPOST from dry and wet deposition of SO_2 and $(NH_4)_2SO_4$ modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Sulfur Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual S Deposition (g/m^2-yr)	Dry and Wet Annual S Deposition (kg/ha-yr)
2001	1.84E-12	3,600	8,760	5.80E-05	5.80E-04
2002	2.03E-12	3,600	8,760	6.40E-05	6.40E-04
2003	2.12E-12	3,600	8,760	6.67E-05	6.67E-04

Table 4.22b. Soils and Vegetation Deposition Impacts at Capitol Reef, 200-foot Overburden, Alternative B, Cumulative

2. Annual Total Nitrogen (N) Deposition estimated by CALPOST from dry and wet deposition of $(NH_4)_2SO_4$, NOx, and HNO_3 modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Nitrogen Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual N Deposition (g/m^2-yr)	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	0.0E+00	3,600	8,760	0.0E+00	0.0E+00
2002	0.0E+00	3,600	8,760	0.0E+00	0.0E+00
2003	0.0E+00	3,600	8,760	0.0E+00	0.0E+00

Table 4.22c. Soils and Vegetation Deposition Impacts at Capitol Reef, 200-foot Overburden, Alternative B, Cumulative

3. Comparison of Maximum Total Annual Sulfur (S) and Nitrogen (N) Deposition to the Minimum Green Line Value for each element

Model Year	Dry and Wet Annual S Deposition (kg/ha-yr)	Model Year	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	5.80E-04	2001	0.0E+00
2002	6.40E-04	2002	0.0E+00
2003	6.67E-04	2003	0.0E+00
Max. Annual Dep.	6.67E-04	Max. Annual Dep.	0.0E+00
Green Line (kg/ha-yr)	3.00	Green Line (kg/ha-yr)	3.00
Above Green Line?	NO	Above Green Line?	NO

Table 4.23a. Soils and Vegetation Deposition Impacts at Capitol Reef, 300-foot Overburden, Alternative C, Cumulative

1. Annual Total Sulfur (S) Deposition estimated by CALPOST from dry and wet deposition of SO_2 and $(NH_4)_2SO_4$ modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Sulfur Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual S Deposition (g/m^2-yr)	Dry and Wet Annual S Deposition (kg/ha-yr)
2001	1.84E-12	3,600	8,760	5.80E-05	5.80E-04
2002	2.03E-12	3,600	8,760	6.40E-05	6.40E-04
2003	2.12E-12	3,600	8,760	6.68E-05	6.68E-04

Table 4.23b. Soils and Vegetation Deposition Impacts at Capitol Reef, 300-foot Overburden, Alternative C, Cumulative

2. Annual Total Nitrogen (N) Deposition estimated by CALPOST from dry and wet deposition of $(NH_4)_2SO_4$, NOx, and HNO_3 modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Nitrogen Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual N Deposition (g/m^2-yr)	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	0.0E+00	3,600	8,760	0.0E+00	0.0E+00
2002	0.0E+00	3,600	8,760	0.0E+00	0.0E+00
2003	0.0E+00	3,600	8,760	0.0E+00	0.0E+00

Table 4.23c. Soils and Vegetation Deposition Impacts at Capitol Reef, 300-foot Overburden, Alternative C, Cumulative

3. Comparison of Maximum Total Annual Sulfur (S) and Nitrogen (N) Deposition to the Minimum Green Line Value for each element

Model Year	Dry and Wet Annual S Deposition (kg/ha-yr)	Model Year	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	5.80E-04	2001	0.0E+00
2002	6.40E-04	2002	0.0E+00
2003	6.68E-04	2003	0.0E+00
Max. Annual Dep.	6.68E-04	Max. Annual Dep.	0.0E+00
Green Line (kg/ha-yr)	3.00	Green Line (kg/ha-yr)	3.00
Above Green Line?	NO	Above Green Line?	NO

Table 4.24a. Soils and Vegetation Deposition Impacts at Escalante, 200-foot Overburden, Alternative B, Cumulative

1. Annual Total Sulfur (S) Deposition estimated by CALPOST from dry and wet deposition of SO_2 and $(NH_4)_2SO_4$ modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Sulfur Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual S Deposition (g/m^2-yr)	Dry and Wet Annual S Deposition (kg/ha-yr)
2001	2.60E-12	3,600	8,760	8.19E-05	8.19E-04
2002	2.81E-12	3,600	8,760	8.86E-05	8.86E-04
2003	3.04E-12	3,600	8,760	9.58E-05	9.58E-04

Table 4.24b. Soils and Vegetation Deposition Impacts at Escalante, 200-foot Overburden, Alternative B, Cumulative

2. Annual Total Nitrogen (N) Deposition estimated by CALPOST from dry and wet deposition of $(NH_4)_2SO_4$, NOx, and HNO_3 modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Nitrogen Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual N Deposition (g/m^2-yr)	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	0.0E+00	3,600	8,760	0.0E+00	0.0E+00
2002	0.0E+00	3,600	8,760	0.0E+00	0.0E+00
2003	0.0E+00	3,600	8,760	0.0E+00	0.0E+00

Table 4.24c. Soils and Vegetation Deposition Impacts at Escalante, 200-foot Overburden, Alternative B, Cumulative

3. Comparison of Maximum Total Annual Sulfur (S) and Nitrogen (N) Deposition to the Minimum Green Line Value for each element

Model Year	Dry and Wet Annual S Deposition (kg/ha-yr)	Model Year	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	8.19E-04	2001	0.0E+00
2002	8.86E-04	2002	0.0E+00
2003	9.58E-04	2003	0.0E+00
Max. Annual Dep.	9.58E-04	Max. Annual Dep.	0.0E+00
Green Line (kg/ha-yr)	3.00	Green Line (kg/ha-yr)	3.00
Above Green Line?	NO	Above Green Line?	NO

Table 4.25a. Soils and Vegetation Deposition Impacts at Escalante, 300-foot Overburden, Alternative C, Cumulative

1. Annual Total Sulfur (S) Deposition estimated by CALPOST from dry and wet deposition of SO_2 and $(NH_4)_2SO_4$ modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Sulfur Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual S Deposition (g/m^2-yr)	Dry and Wet Annual S Deposition (kg/ha-yr)
2001	2.60E-12	3,600	8,760	8.20E-05	8.20E-04
2002	2.81E-12	3,600	8,760	8.86E-05	8.86E-04
2003	3.04E-12	3,600	8,760	9.59E-05	9.59E-04

Table 4.25b. Soils and Vegetation Deposition Impacts at Escalante, 300-foot Overburden, Alternative C, Cumulative

2. Annual Total Nitrogen (N) Deposition estimated by CALPOST from dry and wet deposition of $(NH_4)_2SO_4$, NOx, and HNO_3 modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Nitrogen Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual N Deposition (g/m^2-yr)	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	0.0E+00	3,600	8,760	0.0E+00	0.0E+00
2002	0.0E+00	3,600	8,760	0.0E+00	0.0E+00
2003	0.0E+00	3,600	8,760	0.0E+00	0.0E+00

Table 4.25c. Soils and Vegetation Deposition Impacts at Escalante, 300-foot Overburden, Alternative C, Cumulative

3. Comparison of Maximum Total Annual Sulfur (S) and Nitrogen (N) Deposition to the Minimum Green Line Value for each element

Model Year	Dry and Wet Annual S Deposition (kg/ha-yr)	Model Year	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	8.20E-04	2001	0.0E+00
2002	8.86E-04	2002	0.0E+00
2003	9.59E-04	2003	0.0E+00
Max. Annual Dep.	9.59E-04	Max. Annual Dep.	0.0E+00
Green Line (kg/ha-yr)	3.00	Green Line (kg/ha-yr)	3.00
Above Green Line?	NO	Above Green Line?	NO

Table 4.26a. Soils and Vegetation Deposition Impacts at Grand Canyon, 200-foot Overburden, Alternative B, Cumulative

1. Annual Total Sulfur (S) Deposition estimated by CALPOST from dry and wet deposition of SO_2 and $(NH_4)_2SO_4$ modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Sulfur Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual S Deposition (g/m^2-yr)	Dry and Wet Annual S Deposition (kg/ha-yr)
2001	1.96E-13	3,600	8,760	6.19E-06	6.19E-05
2002	2.94E-13	3,600	8,760	9.28E-06	9.28E-05
2003	2.76E-13	3,600	8,760	8.69E-06	8.69E-05

Table 4.26b. Soils and Vegetation Deposition Impacts at Grand Canyon, 200-foot Overburden, Alternative B, Cumulative

2. Annual Total Nitrogen (N) Deposition estimated by CALPOST from dry and wet deposition of $(NH_4)_2SO_4$, NOx, and HNO_3 modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Nitrogen Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual N Deposition (g/m^2-yr)	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	0.0E+00	3,600	8,760	0.0E+00	0.0E+00
2002	0.0E+00	3,600	8,760	0.0E+00	0.0E+00
2003	0.0E+00	3,600	8,760	0.0E+00	0.0E+00

Table 4.26c. Soils and Vegetation Deposition Impacts at Grand Canyon, 200-foot Overburden, Alternative B, Cumulative

3. Comparison of Maximum Total Annual Sulfur (S) and Nitrogen (N) Deposition to the Minimum Green Line Value for each element

Model Year	Dry and Wet Annual S Deposition (kg/ha-yr)	Model Year	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	6.19E-05	2001	0.0E+00
2002	9.28E-05	2002	0.0E+00
2003	8.69E-05	2003	0.0E+00
Max. Annual Dep.	9.28E-05	Max. Annual Dep.	0.0E+00
Green Line (kg/ha-yr)	3.00	Green Line (kg/ha-yr)	3.00
Above Green Line?	NO	Above Green Line?	NO

Table 4.27a. Soils and Vegetation Deposition Impacts at Grand Canyon, 300-foot Overburden, Alternative C, Cumulative

1. Annual Total Sulfur (S) Deposition estimated by CALPOST from dry and wet deposition of SO_2 and $(NH_4)_2SO_4$ modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Sulfur Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual S Deposition (g/m^2-yr)	Dry and Wet Annual S Deposition (kg/ha-yr)
2001	1.97E-13	3,600	8,760	6.22E-06	6.22E-05
2002	2.95E-13	3,600	8,760	9.31E-06	9.31E-05
2003	2.77E-13	3,600	8,760	8.72E-06	8.72E-05

Table 4.27b. Soils and Vegetation Deposition Impacts at Grand Canyon, 300-foot Overburden, Alternative C, Cumulative

2. Annual Total Nitrogen (N) Deposition estimated by CALPOST from dry and wet deposition of $(NH_4)_2SO_4$, NOx, and HNO_3 modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Nitrogen Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual N Deposition (g/m^2-yr)	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	0.0E+00	3,600	8,760	0.0E+00	0.0E+00
2002	0.0E+00	3,600	8,760	0.0E+00	0.0E+00
2003	0.0E+00	3,600	8,760	0.0E+00	0.0E+00

Table 4.27c. Soils and Vegetation Deposition Impacts at Grand Canyon, 300-foot Overburden, Alternative C, Cumulative

3. Comparison of Maximum Total Annual Sulfur (S) and Nitrogen (N) Deposition to the Minimum Green Line Value for each element

Model Year	Dry and Wet Annual S Deposition (kg/ha-yr)	Model Year	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	6.22E-05	2001	0.0E+00
2002	9.31E-05	2002	0.0E+00
2003	8.72E-05	2003	0.0E+00
Max. Annual Dep.	9.31E-05	Max. Annual Dep.	0.0E+00
Green Line (kg/ha-yr)	3.00	Green Line (kg/ha-yr)	3.00
Above Green Line?	NO	Above Green Line?	NO

Table 4.28a. Soils and Vegetation Deposition Impacts at Zion, 200-foot Overburden, Alternative B, Cumulative

1. Annual Total Sulfur (S) Deposition estimated by CALPOST from dry and wet deposition of SO_2 and $(NH_4)_2SO_4$ modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Sulfur Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual S Deposition (g/m^2-yr)	Dry and Wet Annual S Deposition (kg/ha-yr)
2001	2.91E-13	3,600	8,760	9.18E-06	9.18E-05
2002	2.87E-13	3,600	8,760	9.05E-06	9.05E-05
2003	2.79E-13	3,600	8,760	8.80E-06	8.80E-05

Table 4.28b. Soils and Vegetation Deposition Impacts at Zion, 200-foot Overburden, Alternative B, Cumulative

2. Annual Total Nitrogen (N) Deposition estimated by CALPOST from dry and wet deposition of $(NH_4)_2SO_4$, NOx, and HNO_3 modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Nitrogen Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual N Deposition (g/m^2-yr)	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	0.0E+00	3,600	8,760	0.0E+00	0.0E+00
2002	0.0E+00	3,600	8,760	0.0E+00	0.0E+00
2003	0.0E+00	3,600	8,760	0.0E+00	0.0E+00

Table 4.28c. Soils and Vegetation Deposition Impacts at Zion, 200-foot Overburden, Alternative B, Cumulative

3. Comparison of Maximum Total Annual Sulfur (S) and Nitrogen (N) Deposition to the Minimum Green Line Value for each element

Model Year	Dry and Wet Annual S Deposition (kg/ha-yr)	Model Year	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	9.18E-05	2001	0.0E+00
2002	9.05E-05	2002	0.0E+00
2003	8.80E-05	2003	0.0E+00
Max. Annual Dep.	9.18E-05	Max. Annual Dep.	0.0E+00
Green Line (kg/ha-yr)	3.00	Green Line (kg/ha-yr)	3.00
Above Green Line?	NO	Above Green Line?	NO

Table 4.29a. Soils and Vegetation Deposition Impacts at Zion, 300-foot Overburden, Alternative C, Cumulative

1. Annual Total Sulfur (S) Deposition estimated by CALPOST from dry and wet deposition of SO_2 and $(NH_4)_2SO_4$ modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Sulfur Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual S Deposition (g/m^2-yr)	Dry and Wet Annual S Deposition (kg/ha-yr)
2001	3.02E-13	3,600	8,760	9.51E-06	9.51E-05
2002	2.94E-13	3,600	8,760	9.27E-06	9.27E-05
2003	2.86E-13	3,600	8,760	9.02E-06	9.02E-05

Table 4.29b. Soils and Vegetation Deposition Impacts at Zion, 300-foot Overburden, Alternative C, Cumulative

2. Annual Total Nitrogen (N) Deposition estimated by CALPOST from dry and wet deposition of $(NH_4)_2SO_4$, NOx, and HNO_3 modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Nitrogen Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual N Deposition (g/m^2-yr)	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	0.0E+00	3,600	8,760	0.0E+00	0.0E+00
2002	0.0E+00	3,600	8,760	0.0E+00	0.0E+00
2003	0.0E+00	3,600	8,760	0.0E+00	0.0E+00

Table 4.29c. Soils and Vegetation Deposition Impacts at Zion, 300-foot Overburden, Alternative C, Cumulative

3. Comparison of Maximum Total Annual Sulfur (S) and Nitrogen (N) Deposition to the Minimum Green Line Value for each element

Model Year	Dry and Wet Annual S Deposition (kg/ha-yr)	Model Year	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	9.51E-05	2001	0.0E+00
2002	9.27E-05	2002	0.0E+00
2003	9.02E-05	2003	0.0E+00
Max. Annual Dep.	9.51E-05	Max. Annual Dep.	0.0E+00
Green Line (kg/ha-yr)	3.00	Green Line (kg/ha-yr)	3.00
Above Green Line?	NO	Above Green Line?	NO

Total deposition impacts from direct project and regional sources were also compared to the Fox et al, green lines, and are presented in Tables 4.20-4.29. Background deposition values were never provided, and hence not considered. Once again all S deposition impacts are below the green line thresholds. All N deposition impacts are also considerably below the green line values. The improvements in the cumulative cases versus the Alton alone cases is due to the large nitrogen oxide emission decrease from the Navajo generating station. In fact, the majority of the N deposition values turned out to be 0 - signifying that the Navajo emission decrease over the annual period exceeded the increased impacts from other sources. CALPUFF was used to predict annual deposition fluxes of S and N at Navajo Lake for one scenario - the 300-foot overburden Alternative C case. This is the highest emission scenario for Alton, and provides a conservative estimate. These results are shown in Table 4.30. However, because no data on lake chemistry at Navajo Lake are available, no estimates of ANC change in Navajo Lake were performed.

Table 4.30a. Deposition Impacts at Navajo Lake, 300-foot Overburden, Alternative C (tract only)

1. Annual Total Sulfur (S) Deposition estimated by CALPOST from dry and wet deposition of SO_2 and $(NH_4)_2SO_4$ modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Sulfur Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual S Deposition (g/m^2-yr)	Dry and Wet Annual S Deposition (kg/ha-yr)
2001	5.39E-14	3,600	8,760	1.70E-06	1.70E-05
2002	5.01E-14	3,600	8,760	1.58E-06	1.58E-05
2003	4.59E-14	3,600	8,760	1.45E-06	1.45E-05

Table 4.30b. Deposition Impacts at Navajo Lake, 300-foot Overburden, Alternative C (tract only)

2. Annual Total Nitrogen (N) Deposition estimated by CALPOST from dry and wet deposition of $(NH_4)_2SO_4$, NOx, and HNO_3 modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Nitrogen Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual N Deposition (g/m^2-yr)	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	1.39E-11	3,600	8,760	4.40E-04	4.40E-03
2002	1.19E-11	3,600	8,760	3.74E-04	3.74E-03
2003	1.04E-11	3,600	8,760	3.29E-04	3.29E-03

4.3.3 *Visibility*

CALPOST was run using the FLAG data to calculate the change in light extinction from natural background conditions. This procedure computes light extinction changes from seasonal estimates of natural background aerosol concentrations and either monthly relative humidity factors (method 6) or hourly relative humidity data from the CALMET. visb.dat file (method 2), and CALPUFF-predicted particle species concentrations. Seasonal background extinction values used for the FLAG method are shown in Table 4.3. Those values were input to CALPOST as variables BKSO4 (dry hygroscopic - the value from Table 4.3 divided by 3) and BKSOIL (non-hygroscopic). Using these parameters, CALPOST calculated the change in daily (24-hour) visibility at each receptor, with the results reported in percent change in light extinction and change in deciview (dv). The CALPOST switch "MVISBK" was set to 6 in one test (method 6) and set to 2 in the other test (method 2). The relative humidity data cutoff in CALPOST was set to 90 for the method 2 test. The FLAG method conservatively assumes that the seasonal natural visibility conditions occur every day during the entire season.

Atmospheric light extinction relative to background conditions is used to measure regional haze. Analysis thresholds for atmospheric light extinction are set forth in FLAG (2000). The thresholds are defined as 5% and 10% of the reference background visibility (or 0.5 and 1.0 dv) for sources as a result of mining operations on the tract alone and cumulative source impacts, respectively. In general, if impacts are greater than these thresholds, FLMs may consider the conditions (magnitude, frequency, duration, etc.) of the impact on a case-by-case basis. These thresholds and the FLAG guidelines were developed for NSR applications where an AQRV analysis is required as part of a PSD permit application.

Visibility results for the Alton tract alone are presented in Table 4.31 (200-foot overburden removal, Alternative B) and Table 4.32 (300-foot overburden removal, Alternative C). These tables represent both the lowest and highest emission cases, and summarize method 2 and method 6 processing. For the 200-foot overburden scenario under Alternative B, only Zion NP has an extinction change that exceeds 5%. Results from the 300-foot overburden scenario under Alternative C show that in addition to Zion NP, Grand Canyon NP and Grand Staircase-Escalante also have extinctions in excess of 5%. There are no extinction changes exceeding 10% in any of the areas of interest (maximum change of 5.45% at Grand Canyon).

Cumulative visibility results are presented in Tables 4.33 and 4.34 (the same two Alton emission cases as above). For the 200-foot overburden scenario under Alternative B, no areas with the exceptions of Capital Reef and Bryce Canyon National Parks exceed the 10% change threshold. The same holds true for the 300-foot overburden scenario under Alternative C. Capitol Reef NP has visibility extinction changes that surpass 10%, on only one day during the modeled three year period(maximum of 17.56% for method 2 and 10.74% for method 6). This impact is due to one of the regional sources, as the Alton alone impacts at Capitol Reef NP were small (maximum change of 1.80%). This single impact at Capitol Reef occurred on Dec 4, 2001 – and was located at receptor number 1431 – on the northeast side of the park (the opposite side from the Alton complex). Bryce Canyon had a total of four days using method 2 processing that exceeded a 10% change for the 300-foot overburden scenario, and also four days using method 6. For the 200-foot overburden case, Bryce Canyon only had one day that exceeded 10%, and that was using method 2.

Table 4.31. Tract-only Visibility Impacts, 200-foot Overburden, Alternative B

METHOD 2	**Year**			**Year**			**Year**		
	2001	**2001**	**2001**	**2002**	**2002**	**2002**	**2003**	**2003**	**2003**
Class I/Class II Area	**# Days > 5%**	**# Days > 10%**	**Max Change (%)**	**# Days > 5%**	**# Days > 10%**	**Max Change (%)**	**# Days > 5%**	**# Days > 10%**	**Max Change (%)**
Capitol Reef NP	0	0	0.95	0	0	1.08	0	0	0.87
Grand Canyon NP	0	0	2.42	0	0	1.70	0	0	1.75
Zion NP	1	0	5.13	2	0	5.33	0	0	4.46
Grand Staircase-Escalante NM	0	0	1.55	0	0	2.77	0	0	2.06
METHOD 6	**Year**			**Year**			**Year**		
	2001	**2001**	**2001**	**2002**	**2002**	**2002**	**2003**	**2003**	**2003**
Class I/Class II Area	**# Days > 5%**	**# Days > 10%**	**Max Change (%)**	**# Days > 5%**	**# Days > 10%**	**Max Change (%)**	**# Days > 5%**	**# Days > 10%**	**Max Change (%)**
Capitol Reef NP	0	0	1.13	0	0	1.19	0	0	0.96
Grand Canyon NP	0	0	2.85	0	0	1.32	0	0	1.37
Zion NP	0	0	4.89	1	0	5.38	0	0	4.59
Grand Staircase-Escalante NM	0	0	1.50	0	0	2.13	0	0	2.54

Table 4.32. Tract-only Visibility Impacts, 300-foot Overburden, Alternative C

METHOD 2	**Year**			**Year**			**Year**		
	2001	**2001**	**2001**	**2002**	**2002**	**2002**	**2003**	**2003**	**2003**
Class I/Class II Area	**# Days > 5%**	**# Days > 10%**	**Max Change(%)**	**# Days > 5%**	**# Days > 10%**	**Max Change(%)**	**# Days > 5%**	**# Days > 10%**	**Max Change(%)**
Capitol Reef NP	0	0	1.68	0	0	1.50	0	0	1.61
Grand Canyon NP	0	0	4.44	0	0	3.32	0	0	3.39
Zion NP	1	0	5.15	2	0	5.33	0	0	4.46
Grand Staircase-Escalante NM	0	0	2.75	1	0	5.37	0	0	3.70
METHOD 6	**Year**			**Year**			**Year**		
	2001	**2001**	**2001**	**2002**	**2002**	**2002**	**2003**	**2003**	**2003**
Class I/Class II Area	**# Days > 5%**	**# Days > 10%**	**Max Change (%)**	**# Days > 5%**	**# Days > 10%**	**Max Change (%)**	**# Days > 5%**	**# Days > 10%**	**Max Change (%)**
Capitol Reef NP	0	0	1.69	0	0	1.71	0	0	1.80
Grand Canyon NP	1	0	5.45	0	0	2.35	0	0	2.35
Zion NP	0	0	4.91	1	0	5.38	0	0	4.74
Grand Staircase-Escalante NM	0	0	2.69	0	0	3.83	0	0	4.84

Table 4.33. Cumulative Visibility Impacts, 200-foot Overburden, Alternative B

METHOD 2	Year			Year			Year		
	2001	2001	2001	2002	2002	2002	2003	2003	2003
Class I/Class II Area	# Days > 5%	# Days > 10%	Max Change (%)	# Days > 5%	# Days > 10%	Max Change (%)	# Days > 5%	# Days > 10%	Max Change (%)
Bryce Canyon NP	0	0	4.73	6	1	13.45	2	0	5.92
Capitol Reef NP	3	1	17.14	2	0	7.12	3	0	7.84
Grand Canyon NP	0	0	2.45	0	0	1.54	0	0	2.14
Zion NP	1	0	5.00	2	0	5.36	0	0	4.47
Grand Staircase-Escalante NM	1	0	5.31	3	0	5.37	0	0	4.87
METHOD 6	**Year**			**Year**			**Year**		
	2001	2001	2001	2002	2002	2002	2003	2003	2003
Class I/Class II Area	# Days > 5%	# Days > 10%	Max Change (%)	# Days > 5%	# Days > 10%	Max Change (%)	# Days > 5%	# Days > 10%	Max Change (%)
Bryce Canyon NP	0	0	4.74	5	0	9.63	1	0	5.57
Capitol Reef NP	2	1	10.48	3	0	6.50	6	0	7.33
Grand Canyon NP	0	0	2.87	0	0	1.86	0	0	2.01
Zion NP	0	0	4.78	1	0	5.38	0	0	4.61
Grand Staircase-Escalante NM	0	0	4.96	2	0	5.87	3	0	6.18

Table 4.34. Cumulative Visibility Impacts, 300-foot Overburden, Alternative C

METHOD 2	**Year**			**Year**			**Year**		
	2001	**2001**	**2001**	**2002**	**2002**	**2002**	**2003**	**2003**	**2003**
Class I/Class II Area	**# Days > 5%**	**# Days > 10%**	**Max Change (%)**	**# Days > 5%**	**# Days > 10%**	**Max Change (%)**	**# Days > 5%**	**# Days > 10%**	**Max Change (%)**
Bryce Canyon NP	4	0	7.92	14	3	29.07	6	1	12.44
Capitol Reef NP	3	1	17.56	2	0	7.16	4	0	7.85
Grand Canyon NP	0	0	4.47	0	0	2.17	0	0	3.78
Zion NP	2	0	5.64	2	0	5.36	0	0	4.47
Grand Staircase-Escalante NM	1	0	5.95	4	0	5.79	1	0	5.02
METHOD 6	**Year**			**Year**			**Year**		
	2001	**2001**	**2001**	**2002**	**2002**	**2002**	**2003**	**2003**	**2003**
Class I/Class II Area	**# Days > 5%**	**# Days > 10%**	**Max Change (%)**	**# Days > 5%**	**# Days > 10%**	**Max Change (%)**	**# Days > 5%**	**# Days > 10%**	**Max Change (%)**
Bryce Canyon NP	3	0	7.11	17	4	21.67	4	0	8.97
Capitol Reef NP	2	1	10.74	3	0	6.55	6	0	7.34
Grand Canyon NP	1	0	5.48	0	0	2.46	0	0	2.71
Zion NP	0	0	4.92	1	0	5.38	0	0	4.61
Grand Staircase-Escalante NM	0	0	4.96	2	0	5.92	4	0	6.21

5 ASSESSMENT OF AIR QUALITY IMPACTS

5.1 Near-field Air Quality Impacts

Near-field analysis means the airshed within a 50 × 50–km area with the Alton Coal Tract in the center. Near-field analysis was conducted to assess impacts to public health and welfare and to estimate potential impacts to lakes and viewsheds in nearby (near-field) national parks.

In particular, a near-field ambient air quality impact assessment was performed to quantify maximum-modeled pollutant impacts near the tract. To demonstrate that air quality–related values and standards are protected requires the development of short-term (hourly and daily) and long-term emission rates of regulated pollutants, application of regulatory-approved models to quantify predicted concentrations, and a comparison of predicted impacts plus applicable background concentrations (RFD/RFFA sources) with applicable standards.

The EPA's guideline model, AERMOD, was the refined air dispersion model used to assess these near-field impacts and to verify compliance with the applicable NAAQS in the ambient airshed that encloses the Alton Coal Lease Tract. The modeling analysis focused on the reasonable maximum development year (therefore, the maximum emission year) for the mine. Using this anticipated maximum potential emission year, the AERMOD dispersion model was used to analyze potential near-field impacts of PM_{10}, $PM_{2.5}$, nitrogen dioxide, carbon monoxide, and sulfur dioxide. Photochemical conversion of NO_x and VOCs to O_3 and the secondary formation of $PM_{2.5}$ concentrations from NO_x and SO_2 emissions were not included in the Protocol. These chemical reactions are not considered to be near-field impacts, and they cannot be simulated with the recommended near-field model (AERMOD).

Compliance with the respective annual standards was based on the highest modeled value for each year of the four-year meteorological dataset. Demonstration of compliance with the short-term NAAQS (24-hour, 8-hour, 3-hour, and 1-hour) for carbon monoxide, nitrogen dioxide, and sulfur dioxide was based on the highest second-high modeled concentration for each year of the four-year meteorological period, added to the respective background concentrations

Compliance demonstrations with the 24-hour $PM_{2.5}$ standard use the average of the first highest 24-hour concentration in each year over the length of the meteorological data period. Compliance with the 24-hour PM_{10} standard was verified against the highest fifth-high modeled concentration over the 4-year period. All modeled concentrations were rounded to match the form of the appropriate NAAQS.

5.1.1 *PM_{10} AERMOD Results*

The modeled PM_{10} concentrations associated with the maximum development year are summarized below. Both the 200-foot overburden and 300-foot overburden removal scenarios were modeled for compliance under each action alternative. Results are presented below for the 24-hour highest fifth-high PM_{10} concentration over the four-year modeled dataset for both 200-foot and 300-foot scenarios.

Table 5.1. Highest Fifth-high PM_{10} Modeling Results

Overburden Thickness (feet)	Alternative	Modeled (µg/m3)	Background (µg/m^3)	Total (µg/m^3)	NAAQS (µg/m^3)
200	B	82.7	72	150	150
200	C	83.6	72	160	150
300	B	86.3	72	160	150
300	C	92.9	72	160	150

The 200-foot modeled concentrations indicate compliance with the NAAQS at all modeled receptors. However, the 300-foot results indicate a modeled exceedance at a receptor along the northwest side of the LNCM.

5.1.2 *$PM_{2.5}$ AERMOD Results*

The modeled $PM_{2.5}$ concentrations associated with the maximum development year are summarized below. Both the 200-foot overburden and 300-foot overburden removal scenarios were modeled for compliance under each action alternative. Model results in the tables below for the 24-hour averaging period indicate the average first-high concentration over all modeled years for both 200-foot and 300-foot scenarios. The highest predicted annual concentration over all modeled years for both 200-foot and 300-foot scenarios is presented in the table. Model results in the tables below for the 24-hour averaging periods represent the average concentrations over the four-year meteorological dataset for both 200-foot and 300-foot scenarios.

Table 5.2. $PM_{2.5}$ Modeling Results

Overburden Depth (feet)	Alternative	Averaging Period	Modeled (µg/m^3)	Background (µg/m^3)	Total (µg/m^3)	NAAQS (µg/m^3)
200	B	Annual	4.7	3.6	8	15
		24-hour	19.3	8.6	28	35
	C	Annual	5.1	3.6	9	15
		24-hour	21.1	8.6	30	35
300	B	Annual	6.0	3.6	10	15
		24-hour	22.7	8.6	31	35
	C	Annual	6.5	3.6	10	15
		24-hour	24.5	8.6	33	35

Both the 200-foot and 300-foot modeled concentrations indicate compliance with the NAAQS at all modeled receptors and for both Alternative B and Alternative C.

5.1.3 *Nitrogen Dioxide AERMOD Results*

The maximum-modeled nitrogen oxide concentrations associated with the maximum development year are summarized below. Both the 200-foot overburden and 300-foot overburden removal scenarios were modeled for compliance. The estimated nitrogen oxide emissions are the same for each overburden scenario under both action alternatives. A 75% ozone correction was applied to all annual nitrogen oxide modeling results in accordance with EPA's Ambient Ratio Method as a way to estimate ambient annual nitrogen dioxide concentrations from modeled nitrogen oxides emission rates.

Table 5.3. Annual Maximum Nitrogen Dioxide Modeling Results

Overburden Thickness (feet)	Modeled (µg/m^3)	Background (µg/m^3)	Total (µg/m^3)	NAAQS (µg/m^3)
200	31.6	17	49	100
300	99.9	17	117	100

The 200-foot modeled concentrations indicate compliance with the annual NAAQS at all modeled receptors. However, under the 300-foot overburden removal scenario, there are a few exceedances of the annual NAAQS. The disparity between the 200-foot and 300-foot scenarios is due to the higher emissions associated with the 300-foot scenario in conjunction with the location of the additional emissions on-site.

5.1.4 *Carbon Monoxide AERMOD Results*

The maximum-modeled carbon monoxide concentrations associated with the maximum development year are summarized below. Both the 200-foot overburden and 300-foot overburden removal scenarios were modeled for compliance. The estimated carbon monoxide emissions are the same for each overburden scenario under both action alternatives. Separate model runs were not necessary within each of the overburden removal depth scenarios.

Table 5.4. Carbon Monoxide Modeling Results

Overburden Thickness (feet)	Averaging Period	Modeled (µg/m^3)	Background (µg/m^3)	Total (µg/m^3)	NAAQS (µg/m^3)
200	8-hour	582	1,150	1,732	10,000
	1-hour	2,639	1,150	3,789	40,000
300	8-hour	582	1,150	1,732	10,000
	1-hour	2,639	1,150	3,789	40,000

Both 200-foot and 300-foot modeled concentrations indicate compliance with the 1-hour and 8-hour NAAQS at all modeled receptors.

5.1.5 *Sulfur Dioxide AERMOD Results*

The modeled sulfur dioxide concentrations associated with the maximum development year are summarized below. The potential sulfur dioxide emissions associated with the mining activities are nominal but modeling was still completed. Both the 200-foot overburden and 300-foot overburden removal scenarios were modeled for compliance. Because the estimated sulfur dioxide emissions for Alternative B and C are the same, separate model runs were not necessary within each of the overburden scenarios. The applicable averaging periods for comparison to the sulfur dioxide NAAQS include the 3-hour, 24-hour, and annual averaging periods.

Table 5.5. Sulfur Dioxide Modeling Results

Overburden Thickness (feet)	Averaging Period	Modeled ($\mu g/m^3$)	Background ($\mu g/m^3$)	Total ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)
200	3-hour	1.64	20	22	1,300
	24-hour	0.47	10	10	365
	Annual	0.10	5	5	80
300	3-hour	1.90	20	22	1,300
	24-hour	0.47	10	10	365
	Annual	0.14	5	5	80

Both 200-foot and 300-foot modeled concentrations indicate compliance with the 1-hour and 8-hour NAAQS at all modeled receptors.

5.1.6 *HAP Impact Assessment*

Hazardous air pollutants can cause various adverse health effects. They are not part of the NAAQS, but high levels at the property boundary could indicate the need for further analysis and/or mitigation strategies. Therefore, HAPs have been included in the emission inventory and were modeled in the AERMOD near-field analysis. The modeled concentrations were compared with known health exposure levels as a means of assessing potential impacts.

The potential emissions of HAPs associated with this project are relatively insignificant. The only quantifiable source of HAPs from the Alton Coal lease in the emissions inventory is the proposed generators. The potential HAP emissions are the same for both the 200-foot and 300-foot overburden removal scenarios, as well as the Alternative B and C pit layouts. As seen in Tables 5.6a and 5.6b, no adverse impacts associated specifically with the Alton sources are anticipated.

Table 5.6a. Hazardous Air Pollutants AERMOD Modeling Results

Pollutant	Model Years	Average Period	Receptor Location		Modeled (µg/m^3)	Threshold (µg/m^3)[1]
			UTME	UTMN		
Benzene	2005-2008	1-hour	371800	4140300	0.440	1,300 (REL)
		24-hour	368400	4142500	0.046	53 (TSL)
		Annual	370060	4140000	0.003	30 (RfC)
Toluene	2005-2008	1-hour	371800	4140300	0.160	37,000 (REL)
		24-hour	368400	4142500	0.017	2,512 (TSL)
		Annual	370060	4140000	0.001	5,000 (RfC)
Xylenes	2005-2008	1-hour	371800	4140300	0.110	22,000 (REL)
		24-hour	368400	4142500	0.011	14,473 (TSL)
		Annual	370060	4140000	0.001	100 (RfC)
Formaldehyde	2005-2008	1-hour	371800	4140300	0.045	37 (TSL)
		Annual	370060	4140000	0.0003	9.8 (RfC)

[1] REL = recommended exposure limit; TSL = Toxic Screening Level; RfC = Reference Concentration

Table 5.6b HAPs Risk Assessment

Analysis[1]	HAP Constituent	Carcinogenic Annual RfC (Risk Factor)[2] 1/(µg/m^3)	Exposure Adjustment Factor	Modeled (µg/m^3)	Calculated Risk	Significance Criterion
MLE	Benzene	7.80E-06	0.0949	0.003	2.2E-09	1.00E-06
MLE	Formaldehyde	5.50E-09	0.0949	0.0003	1.6E-13	1.00E-06
MEI	Benzene	7.80E-06	0.33	0.003	7.7E-09	1.00E-06
MEI	Formaldehyde	5.50E-09	0.33	0.0003	5.4E-13	1.00E-06

[1] MLE = most likely exposure; MEI = maximally exposed individual.

[2] EPA Air Toxics Database, Table 1 (EPA 2007).

5.1.7 *Near-Field VISCREEN Analysis*

VISCREEN was used to assess potential visibility impacts within the near-field modeling grid at Bryce Canyon National Park. The primary pollutants of concern that may impact visibility in the near-field are particulate matter and nitrogen oxide.

The Level-2 VISCREEN visual impacts using this most conservative dispersion category inside of Bryce Canyon National Park are summarized below in Tables 5.7a and 5.7b.

Table 5.7a Visual Impacts Inside of Bryce Canyon National Park, 200-foot Overburden Results

Background	Theta	Azimuth	Distance from Alton (km)	Alpha	Delta E		Contrast	
					Criteria	Plume	Criteria	Plume
SKY	10	157	35	11	6.21	0.267	0.13	0.005
SKY	140	157	35	11	3.41	0.074	0.13	-0.002
TERRAIN	10	84	18	84	6.8	0.691	0.28	0.003
TERRAIN	140	84	18	84	4.05	0.029	0.28	0.00

Table 5.7b. Visual Impacts inside of Bryce Canyon National Park, 300-foot Overburden Results

Background	Theta	Azimuth	Distance from Alton (km)	Alpha	Delta E		Contrast	
					Criteria	Plume	Criteria	Plume
SKY	10	157	35	11	6.21	0.372	0.13	0.006
SKY	140	157	35	11	3.41	0.149	0.13	-0.003
TERRAIN	10	84	18	84	6.8	0.904	0.28	0.004
TERRAIN	140	84	18	84	4.05	0.041	0.28	0.000

These results demonstrate that the maximum impacts inside of Bryce Canyon National Park from a potential Alton mine plume under the 200-foot and 300-foot overburden removal scenarios will be less than the VISCREEN acceptance criteria for both color change (Delta E) and contrast.

5.1.8 *Far-field Analysis*

The purpose of the far-field analysis is to quantify potential air quality impacts to both ambient air concentrations and AQRVs from air pollutant emissions of nitrogen oxide, carbon monoxide, sulfur dioxide, PM_{10}, and $PM_{2.5}$ that are expected to result from mining operations on the tract. Photochemical conversion of NO_x and VOCs to O_3 and the secondary formation of $PM_{2.5}$ concentrations from NO_x and SO_2 emissions were not included in the Protocol. These chemical reactions cannot be simulated with the recommended far-field model (CALPUFF).

The analyses were performed using the EPA-recommended CALMET/CALPUFF/CALPOST modeling system to predict air quality direct and cumulative impacts at far-field PSD Class I areas and selected Class II areas. The term "CALPUFF" is generally used to represent the entire modeling system, including the pre- and post-processors.

5.1.8.1 CLASS I AND CLASS II INCREMENTS

Under federal and state PSD regulations, increases in ambient air concentrations in Class I areas are limited by PSD Class I Increments. Specifically, emissions associated with a particular development may

increase ambient concentrations above baseline levels only within those specific increments developed for sulfur dioxide, PM_{10}, and nitrogen dioxide. The modeling results for the maximum cumulative scenario are presented in Table 5.8.

Table 5.8. Class I and Class II Results

Pollutant	Averaging Period	Class I Analysis Results		Class II Analysis Results	
		Cumulative Concentration	Class I Increment	Cumulative Concentration	Class II Increment
PM_{10}	Annual	0.15	4	0.04	17
	24-hour	1.06	8	0.25	30
SO_2	Annual	0.00	2	0.001	20
	24-hour	0.02	5	0.01	91
	3-hour	0.06	25	0.07	512
NO_x	Annual	0.01	2.5	-0.01	25
$PM_{2.5}$	Annual	0.01	NA	0.004	NA
	24-hour	0.09	NA	0.03	NA
CO	8-hour	25	NA	52	NA
	1-hour	108	NA	118	NA

All of the results for the Alton alone modeling showed values far below the relevant increments. Cumulative results were produced for the maximum emission rate case (300-foot overburden removal, Alternative C) and are presented above. The impacts are significantly below both the Class I and Class II increments. Even though there are no increments for $PM_{2.5}$ or carbon monoxide, results are presented in the above table to convey a general impression of impact levels.

5.1.9 *Visibility*

Atmospheric light extinction relative to background conditions is used to measure regional haze. Analysis thresholds for atmospheric light extinction are set forth in FLAG (2000). The thresholds are defined as 5% and 10% of the reference background visibility (or 0.5 and 1.0 dv) for sources as a result of mining operations on the tract alone and cumulative source impacts, respectively.

Visibility results for the Alton tract alone are presented in Table 5.9 (200-foot overburden removal, Alternative B and 300-foot overburden removal, Alternative C). These results represent both the lowest and highest emission cases, and summarize method 2 and method 6 processing. For the 200-foot overburden scenario under Alternative B, only Zion NP has an extinction change that exceeds 5%. The 300-foot Alternative C results show that in addition to Zion NP, Grand Canyon NP and Grand Staircase-Escalante also have extinctions in excess of 5%. There are no extinction changes exceeding 10% in any of the areas of interest (maximum change of 5.5% at Grand Canyon).

Table 5.9. Visibility Results, Alton

Method 2	**200-foot Overburden, Alternative B**		**300-foot Overburden, Alternative C**	
Class I/Class II Area	**# Days > 5%**	**Max Change (%)**	**# Days > 5%**	**Max Change (%)**
Capitol Reef NP	0	1.1	0	1.5
Grand Canyon NP	0	1.7	0	3.3
Zion NP	2	5.3	2	5.3
Grand Staircase-Escalante NM	0	2.8	1	5.4
Method 6	**200-foot Overburden, Alternative B**		**300-foot Overburden, Alternative C**	
Class I/Class II Area	**# Days > 5%**	**Max Change (%)**	**# Days > 5%**	**Max Change (%)**
Capitol Reef NP	0	1.2	0	1.7
Grand Canyon NP	0	1.3	1	5.5
Zion NP	1	5.4	0	4.9
Grand Staircase-Escalante NM	0	2.1	0	2.7

Cumulative visibility results are presented in Table 5.10 (the same two Alton emission cases as above). For the 200-foot overburden scenario under Alternative B, all areas except Grand Canyon NP have extinction changes that exceed 5%. For the 300-foot overburden scenario under Alternative C, all areas have changes that exceed 5%. Only Capitol Reef and Bryce Canyon National Parks have visibility extinction changes that surpass 10%., For Capitol Reef, that is only on one day (maximum of 17.6% for method 2 and 10.7% for method 6). This impact is due to one of the regional sources, as the Alton alone impacts at Capitol Reef NP were small (maximum change of 1.80%). Bryce Canyon had a total of four days using method 2 processing that exceeded a 10% change for the 300-foot overburden scenario, and also four days using method 6. For the 200-foot overburden case, Bryce Canyon only had one day that exceeded 10%, and that was using method 2.

Table 5.10. Visibility Results - Cumulative

Method 2	**200-foot Overburden, Alternative B**			**300-foot Overburden, Alternative C**		
Class I/Class II Area	**# Days > 5%**	**# Days > 10%**	**Max Change (%)**	**# Days > 5%**	**# Days > 10%**	**Max Change (%)**
Bryce Canyon NP	8	1	13.5	24	4	29.1
Capitol Reef NP	3	1	17.1	3	1	17.6
Grand Canyon NP	0	0	2.5	0	0	4.5
Zion NP	1	0	5.0	2	0	5.6
Grand Staircase-Escalante NM	1	0	5.3	1	0	6.0
Method 6						
Class I/Class II Area	**# Days > 5%**	**# Days > 10%**	**Max Change (%)**	**# Days > 5%**	**# Days > 10%**	**Max Change (%)**
Bryce Canyon NP	6	0	9.6	24	4	21.7
Capitol Reef NP	2	1	10.5	2	1	10.7
Grand Canyon NP	0	0	2.9	1	0	5.5
Zion NP	0	0	4.8	0	0	4.9
Grand Staircase-Escalante NM	0	0	5.0	0	0	5.0

5.1.10 *Deposition*

Maximum predicted S and N deposition impacts were estimated for two direct project and cumulative source scenarios: the 200-foot overburden, Alternative B and the 300-foot overburden, Alternative C. As above, this approach gives a good representation of impacts from both the lowest and highest Alton emission scenarios.

Predicted direct project impacts were compared to the Fox et al, green line deposition values for total N and S deposition in the western U.S., which are defined as 3.00 kilogram per hectare per year (kg/ha-year) for both N and S. These results are presented in Table 5.11. Impacts for S deposition are below the green line value in all cases. The same is true for N deposition - no impacts exceed the green line value.

Total deposition impacts from direct project and regional sources were also compared to the green line value. Once again all S and N deposition impacts are below the green line thresholds. The improvements in the cumulative cases versus the Alton alone cases are due to the large nitrogen oxide emission decrease from the Navajo generating station. In fact, the majority of the N deposition values turned out to be 0 - signifying that the Navajo decrease over the annual period exceeded the positive impacts of the other sources.

Table 5.11. Deposition Results

Location	Overburden Thickness (feet)	Alt.	Alton Coal Tract				Cumulative Sources			
			Maximum Dry and Wet Annual S Deposition, (kg/ha-yr)	>Green Line?	Maximum Dry and Wet Annual N Deposition, (kg/ha-yr)	>Green Line?	Maximum Dry and Wet Annual S Deposition, (kg/ha-yr)	>Green Line?	Maximum Dry and Wet Annual N Deposition, (kg/ha-yr)	>Green Line?
Bryce Canyon	200	B	0.0001	No	0.0124	No	0.0003	No	0.0000	No
	300	C	0.0001	No	0.0262	No	0.0003	No	0.0110	No
Capitol Reef	200	B	0.0000	No	0.0004	No	0.0007	No	0.0000	No
	300	C	0.0000	No	0.0009	No	0.0007	No	0.0000	No
Grand Staircase Escalante	200	B	0.0000	No	0.0013	No	0.0010	No	0.0000	No
	300	C	0.0000	No	0.0024	No	0.0010	No	0.0000	No
Grand Canyon	200	B	0.0000	No	0.0003	No	0.0001	No	0.0000	No
	300	C	0.0000	No	0.0006	No	0.0001	No	0.0000	No
Zion	200	B	0.0000	No	0.0038	No	0.0001	No	0.0000	No
	300	C	0.0000	No	0.0087	No	0.0001	No	0.0000	No
Navajo Lake	300	C	0.0000	No	0.0044	No				

5.1.11 *Acid Neutralizing Capacity*

CALPUFF was used to predict annual deposition fluxes of S and N at Navajo Lake for one scenario - the 300-foot overburden scenario under Alternative C. This scenario produces the highest emissions for Alton, and provides a conservative estimate. These results are shown in Table 5.11. Because no data on lake chemistry at Navajo Lake are available, no estimates of acid neutralizing capacity change in Navajo Lake were performed.

5.2 Greenhouse Gases

Naturally occurring greenhouse gases (GHGs) include water vapor, carbon dioxide, methane (CH_4), nitrous oxide (N_2O), and ozone (O_3). Other man-made greenhouse gases include, hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF6). Water vapor accounts for the largest percentage of greenhouse effect. Next to water vapor, carbon dioxide is the most abundant GHG. Because carbon dioxide is relatively stable in the atmosphere and uniformly mixed throughout the troposphere and stratosphere, the climatic impact of carbon dioxide emissions does not depend on the carbon dioxide source location on earth. The Proposed Actions would produce GHG emissions from the combustion of fuel by the vehicles and generators.

Research on how emissions of GHGs influence global climate change and associated effects has focused on the overall impact of emissions from aggregate regional or global sources. This approach is required primarily because GHG emissions from single sources are small relative to aggregate emissions. The climate change research community has not yet developed tools specifically intended for evaluating or quantifying end-point impacts attributable to the emissions of GHGs from a single source. The current tools for simulating climate change generally focus on global and regional-scale modeling. Global and regional-scale models lack the capability to represent explicitly many important small-scale processes. As a result, confidence in regional- and sub-regional-scale projections is lower than at the global scale. There is thus limited scientific capability in assessing, detecting, or measuring the relationship between emissions of GHGs from a specific single source and any localized impacts.

Globally, approximately 30,377 million (MM) metric tons of carbon dioxide was added to the atmosphere through the combustion of fossil fuels in 2008 (EPA 2010). The highest on-site plus off-site carbon dioxide emission from the alternatives evaluated occur in the 300-foot overburden thickness alternatives (i.e, Alternatives B and C). The 77,153 tons (69,992 metric tons) of carbon dioxide calculated for these alternatives represents approximately 0.00023% of the global emissions, an insignificant fraction of that total.

The annual coal production from the Alton Mine is estimated to be approximately 2 million tons. The annual worldwide primary coal production based on 2008 data is approximately 7.3 billion tons (EIA 2008). The coal produced for the Alton mine could therefore be expected to produce approximately 0.028% of the total worldwide production.

Because site-specific data are not available, EPA's default emission factor of 4,810 pounds per ton of coal for subbituminous coal (EPA 2008) was used to approximate the annual emissions from combusting the 2 million tons of coal produced at the Alton Mine.

2 MMtons/yr Coal * 4,810 lbCO_2/ton of Coal / 2,000 lb/ton = 4.8 MM TPY CO_2

The resulting emissions of 4.8 million tons carbon dioxide per year (4.4 MM metric tons) would be emitted by the end user of the coal produced at the Alton Mine. This total represents 0.014% of the total carbon dioxide emissions from global fossil fuel combustion. A summary of these comparisons is presented in Table 5.12.

Table 5.12. Greenhouse Gas Comparisons

Comparison	Global	Alton Project	Alton Coal	Alton % of Global
CO2 Emissions from Fossil Fuel Combustion, MM metric tons/yr	30,377	0.067	4.4	0.015
Annual Coal Production, million tons	7271	2	–	0.028

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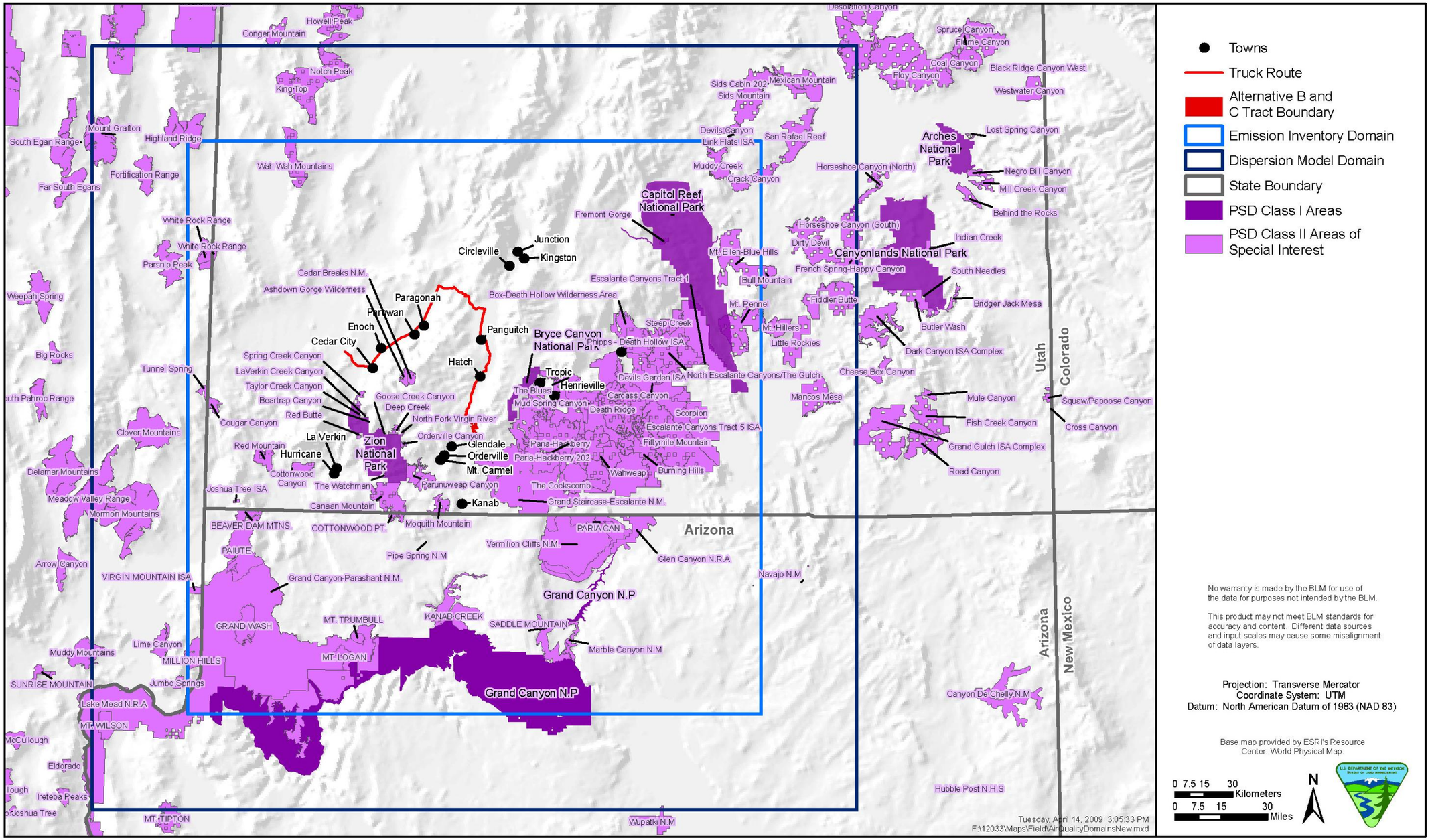
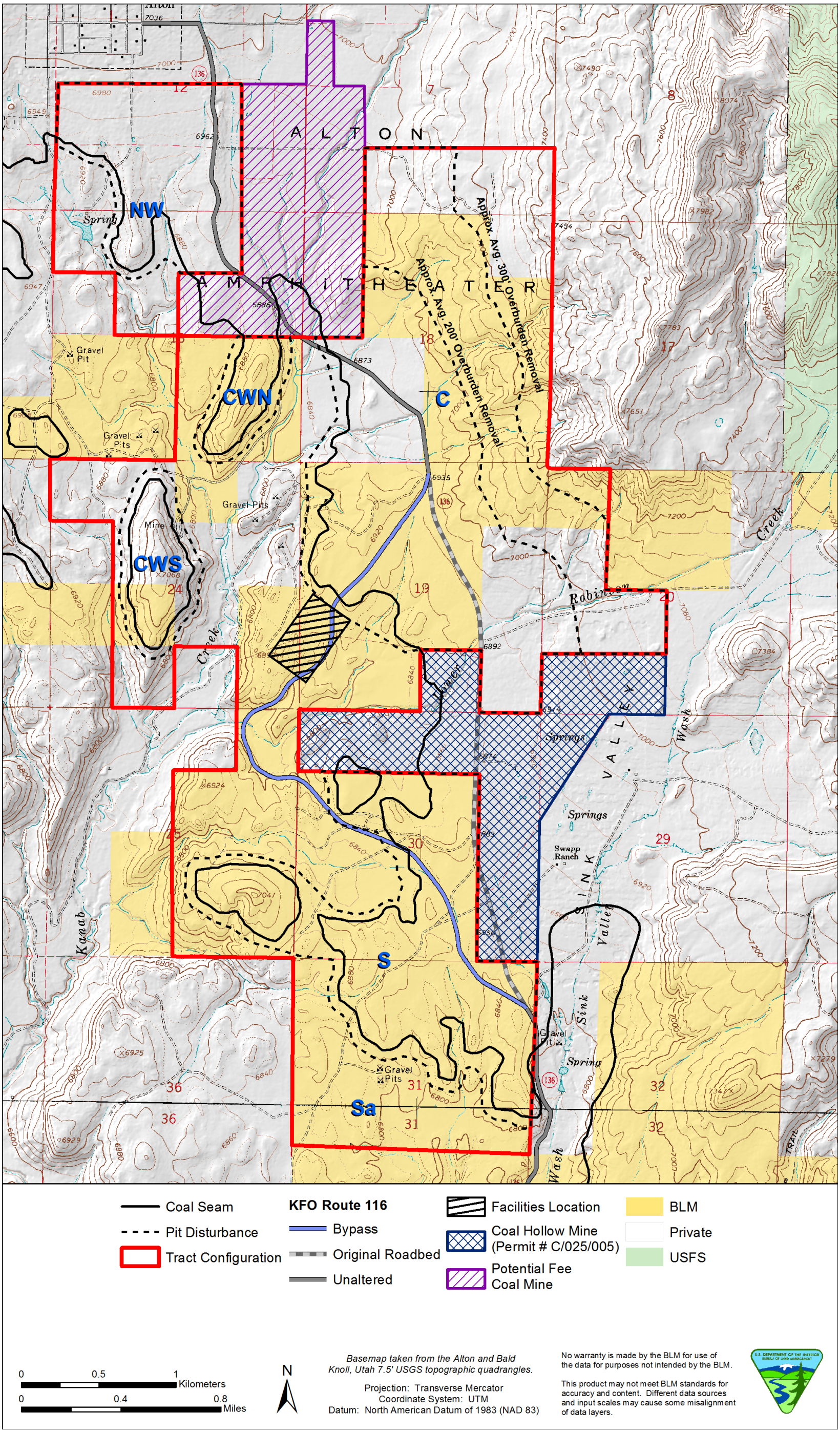
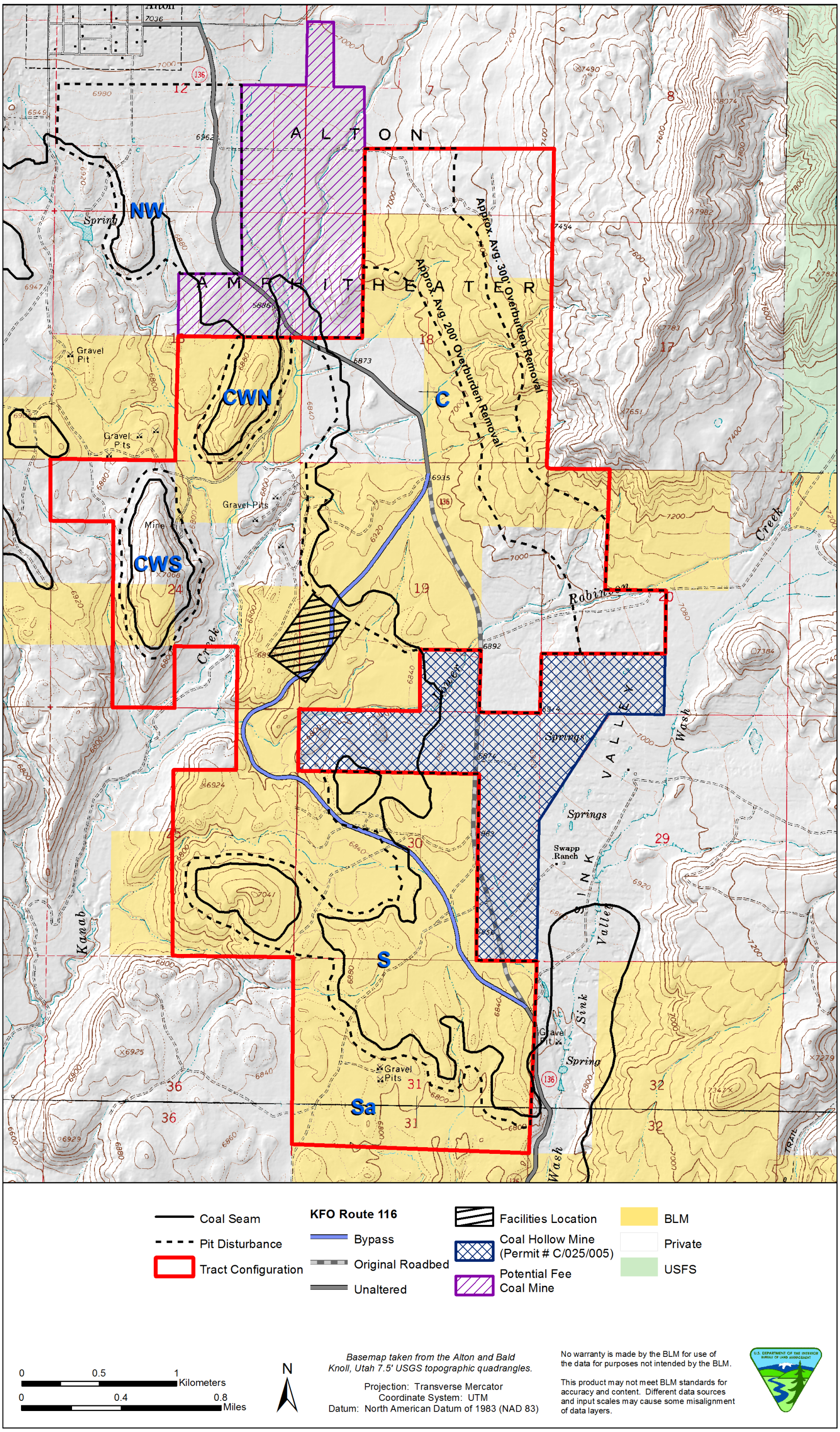
Appendix A: Maps



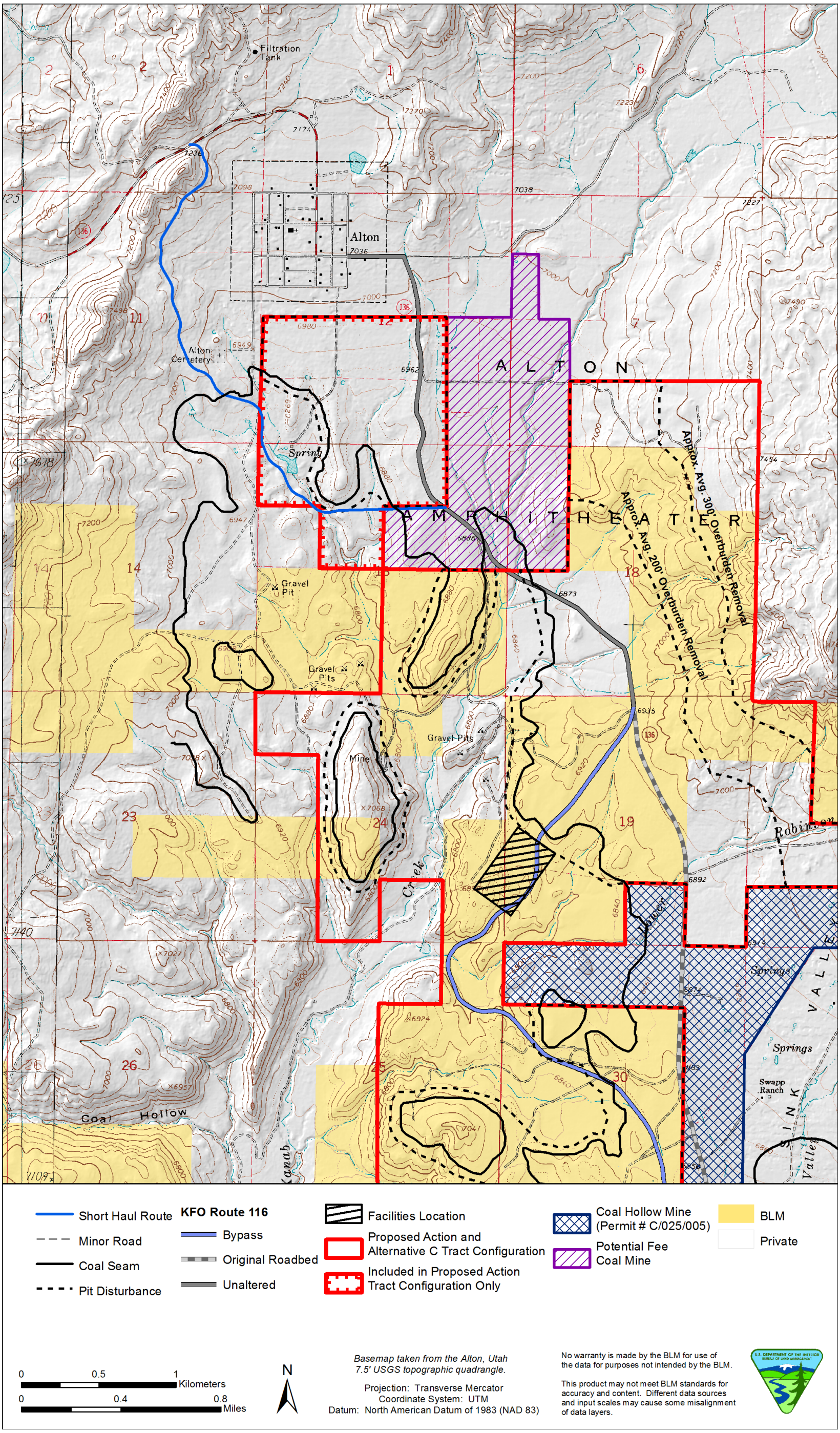
Map 1.1. Emission inventory and modeling domain (air resource modeling domain).



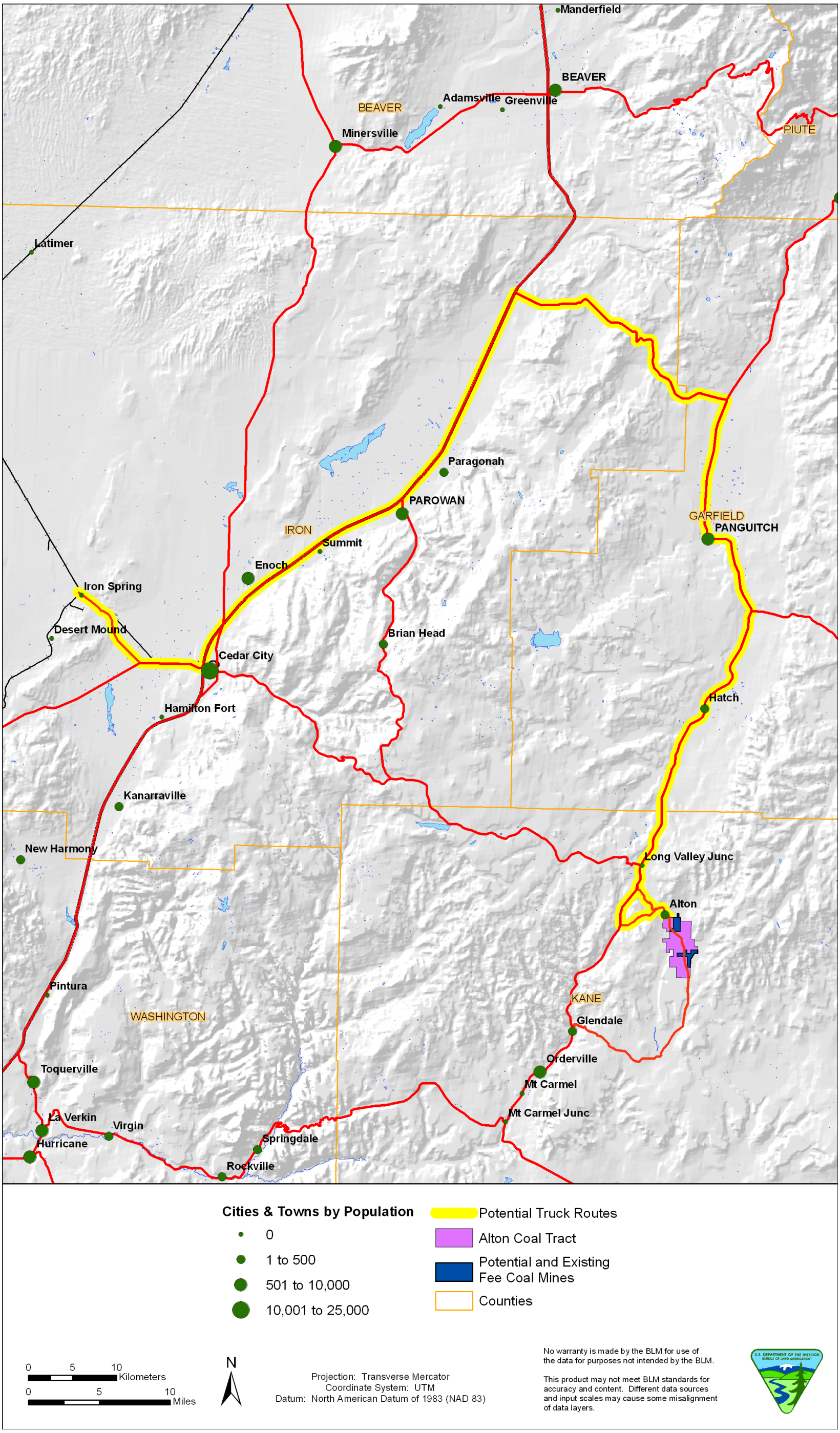
Map 1.2. Alton Coal Tract under Alternative B.



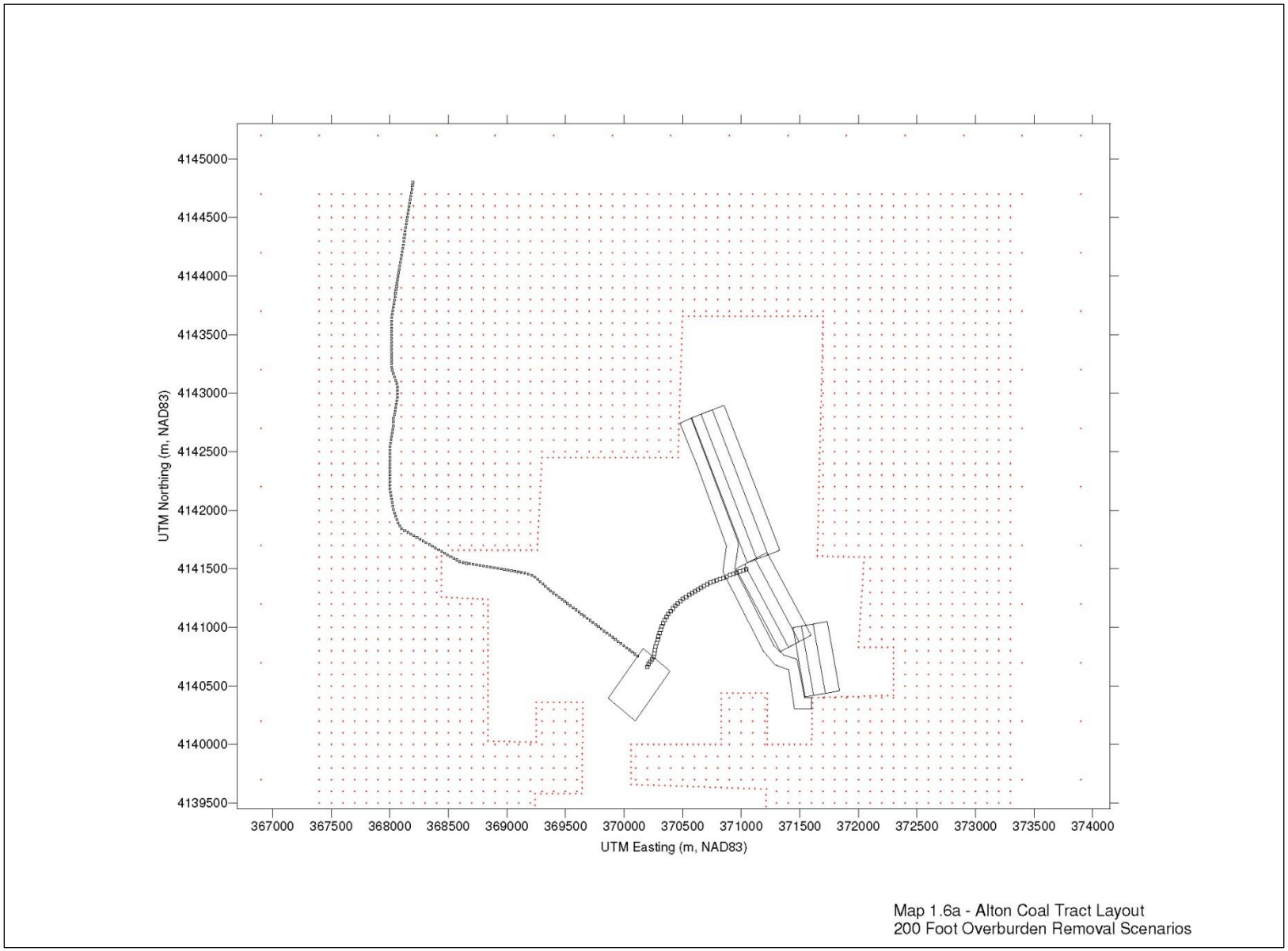
Map 1.3. Alton Coal Tract under Alternative C.



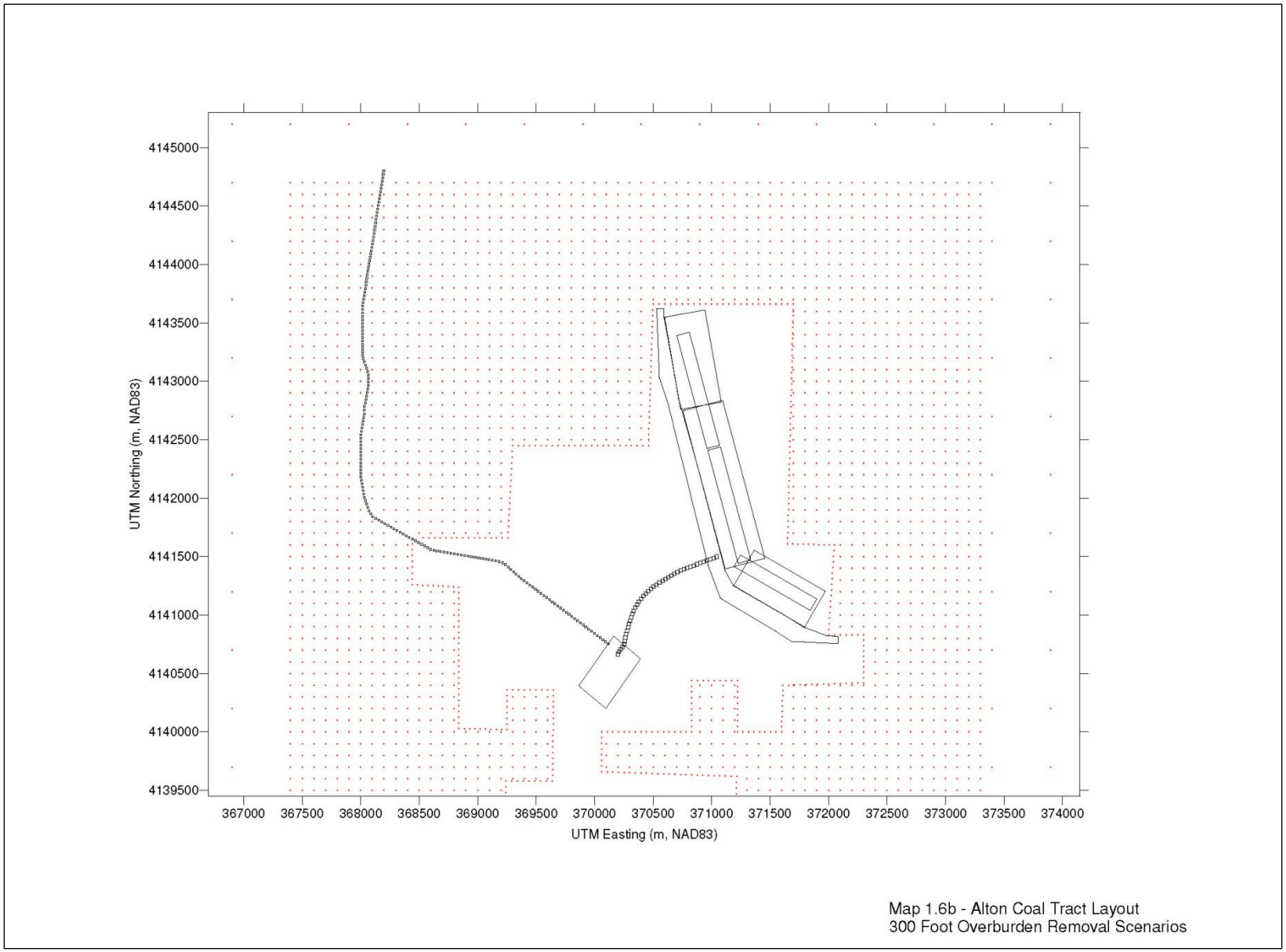
Map 1.4. Reasonably foreseeable short haul route (mine site to KFO Route 116 north of the Town of Alton).



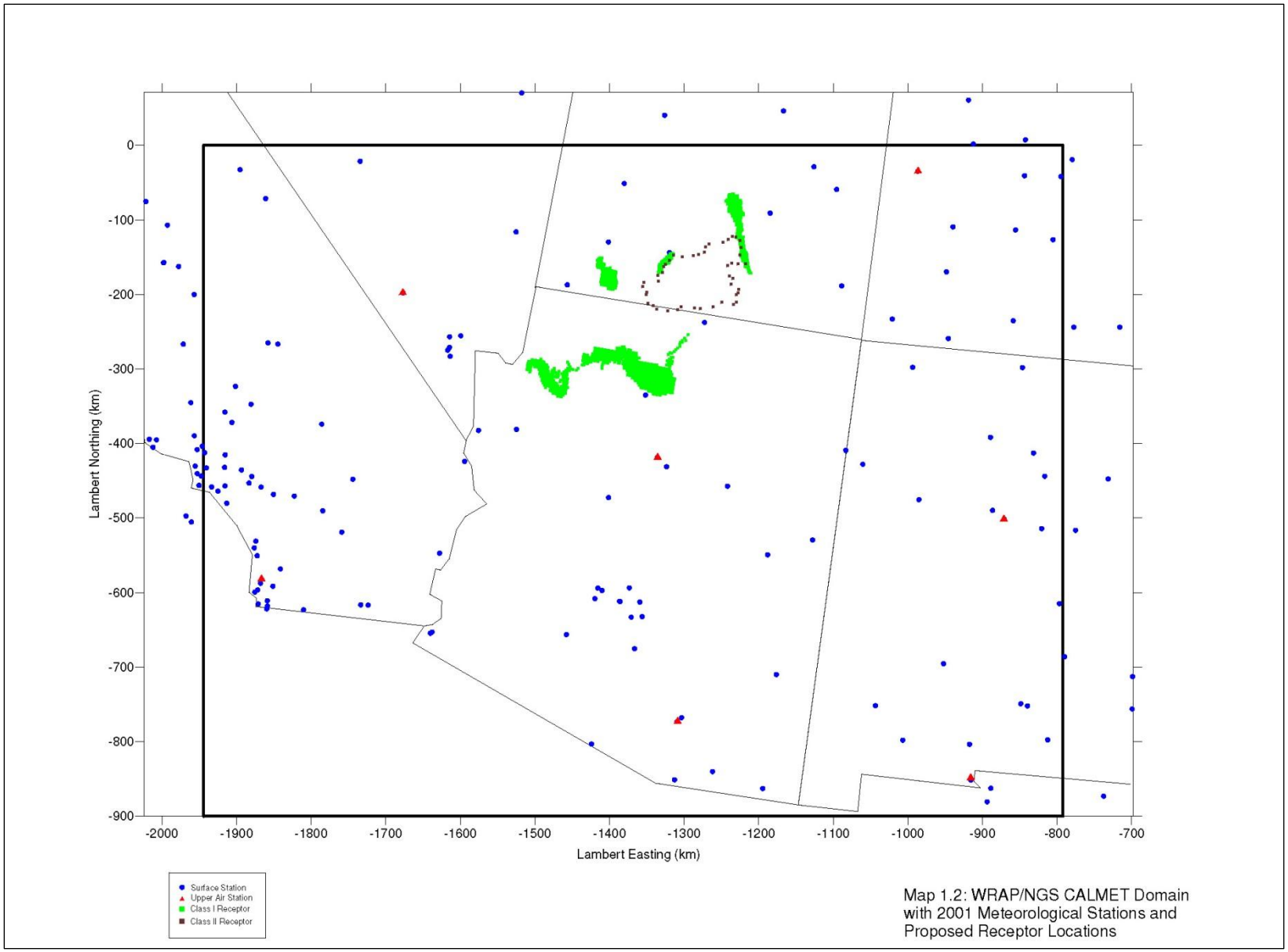
Map 1.5. Reasonably foreseeable rail loadout facility and coal haul transportation route.



Map 1.6a. Maximum development year layout (200-foot overburden scenario).



Map 1.6b. Maximum development year layout (300-foot overburden removal scenario).



Map 1.7. WRAP/NGS CALMET domain with 2001 meteorological stations and proposed receptor locations.

Appendix B: Mining Emission Inventory Results

Alton 200-foot Overburden Scenario, Alternative B

Alton Tract - Alternative B

AERMOD Area Source CO Modeling Emissions

		Emissions by Area (g/s)						
Emission Activities	**Total Annual CO Q(g/s)**	**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck Road**	**Access Road**	
Graders	0.2878	0.1439	0.0576			0.0863		0.2878
Bulldozers	0.8702	0.4351	0.2610	0.1740				0.8702
Overburden Loading	0.0000	0.0000	0.0000					0.0000
Overburden Haul Truck	4.8865	3.4205	1.4659					4.8865
Topsoil Scraping	0.4453			0.4453				0.4453
Coal Loading	0.4550		0.4550					0.4550
Blasting	0.2891	0.2024	0.0867					0.2891
Wind Erosion	0.0000	0.0000	0.0000	0.0000				0.0000
Coal Processing	0.0000				0.0000			0.0000
Access Road Traffic	0.3188						0.3188	0.3188
Coal Haul Truck	0.6806	0.0681	0.1361			0.4764		0.6806
Service Vehicles (separated from graders line item)	0.0151	0.0076	0.0030			0.0045		0.0151
Total	**8.23**	**4.27**	**2.46**	**0.62**	**0.00**	**0.56**	**0.32**	8.2331
	286.18							
Source Description		**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck**	**Alton to Facilities area**	
Area (m^2)		1,255,880	303,991	264,387	152,856			
Emissions (g/s)		4 2699	2 4624	0 6193	0 0000	0 5627	0 3188	
Initial Lateral Width (m)						45 77	45 77	
Road Segment Length (m)								
Model Emission Rate (g/s-m2)		3 39995E-06	8 10024E-06	2 34246E-06	0			
Road Segments						66	143	
Volume Source Emission Rate (g/s)						0 00853	0 00223	
						0 01076	Haul road and access road overlap	

Alton Tract - Alternative B

AERMOD Area Source NOx Modeling Emissions

		Emissions by Area (g/s)						
Emission Activities	**Total Annual NOx Q (g/s)**	**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck Road**	**Access Road**	
Graders	0.0329	0.0164	0.0066			0.0099		0.0329
Bulldozers	0.0994	0.0497	0.0298	0.0199				0.0994
Overburden Loading	0.0000	0.0000	0.0000					0.0000
Overburden Haul Truck	4.8865	3.4205	1.4659					4.8865
Topsoil Scraping	0.0509			0.0509				0.0509
Coal Loading	0.0520		0.0520					0.0520
Blasting	0.0734	0.0513	0.0220					0.0734
Wind Erosion	0.0000	0.0000	0.0000	0.0000				0.0000
Coal Processing	0.0000				0.0000			0.0000
Access Road Traffic	0.1230						0.1230	0.1230
Coal Haul Truck	0.6806	0.0681	0.1361			0.4764		0.6806
Service Vehicles (separated from graders line item)	0.0339	0.0169	0.01			0.0102		0.0339
Total	**6.03**	**3.62**	**1.72**	**0.07**	**0.00**	**0.50**	**0.12**	6.03
	209.69							
Source Description		**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck**	**Alton to Facilities area**	
Area (m^2)		1,255,880	303,991	264,387	152,856			
Emissions (g/s)		3 6230	1 7192	0 0708	0 0000	0 4964	0 1230	
Initial Lateral Width (m)						45 77	45 77	
Road Segment Length (m)								
Model Emission Rate (g/s-m2)		2 88486E-06	5 6556E-06	2 6771E-07	0			
Road Segments						66	143	
Volume Source Emission Rate (g/s)						0 0075	0 00086	
						0 00838	Haul road and access road overlap	

Alton Tract - Alternative B

AERMOD Area Source PM-10 Modeling Emissions

		Emissions by Area (g/s)							
Emission Activities	**Total Annual PM-10 Q (g/s)**	**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck Road**	**Access Road**	**Check**	
Graders	0 0390	0 0195	0 0078			0 0117		0 0390	
Bulldozers	0 4846	0 2423	0 1454	0 0969				0 4846	
Overburden Loading	0 1156	0 0809	0 0347					0 1156	
Overburden Haul Truck	0 8578	0 4615	0 3963					0 8578	
Topsoil Scraping	0 2956			0 2956				0 2956	
Coal Loading	0 0060		0 0060					0 0060	
Blasting (within pit)	0 0073	0 0051	0 0022					0 0073	
Wind Erosion	0 2854	0 1427	0 0856	0 0571				0 2854	
Coal Processing (increase to 25' release height)	0 3351				0 3351			0 3351	
Access Road Traffic	1 4287						1 4287	1 4287	
Coal Haul Truck	0 3647	0 0303	0 1218			0 2126		0 3647	
Service Vehicles (separated from graders line item)	0 1415	0 0590	0 0471			0 0354		0 1415	
Total Emissions by Area	**4.3613**	**1.04**	**0.85**	**0.45**	**0.34**	**0.26**	**1.43**	4 3613	
Source Description		**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck**	**Alton to Facilities area**		
Area (m^2)		806,600	274,081	274,713	152,856				
Emissions (g/s)		1 0413	0 8469	0 4496	0 3351	0 2597	1 4287		
Initial Lateral Width (m)									
Road Segment Length (m)									
Model Emission Rate (g/s-m2)		1 29098E-06	3 08996E-06	1 63661E-06	2 19215E-06				
Road Segments						44	140		
Volume Source Emission Rate (g/s)						0 0059	0 01021		
Open Pits Source Calculations	have to model volume sources as independent adjacent sources with emissions input as g/s (BEEST figures out g/sec-m2 by area and volume inputs)								
Coal Pit Volumes(Assumes 180ft Depth)	**Leg 1**	**Leg 2**	**Leg 3**						
Xinit(m)	100.58	100.58	100.58						
Yinit(m)	1325	800	600						
Depth(m)**	54.9	54.9	54.9	**Total Volume of Open pits**					
Volume (m3)	7,311,643	4,414,577	3,310,933	15037152.55					
Equivalent Surface Area (m2)	133268.5	80464	60348	274080.5					
Emissions (g/s)	0.411794851	0.248630854	0.18647314	0.8469	(Matches main coal pit emissions above)				
Model Emission Rate (g/s-m2)				3.0900E-06					
Main Pit (Overburden removal, etc.)	**Leg 1**	**Leg 2**	**Leg 3**						
Assumes 120 foot average depth									
Xinit(m)	296	296	296						
Yinit(m)	1325	800	600						
Depth(m) **	36.58	36.58	36.58	**Total Volume of Open pits**					
Volume (m3)	14,345,107	8,661,197	6,495,898	29502201.60					
Equivalent Surface Area (m2)	392200	236800	177600	806600					
Total (g/s)	0.506323242	0.305704599	0.229278449	1.0413	(Matches total development area emissions above)				

Model Emission Rate (g/s-m2)				1.2910E-06					
** The BEEST AERMOD processor figures out the pit depth by using the input volume and surface area for the source									

Alton Tract - Alternative B

AERMOD Area Source PM-2.5 Modeling Emissions

		Emissions by Area (g/s)						
Emission Activities	**Total Annual PM-2.5 Q (g/s)**	**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck Road**	**Access Road**	
Graders	0.0027	0.0014	0.0005			0.0008		0.0027
Bulldozers	0.2652	0.1326	0.0796	0.0530				0.2652
Overburden Loading	0.0175	0.0123	0.0053					0.0175
Overburden Haul Truck	0.0858	0.0462	0.0396					0.0858
Topsoil Scraping	0.0296			0.0296				0.0296
Coal Loading	0.0009		0.0009					0.0009
Blasting	0.0004	0.0003	0.0001					0.0004
Wind Erosion	0.0428	0.0214	0.0128	0.0086				0.0428
Coal Processing	0.0338				0.0338			0.0338
Access Road Traffic	0.1463						0.1463	0.1463
Coal Haul Truck	0.0365	0.0030	0.0122			0.0213		0.0365
Service Vehicles (separated from graders line item)	0.0141	0.0071	0.0028			0.0042		0.0141
Total, g/sec	**0.676**	**0.22**	**0.15**	**0.09**	**0.03**	**0.03**	**0.15**	0.6757
Total, ton/yr	23.49							
Source Description		**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck**	**Alton to Facilities area**	
Area (m^2)		806,600	274,081	274,713	152,856			
Emissions (g/s)		0 2242	0 1539	0 0912	0 0338	0 0263	0 1463	
Initial Lateral Width (m)								
Road Segment Length (m)								
Model Emission Rate (g/s-m2)		2 77941E-07	5 61463E-07	3 3186E-07	2 21334E-07			
Road Segments						44	144	
Volume Source Emission Rate (g/s)						0 00060	0 00102	
						0 001614	Haul road and access road overlap	
Open Pits								
Coal Pit Volumes (210' below grade)	**Leg 1**	**Leg 2**	**Leg 3**					
Xinit(m)	110	110	110					
Yinit(m)	1000	1000	750					
Depth(m)	62.5	62.5	62.5					
Volume (m3)	6873240	6873240	5154930	18901410				
Equivalent Surface Area (m2)	110000	110000	82500	302500				
Emissions at Pit Bottom (g/s)				0.0009				
Emissions assumed at 1/2 depth of pit g/s)				0.1380				
Emissions (g/s)	0.013772862	0.050500493	0.03787537	0.1389	0.102148725			
Model Emission Rate (g/s-m2)				4.5910E-07				
Main Pit (Overburden removal, etc.)	**Leg 1**	**Leg 2**	**Leg 3**					
assume 100' below grade								
Xinit(m)	350	350	350					

Yinit(m)	800	1400	700					
Depth(m)	30	30	30					
Volume (m3)	8,400,000	14,700,000	7,350,000					
Equivalent Surface Area (m2)	280000	490000	245000	1015000				
emissions in main pit overburden removal area (g/s)				0.0584				
other emissions assumed at 1/2 depth of main pit area				0.1557				
Total (g/s)	0.05905856	0.10335248	0.05167624	0.2141				
Model Emission Rate (g/s-m2)				2.1092E-07				

Alton Tract - Alternative B

AERMOD Area Source SO2 Modeling Emissions

		Emissions by Area (g/s)						
Emission Activities	**Total Annual SO2 Q(g/s)**	**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck Road**	**Access Road**	
Graders	0.0001	0.0001	0.0000			0.0000		0.0001
Bulldozers	0.0012	0.0006	0.0004	0.0002				0.0012
Overburden Loading	0.0000	0.0000	0.0000					0.0000
Overburden Haul Truck	0.0014	0.0010	0.0004					0.0014
Topsoil Scraping	0.0004			0.0004				0.0004
Coal Loading	0.0006		0.0006					0.0006
Blasting	0.0086	0.0060	0.0026					0.0086
Wind Erosion	0.0000	0.0000	0.0000	0.0000				0.0000
Coal Processing	0.0000				0.0000			0.0000
Access Road Traffic	0.0002						0.0002	0.0002
Coal Haul Truck	0.0003	0.0000	0.0001			0.0002		0.0003
Service Vehicles (separated from graders line item)	0.0000	0.0000	0.0000			0.0000		0.0000
Total	**0.0129**	**0.0078**	**0.0041**	**0.0006**	**0.0000**	**0.0002**	**0.0002**	0.0129
	0.45							
Source Description		**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck**	**Alton to Facilities area**	
Area (m^2)		1,255,880	303,991	264,387	152,856			
Emissions (g/s)		0 0078	0 0041	0 0006	0 0000	0 0002	0 0002	
Initial Lateral Width (m)						45 77	45 77	
Road Segment Length (m)								
Model Emission Rate (g/s-m2)		6 1817E-09	1 34214E-08	2 34853E-09	0			
Road Segments						66	143	
Volume Source Emission Rate (g/s)						0 000004	0 000001	
						0 000005	Haul road and access road overlap	

Alton 200-foot Overburden Scenario, Alternative C

Alton Tract - Alternative C

AERMOD Area Source CO Modeling Emissions

		Emissions by Area (g/s)						
Emission Activities	**Total Annual CO Q(g/s)**	**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck Road**	**Access Road**	
Graders	0.2878	0.1439	0.0576			0.0863		0.2878
Bulldozers	0.8702	0.4351	0.2610	0.1740				0.8702
Overburden Loading	0.0000	0.0000	0.0000					0.0000
Overburden Haul Truck	4.8865	3.4205	1.4659					4.8865
Topsoil Scraping	0.4453			0.4453				0.4453
Coal Loading	0.4550		0.4550					0.4550
Blasting	0.2891	0.2024	0.0867					0.2891
Wind Erosion	0.0000	0.0000	0.0000	0.0000				0.0000
Coal Processing	0.0000				0.0000			0.0000
Access Road Traffic	0.3188						0.3188	0.3188
Coal Haul Truck	0.6806	0.0681	0.1361			0.4764		0.6806
Service Vehicles (separated from graders line item)	0.0151	0.0076	0.0030			0.0045		0.0151
Total	**8.23**	**4.27**	**2.46**	**0.62**	**0.00**	**0.56**	**0.32**	8.2331
	286.18							
Source Description		**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck**	**Alton to Facilities area**	
Area (m^2)		1,255,880	303,991	264,387	152,856			
Emissions (g/s)		4 2699	2 4624	0 6193	0 0000	0 5627	0 3188	
Initial Lateral Width (m)						45 77	45 77	
Road Segment Length (m)								
Model Emission Rate (g/s-m2)		3 39995E-06	8 10024E-06	2 34246E-06	0			
Road Segments						66	143	
Volume Source Emission Rate (g/s)						0 00853	0 00223	
						0 01076	Haul road and access road overlap	

Alton Tract - Alternative C

AERMOD Area Source NOx Modeling Emissions

		Emissions by Area (g/s)						
Emission Activities	**Total Annual NOx Q (g/s)**	**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck Road**	**Access Road**	
Graders	0.0329	0.0164	0.0066			0.0099		0.0329
Bulldozers	0.0994	0.0497	0.0298	0.0199				0.0994
Overburden Loading	0.0000	0.0000	0.0000					0.0000
Overburden Haul Truck	4.8865	3.4205	1.4659					4.8865
Topsoil Scraping	0.0509			0.0509				0.0509
Coal Loading	0.0520		0.0520					0.0520
Blasting	0.0734	0.0513	0.0220					0.0734
Wind Erosion	0.0000	0.0000	0.0000	0.0000				0.0000
Coal Processing	0.0000				0.0000			0.0000
Access Road Traffic	0.1230						0.1230	0.1230
Coal Haul Truck	0.6806	0.0681	0.1361			0.4764		0.6806
Service Vehicles (separated from graders line item)	0.0339	0.0169	0.01			0.0102		0.0339
Total	**6.03**	**3.62**	**1.72**	**0.07**	**0.00**	**0.50**	**0.12**	6.03
	209.69							
Source Description		**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck**	**Alton to Facilities area**	
Area (m^2)		1,255,880	303,991	264,387	152,856			
Emissions (g/s)		3 6230	1 7192	0 0708	0 0000	0 4964	0 1230	
Initial Lateral Width (m)						45 77	45 77	
Road Segment Length (m)								
Model Emission Rate (g/s-m2)		2 88486E-06	5 6556E-06	2 6771E-07	0			
Road Segments						66	143	
Volume Source Emission Rate (g/s)						0 0075	0 00086	
						0 00838	Haul road and access road overlap	

Alton Tract - Alternative C

AERMOD Area Source PM-10 Modeling Emissions

		Emissions by Area (g/s)								
Emission Activities	**Total Annual PM-10 Q (g/s)**	**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck Road**	**Access Road**	**Check**		
Graders	0 0390	0 0195	0 0078			0 0117		0 0390		
Bulldozers	0 4846	0 2423	0 1454	0 0969				0 4846		
Overburden Loading	0 1156	0 0809	0 0347					0 1156		
Overburden Haul Truck	0 8578	0 4615	0 3963					0 8578		
Topsoil Scraping	0 2956			0 2956				0 2956		
Coal Loading	0 0060		0 0060					0 0060		
Blasting (within pit)	0 0073	0 0051	0 0022					0 0073		
Wind Erosion	0 5708	0 2854	0 1712	0 1142				0 5708		
Coal Processing (increase to 25' release height)	0 3351				0 3351			0 3351		
Access Road Traffic	1 4287						1 4287	1 4287		
Coal Haul Truck	0 3647	0 0303	0 1218			0 2126		0 3647		
Service Vehicles (separated from graders line item)	0 1415	0 0590	0 0471			0 0354		0 1415		
Total Emissions by Area	**4.6467**	**1.18**	**0.93**	**0.51**	**0.34**	**0.26**	**1.43**	4 6467		
Source Description		**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck**	**Alton to Facilities area**			
Area (m^2)		806,600	274,081	274,713	152,856					
Emissions (g/s)		1.1840	0.9325	0.5067	0.3351	0.2597	1.4287			
Initial Lateral Width (m)										
Road Segment Length (m)										
Model Emission Rate (g/s-m2)		1.4679E-06	3.40236E-06	1.84439E-06	2.19215E-06					
Road Segments						44	140			
Volume Source Emission Rate (g/s)						0.0059	0.01021			
Open Pits Source Calculations	have to model volume sources as independent adjacent sources with emissions input as g/s (BEEST figures out g/sec-m2 by area and volume inputs)									
Coal Pit Volumes(Assumes 180ft Depth)	**Leg 1**	**Leg 2**	**Leg 3**							
Xinit(m)	100.58	100.58	100.58							
Yinit(m)	1325	800	600							
Depth(m)**	54.9	54 9	54.9	**Total Volume of Open pits**						
Volume (m3)	7,311,643	4,414,577	3,310,933	15037152.55						
Equivalent Surface Area (m2)	133268.5	80464	60348	274080.5						
Emissions (g/s)	0.453427041	0.27376727	0 205325452	0.9325	(Matches main coal pit emissions above)					
Model Emission Rate (g/s-m2)				3.4024E-06						
Main Pit (Overburden removal, etc.)	**Leg 1**	**Leg 2**	**Leg 3**							
Assumes 120 foot average depth										
Xinit(m)	296	296	296							
Yinit(m)	1325	800	600							
Depth(m) **	36.58	36.58	36 58	**Total Volume of Open pits**						
Volume (m3)	14,345,107	8,661,197	6,495,898	29502201.60						
Equivalent Surface Area (m2)	392200	236800	177600	806600						
Total (g/s)	0 575710224	0.347598626	0 260698969	1.1840	(Matches total development area emissions above)					
Model Emission Rate (g/s-m2)				1.4679E-06						

** The BEEST AERMOD processor figures out the pit depth by using he input volume and surface area for the source										

Alton Tract - Alternative C

AERMOD Area Source PM-2.5 Modeling Emissions

		Emissions by Area (g/s)						
Emission Activities	**Total Annual PM-2.5 Q (g/s)**	**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck Road**	**Access Road**	
Graders	0.0027	0.0014	0.0005			0.0008		0.0027
Bulldozers	0.2652	0.1326	0.0796	0.0530				0.2652
Overburden Loading	0.0175	0.0123	0.0053					0.0175
Overburden Haul Truck	0.0858	0.0462	0.0396					0.0858
Topsoil Scraping	0.0296			0.0296				0.0296
Coal Loading	0.0009		0.0009					0.0009
Blasting	0.0004	0.0003	0.0001					0.0004
Wind Erosion	0.0856	0.0428	0.0257	0.0171				0.0856
Coal Processing	0.0338				0.0338			0.0338
Access Road Traffic	0.1463						0.1463	0.1463
Coal Haul Truck	0.0365	0.0030	0.0122			0.0213		0.0365
Service Vehicles (separated from graders line item)	0.0141	0.0071	0.0028			0.0042		0.0141
Total, g/sec	**0.718**	**0.25**	**0.17**	**0.10**	**0.03**	**0.03**	**0.15**	0.7185
Total, ton/yr	24.97							
Source Description		**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck**	**Alton to Facilities area**	
Area (m^2)		806,600	274,081	274,713	152,856			
Emissions (g/s)		0 2456	0 1667	0 0997	0 0338	0 0263	0 1463	
Initial Lateral Width (m)								
Road Segment Length (m)								
Model Emission Rate (g/s-m2)		3 04478E-07	6 08322E-07	3 63027E-07	2 21334E-07			
Road Segments						44	144	
Volume Source Emission Rate (g/s)						0 00060	0 00102	
						0 001614	Haul road and access road overlap	
Open Pits								
Coal Pit Volumes (210' below grade)	**Leg 1**	**Leg 2**	**Leg 3**					
Xinit(m)	110	110	110					
Yinit(m)	1000	1000	750					
Depth(m)	62.5	62.5	62.5					
Volume (m3)	6873240	6873240	5154930	18901410				
Equivalent Surface Area (m2)	110000	110000	82500	302500				
Emissions at Pit Bottom (g/s)				0.0009				
Emissions assumed at 1/2 depth of pit g/s)				0.1508				
Emissions (g/s)	0.015046561	0.055170725	0.041378044	0.1517	0.111595331			
Model Emission Rate (g/s-m2)				5.0155E-07				
Main Pit (Overburden removal, etc.)	**Leg 1**	**Leg 2**	**Leg 3**					
assume 100' below grade								
Xinit(m)	350	350	350					

Yinit(m)	800	1400	700					
Depth(m)	30	30	30					
Volume (m3)	8,400,000	14,700,000	7,350,000					
Equivalent Surface Area (m2)	280000	490000	245000	1015000				
emissions in main pit overburden removal area (g/s)				0.0584				
other emissions assumed at 1/2 depth of main pit area				0.1771				
Total (g/s)	0.064963451	0.113686039	0.05684302	0.2355				
Model Emission Rate (g/s-m2)				2.3201E-07				

Alton Tract - Alternative C

AERMOD Area Source SO2 Modeling Emissions

		Emissions by Area (g/s)						
Emission Activities	**Total Annual SO2 Q(g/s)**	**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck Road**	**Access Road**	
Graders	0.0001	0.0001	0.0000			0.0000		0.0001
Bulldozers	0.0012	0.0006	0.0004	0.0002				0.0012
Overburden Loading	0.0000	0.0000	0.0000					0.0000
Overburden Haul Truck	0.0014	0.0010	0.0004					0.0014
Topsoil Scraping	0.0004			0.0004				0.0004
Coal Loading	0.0006		0.0006					0.0006
Blasting	0.0086	0.0060	0.0026					0.0086
Wind Erosion	0.0000	0.0000	0.0000	0.0000				0.0000
Coal Processing	0.0000				0.0000			0.0000
Access Road Traffic	0.0002						0.0002	0.0002
Coal Haul Truck	0.0003	0.0000	0.0001			0.0002		0.0003
Service Vehicles (separated from graders line item)	0.0000	0.0000	0.0000			0.0000		0.0000
Total	**0.0129**	**0.0078**	**0.0041**	**0.0006**	**0.0000**	**0.0002**	**0.0002**	0.0129
	0.45							
Source Description		**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck**	**Alton to Facilities area**	
Area (m^2)		1,255,880	303,991	264,387	152,856			
Emissions (g/s)		0 0078	0 0041	0 0006	0 0000	0 0002	0 0002	
Initial Lateral Width (m)						45 77	45 77	
Road Segment Length (m)								
Model Emission Rate (g/s-m2)		6 1817E-09	1 34214E-08	2 34853E-09	0			
Road Segments						66	143	
Volume Source Emission Rate (g/s)						0 000004	0 000001	
						0 000005	Haul road and access road overlap	

Alton 300-foot Overburden Scenario, Alternative B

Alton Tract - Alternative B

AERMOD Area Source CO Modeling Emissions

		Emissions by Area (g/s)						
Emission Activities	**Total Annual CO Q(g/s)**	**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck Road**	**Access Road**	
Graders	0.2878	0.1439	0.0576			0.0863		0.2878
Bulldozers	1.0442	0.5221	0.3133	0.2088				1.0442
Overburden Loading	0.0000	0.0000	0.0000					0.0000
Overburden Haul Truck	14.6594	10.2616	4.3978					14.6594
Topsoil Scraping	0.4453			0.4453				0.4453
Coal Loading	0.4550		0.4550					0.4550
Blasting	0.2891	0.2024	0.0867					0.2891
Wind Erosion	0.0000	0.0000	0.0000	0.0000				0.0000
Coal Processing	0.0000				0.0000			0.0000
Access Road Traffic	0.3188						0.3188	0.3188
Coal Haul Truck	0.6806	0.0681	0.1361			0.4764		0.6806
Service Vehicles (separated from graders line item)	0.0151	0.0076	0.0030			0.0045		0.0151
Total	**18.18**	**11.20**	**5.45**	**0.65**	**0.00**	**0.56**	**0.32**	18.1801
	631.94							
Source Description		**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck**	**Alton to Facilities area**	
Area (m^2)		1,255,880	303,991	264,387	152,856			
Emissions (g/s)		11 1980	5 4465	0 6541	0 0000	0 5627	0 3188	
Initial Lateral Width (m)						45 77	45 77	
Road Segment Length (m)								
Model Emission Rate (g/s-m2)		8 91646E-06	1 79166E-05	2 47411E-06	0			
Road Segments						66	143	
Volume Source Emission Rate (g/s)						0 00853	0 00223	
						0 01076	Haul road and access road overlap	

Alton Tract - Alternative B

AERMOD Area Source NOx Modeling Emissions

		Emissions by Area (g/s)						
Emission Activities	**Total Annual NOx Q (g/s)**	**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck Road**	**Access Road**	
Graders	0.0329	0.0164	0.0066			0.0099		0.0329
Bulldozers	0.1193	0.0597	0.0358	0.0239				0.1193
Overburden Loading	0.0000	0.0000	0.0000					0.0000
Overburden Haul Truck	14.6594	10.2616	4.3978					14.6594
Topsoil Scraping	0.0509			0.0509				0.0509
Coal Loading	0.0520		0.0520					0.0520
Blasting	0.0734	0.0513	0.0220					0.0734
Wind Erosion	0.0000	0.0000	0.0000	0.0000				0.0000
Coal Processing	0.0000				0.0000			0.0000
Access Road Traffic	0.1230						0.1230	0.1230
Coal Haul Truck	0.6806	0.0681	0.1361			0.4764		0.6806
Service Vehicles (separated from graders line item)	0.0339	0.0169	0.01			0.0102		0.0339
Total	**15.83**	**10.47**	**4.66**	**0.07**	**0.00**	**0.50**	**0.12**	15.83
	550.09							
Source Description		**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck**	**Alton to Facilities area**	
Area (m^2)		1,255,880	303,991	264,387	152,856			
Emissions (g/s)		10 4740	4 6571	0 0748	0 0000	0 4964	0 1230	
Initial Lateral Width (m)						45 77	45 77	
Road Segment Length (m)								
Model Emission Rate (g/s-m2)		8 34001E-06	1 53199E-05	2 82755E-07	0			
Road Segments						66	143	
Volume Source Emission Rate (g/s)						0 0075	0 00086	
						0 00838	Haul road and access road overlap	

Alton Tract - Alternative B

AERMOD Area Source PM-10 Modeling Emissions

		Emissions by Area (g/s)							
Emission Activities	**Total Annual PM-10 Q (g/s)**	**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck Road**	**Access Road**	**Check**	
Graders	0 0390	0 0195	0 0078			0 0117		0 0390	
Bulldozers	0 5815	0 2908	0 1745	0 1163				0 5815	
Overburden Loading	0 1908	0 1336	0 0572					0 1908	
Overburden Haul Truck	1 6041	0 8630	0 7411					1 6041	
Topsoil Scraping	0 3683			0 3683				0 3683	
Coal Loading	0 0060		0 0060					0 0060	
Blasting (within pit)	0 0073	0 0051	0 0022					0 0073	
Wind Erosion	0 3437	0 1718	0 1031	0 0687				0 3437	
Coal Processing (increase to 25' release height)	0 3351				0 3351			0 3351	
Access Road Traffic	1 4287						1 4287	1 4287	
Coal Haul Truck	0 7294	0 0605	0 2436			0 4252		0 7294	
Service Vehicles (separated from graders line item)	0 1415	0 0590	0 0471			0 0354		0 1415	
Total Emissions by Area	**5.7753**	**1.60**	**1.38**	**0.55**	**0.34**	**0.47**	**1.43**	5 7753	
Source Description		**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck**	**Alton to Facilities area**		
Area (m^2)		806,600	274,081	274,713	152,856				
Emissions (g/s)		1 6033	1 3826	0 5533	0 3351	0 4723	1 4287		
Initial Lateral Width (m)									
Road Segment Length (m)									
Model Emission Rate (g/s-m2)		1 98774E-06	5 04454E-06	2 01420E-06	2 19215E-06				
Road Segments						44	140		
Volume Source Emission Rate (g/s)						0 0107	0 01021		
Open Pits Source Calculations	have to model volume sources as independent adjacent sources with emissions input as g/s (BEEST figures out g/sec-m2 by area and volume inputs)								
Coal Pit Volumes(Assumes 180ft Depth)	**Leg 1**	**Leg 2**	**Leg 3**						
Xinit(m)	100.58	100.58	100.58						
Yinit(m)	1325	800	600						
Depth(m)**	54.9	54.9	54.9	**Total Volume of Open pits**					
Volume (m3)	7,311,643	4,414,577	3,310,933	15037152.55					
Equivalent Surface Area (m2)	133268.5	80464	60348	274080.5					
Emissions (g/s)	0.672278452	0.405903971	0.304427978	1.3826	(Matches main coal pit emissions above)				
Model Emission Rate (g/s-m2)				5.0445E-06					
Main Pit (Overburden removal, etc.)	**Leg 1**	**Leg 2**	**Leg 3**						
Assumes 120 foot average depth									
Xinit(m)	296	296	296						
Yinit(m)	1325	800	600						
Depth(m) **	36.58	36.58	36.58	**Total Volume of Open pits**					
Volume (m3)	14,345,107	8,661,197	6,495,898	29502201.60					
Equivalent Surface Area (m2)	392200	236800	177600	806600					
Total (g/s)	0.77959016	0.470695946	0.353021959	1.6033	(Matches total development area emissions above)				

Model Emission Rate (g/s-m2)				1.9877E-06					
** The BEEST AERMOD processor figures out the pit depth by using the input volume and surface area for the source									

Alton Tract - Alternative B

AERMOD Area Source PM-2.5 Modeling Emissions

		Emissions by Area (g/s)						
Emission Activities	**Total Annual PM-2.5 Q (g/s)**	**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck Road**	**Access Road**	
Graders	0 0027	0 0014	0 0005			0 0008		0 0027
Bulldozers	0 3183	0 1591	0 0955	0 0637				0 3183
Overburden Loading	0 0289	0 0202	0 0087					0 0289
Overburden Haul Truck	0 1604	0 0863	0 0741					0 1604
Topsoil Scraping	0 0368			0 0368				0 0368
Coal Loading	0 0009		0 0009					0 0009
Blasting	0 0004	0 0003	0 0001					0 0004
Wind Erosion	0 0516	0 0258	0 0155	0 0103				0 0516
Coal Processing	0 0338				0 0338			0 0338
Access Road Traffic	0 1463						0 1463	0 1463
Coal Haul Truck	0 0729	0 0061	0 0244			0 0425		0 0729
Service Vehicles (separated from graders line item)	0 0141	0 0071	0 0028			0 0042		0 0141
Total, g/sec	**0.867**	**0.31**	**0.22**	**0.11**	**0.03**	**0.05**	**0.15**	0 8672
Total, ton/yr	30 14							
Source Description		**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck**	**Alton to Facilities area**	
Area (m^2)		806,600	274,081	274,713	152,856			
Emissions (g/s)		0.3062	0.2225	0.1108	0.0338	0.0476	0.1463	
Initial Lateral Width (m)								
Road Segment Length (m)								
Model Emission Rate (g/s-m2)		3.79651E-07	8.11793E-07	4.03302E-07	2.21334E-07			
Road Segments						44	144	
Volume Source Emission Rate (g/s)						0.00108	0.00102	
						0.002097	Haul road and access road overlap	
Open Pits								
Coal Pit Volumes (210' below grade)	**Leg 1**	**Leg 2**	**Leg 3**					
Xinit(m)	110	110	110					
Yinit(m)	1000	1000	750					
Depth(m)	62 5	62 5	62.5					
Volume (m3)	6873240	6873240	5154930	18901410				
Equivalent Surface Area (m2)	110000	110000	82500	302500				
Emissions at Pit Bottom (g/s)				0.0009				
Emissions assumed at 1/2 depth of pit g/s)				0.1944				
Emissions (g/s)	0.019369262	0.071020628	0.053265471	0.1953	0.143655361			
Model Emission Rate (g/s-m2)				6.4564E-07				
Main Pit (Overburden removal, etc.)	**Leg 1**	**Leg 2**	**Leg 3**					
assume 100' below grade								
Xinit(m)	350	350	350					
Yinit(m)	800	1400	700					
Depth(m)	30	30	30					
Volume (m3)	8,400,000	14,700,000	7,350,000					
Equivalent Surface Area (m2)	280000	490000	245000	1015000				
emissions in main pit overburden removal area (g/s)				0.1065				
other emissions assumed at 1/2 depth of main pit area				0.1866				
Total (g/s)	0.08085511	0.141496442	0.070748221	0.2931				
Model Emission Rate (g/s-m2)				2 8877E-07				

Alton Tract - Alternative B

AERMOD Area Source SO2 Modeling Emissions

		Emissions by Area (g/s)						
Emission Activities	**Total Annual SO2 Q(g/s)**	**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck Road**	**Access Road**	
Graders	0.0001	0.0001	0.0000			0.0000		0.0001
Bulldozers	0.0015	0.0007	0.0004	0.0003				0.0015
Overburden Loading	0.0000	0.0000	0.0000					0.0000
Overburden Haul Truck	0.0043	0.0030	0.0013					0.0043
Topsoil Scraping	0.0004			0.0004				0.0004
Coal Loading	0.0006		0.0006					0.0006
Blasting	0.0086	0.0060	0.0026					0.0086
Wind Erosion	0.0000	0.0000	0.0000	0.0000				0.0000
Coal Processing	0.0000				0.0000			0.0000
Access Road Traffic	0.0002						0.0002	0.0002
Coal Haul Truck	0.0003	0.0000	0.0001			0.0002		0.0003
Service Vehicles (separated from graders line item)	0.0000	0.0000	0.0000			0.0000		0.0000
Total	**0.0160**	**0.0099**	**0.0050**	**0.0007**	**0.0000**	**0.0002**	**0.0002**	0.0160
	0.56							
Source Description		**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck**	**Alton to Facilities area**	
Area (m^2)		1,255,880	303,991	264,387	152,856			
Emissions (g/s)		0 0099	0 0050	0 0007	0 0000	0 0002	0 0002	
Initial Lateral Width (m)						45 77	45 77	
Road Segment Length (m)								
Model Emission Rate (g/s-m2)		7 88455E-09	1 65062E-08	2 53601E-09	0			
Road Segments						66	143	
Volume Source Emission Rate (g/s)						0 000004	0 000001	
						0 000005	Haul road and access road overlap	

Alton 300-foot Overburden Scenario, Alternative C

Alton Tract - Alternative C

AERMOD Area Source CO Modeling Emissions

		Emissions by Area (g/s)						
Emission Activities	**Total Annual CO Q(g/s)**	**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck Road**	**Access Road**	
Graders	0.2878	0.1439	0.0576			0.0863		0.2878
Bulldozers	1.0442	0.5221	0.3133	0.2088				1.0442
Overburden Loading	0.0000	0.0000	0.0000					0.0000
Overburden Haul Truck	14.6594	10.2616	4.3978					14.6594
Topsoil Scraping	0.4453			0.4453				0.4453
Coal Loading	0.4550		0.4550					0.4550
Blasting	0.2891	0.2024	0.0867					0.2891
Wind Erosion	0.0000	0.0000	0.0000	0.0000				0.0000
Coal Processing	0.0000				0.0000			0.0000
Access Road Traffic	0.3188						0.3188	0.3188
Coal Haul Truck	0.6806	0.0681	0.1361			0.4764		0.6806
Service Vehicles (separated from graders line item)	0.0151	0.0076	0.0030			0.0045		0.0151
Total	**18.18**	**11.20**	**5.45**	**0.65**	**0.00**	**0.56**	**0.32**	18.1801
	631.94							
Source Description		**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck**	**Alton to Facilities area**	
Area (m^2)		1,255,880	303,991	264,387	152,856			
Emissions (g/s)		11 1980	5 4465	0 6541	0 0000	0 5627	0 3188	
Initial Lateral Width (m)						45 77	45 77	
Road Segment Length (m)								
Model Emission Rate (g/s-m2)		8 91646E-06	1 79166E-05	2 47411E-06	0			
Road Segments						66	143	
Volume Source Emission Rate (g/s)						0 00853	0 00223	
						0 01076	Haul road and access road overlap	

Alton Tract - Alternative C

AERMOD Area Source NOx Modeling Emissions

		Emissions by Area (g/s)						
Emission Activities	**Total Annual NOx Q (g/s)**	**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck Road**	**Access Road**	
Graders	0.0329	0.0164	0.0066			0.0099		0.0329
Bulldozers	0.1193	0.0597	0.0358	0.0239				0.1193
Overburden Loading	0.0000	0.0000	0.0000					0.0000
Overburden Haul Truck	14.6594	10.2616	4.3978					14.6594
Topsoil Scraping	0.0509			0.0509				0.0509
Coal Loading	0.0520		0.0520					0.0520
Blasting	0.0734	0.0513	0.0220					0.0734
Wind Erosion	0.0000	0.0000	0.0000	0.0000				0.0000
Coal Processing	0.0000				0.0000			0.0000
Access Road Traffic	0.1230						0.1230	0.1230
Coal Haul Truck	0.6806	0.0681	0.1361			0.4764		0.6806
Service Vehicles (separated from graders line item)	0.0339	0.0169	0.01			0.0102		0.0339
Total	**15.83**	**10.47**	**4.66**	**0.07**	**0.00**	**0.50**	**0.12**	15.83
	550.09							
Source Description		**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck**	**Alton to Facilities area**	
Area (m^2)		1,255,880	303,991	264,387	152,856			
Emissions (g/s)		10 4740	4 6571	0 0748	0 0000	0 4964	0 1230	
Initial Lateral Width (m)						45 77	45 77	
Road Segment Length (m)								
Model Emission Rate (g/s-m2)		8 34001E-06	1 53199E-05	2 82755E-07	0			
Road Segments						66	143	
Volume Source Emission Rate (g/s)						0 0075	0 00086	
						0 00838	Haul road and access road overlap	

Alton Tract - Alternative C

AERMOD Area Source PM-10 Modeling Emissions

		Emissions by Area (g/s)							
Emission Activities	**Total Annual PM-10 Q (g/s)**	**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck Road**	**Access Road**	**Check**	
Graders	0 0390	0 0195	0 0078			0 0117		0 0390	
Bulldozers	0 5815	0 2908	0 1745	0 1163				0 5815	
Overburden Loading	0 1908	0 1336	0 0572					0 1908	
Overburden Haul Truck	1 6041	0 8630	0 7411					1 6041	
Topsoil Scraping	0 3683			0 3683				0 3683	
Coal Loading	0 0060		0 0060					0 0060	
Blasting (within pit)	0 0073	0 0051	0 0022					0 0073	
Wind Erosion	0 6874	0 3437	0 2062	0 1375				0 6874	
Coal Processing (increase to 25' release height)	0 3351				0 3351			0 3351	
Access Road Traffic	1 4287						1 4287	1 4287	
Coal Haul Truck	0 7294	0 0605	0 2436			0 4252		0 7294	
Service Vehicles (separated from graders line item)	0 1415	0 0590	0 0471			0 0354		0 1415	
Total Emissions by Area	**6.1190**	**1.78**	**1.49**	**0.62**	**0.34**	**0.47**	**1.43**	6 1190	
Source Description		**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck**	**Alton to Facilities area**		
Area (m^2)		806,600	274,081	274,713	152,856				
Emissions (g/s)		1.7752	1.4857	0.6221	0.3351	0.4723	1.4287		
Initial Lateral Width (m)									
Road Segment Length (m)									
Model Emission Rate (g/s-m2)		2.20078E-06	5.42073E-06	2.26441E-06	2.19215E-06				
Road Segments						44	140		
Volume Source Emission Rate (g/s)						0.0107	0.01021		
Open Pits Source Calculations	have to model volume sources as independent adjacent sources with emissions input as g/s (BEEST figures out g/sec-m2 by area and volume inputs)								
Coal Pit Volumes(Assumes 180ft Depth)	**Leg 1**	**Leg 2**	**Leg 3**						
Xinit(m)	100.58	100.58	100.58						
Yinit(m)	1325	800	600						
Dep h(m)**	54.9	54 9	54.9	**Total Volume of Open pits**					
Volume (m3)	7,311,643	4,414,577	3,310,933	15037152.55					
Equivalent Surface Area (m2)	133268.5	80464	60348	274080.5					
Emissions (g/s)	0.722412548	0.436173614	0.327130211	1.4857	(Matches main coal pit emissions above)				
Model Emission Rate (g/s-m2)				5.4207E-06					
Main Pit (Overburden removal, etc.)	**Leg 1**	**Leg 2**	**Leg 3**						
Assumes 120 foot average depth									
Xinit(m)	296	296	296						
Yinit(m)	1325	800	600						
Dep h(m) **	36.58	36.58	36.58	**Total Volume of Open pits**					
Volume (m3)	14,345,107	8,661,197	6,495,898	29502201.60					
Equivalent Surface Area (m2)	392200	236800	177600	806600					
Total (g/s)	0.863146988	0.521145351	0.390859013	1.7752	(Matches total development area emissions above)				
Model Emission Rate (g/s-m2)				2.2008E-06					
** The BEEST AERMOD processor figures out the pit depth by using the input volume and surface area for the source									

Alton Tract - Alternative C

AERMOD Area Source PM-2.5 Modeling Emissions

		Emissions by Area (g/s)						
Emission Activities	**Total Annual PM-2.5 Q (g/s)**	**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck Road**	**Access Road**	
Graders	0.0027	0.0014	0.0005			0.0008		0.0027
Bulldozers	0.3183	0.1591	0.0955	0.0637				0.3183
Overburden Loading	0.0289	0.0202	0.0087					0.0289
Overburden Haul Truck	0.1604	0.0863	0.0741					0.1604
Topsoil Scraping	0.0368			0.0368				0.0368
Coal Loading	0.0009		0.0009					0.0009
Blasting	0.0004	0.0003	0.0001					0.0004
Wind Erosion	0.1031	0.0516	0.0309	0.0206				0.1031
Coal Processing	0.0338				0.0338			0.0338
Access Road Traffic	0.1463						0.1463	0.1463
Coal Haul Truck	0.0729	0.0061	0.0244			0.0425		0.0729
Service Vehicles (separated from graders line item)	0.0141	0.0071	0.0028			0.0042		0.0141
Total, g/sec	**0.919**	**0.33**	**0.24**	**0.12**	**0.03**	**0.05**	**0.15**	0.9187
Total, ton/yr	31.94							
Source Description		**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck**	**Alton to Facilities area**	
Area (m^2)		806,600	274,081	274,713	152,856			
Emissions (g/s)		0 3320	0 2380	0 1211	0 0338	0 0476	0 1463	
Initial Lateral Width (m)								
Road Segment Length (m)								
Model Emission Rate (g/s-m2)		4 11608E-07	8 68222E-07	4 40835E-07	2 21334E-07			
Road Segments						44	144	
Volume Source Emission Rate (g/s)						0 00108	0 00102	
						0 002097	Haul road and access road overlap	
Open Pits								
Coal Pit Volumes (210' below grade)	**Leg 1**	**Leg 2**	**Leg 3**					
Xinit(m)	110	110	110					
Yinit(m)	1000	1000	750					
Depth(m)	62.5	62.5	62.5					
Volume (m3)	6873240	6873240	5154930	18901410				
Equivalent Surface Area (m2)	110000	110000	82500	302500				
Emissions at Pit Bottom (g/s)				0.0009				
Emissions assumed at 1/2 depth of pit g/s)				0.2099				
Emissions (g/s)	0.02090307	0.07664459	0.057483442	0.2108	0.155031102			
Model Emission Rate (g/s-m2)				6.9677E-07				
Main Pit (Overburden removal, etc.)	**Leg 1**	**Leg 2**	**Leg 3**					
assume 100' below grade								
Xinit(m)	350	350	350					

Yinit(m)	800	1400	700					
Depth(m)	30	30	30					
Volume (m3)	8,400,000	14,700,000	7,350,000					
Equivalent Surface Area (m2)	280000	490000	245000	1015000				
emissions in main pit overburden removal area (g/s)				0.1065				
other emissions assumed at 1/2 depth of main pit area				0.2123				
Total (g/s)	0.087965866	0.153940266	0.076970133	0.3189				
Model Emission Rate (g/s-m2)				3.1416E-07				

Alton Tract - Alternative C

AERMOD Area Source SO2 Modeling Emissions

		Emissions by Area (g/s)						
Emission Activities	**Total Annual SO2 Q(g/s)**	**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck Road**	**Access Road**	
Graders	0.0001	0.0001	0.0000			0.0000		0.0001
Bulldozers	0.0015	0.0007	0.0004	0.0003				0.0015
Overburden Loading	0.0000	0.0000	0.0000					0.0000
Overburden Haul Truck	0.0043	0.0030	0.0013					0.0043
Topsoil Scraping	0.0004			0.0004				0.0004
Coal Loading	0.0006		0.0006					0.0006
Blasting	0.0086	0.0060	0.0026					0.0086
Wind Erosion	0.0000	0.0000	0.0000	0.0000				0.0000
Coal Processing	0.0000				0.0000			0.0000
Access Road Traffic	0.0002						0.0002	0.0002
Coal Haul Truck	0.0003	0.0000	0.0001			0.0002		0.0003
Service Vehicles (separated from graders line item)	0.0000	0.0000	0.0000			0.0000		0.0000
Total	**0.0160**	**0.0099**	**0.0050**	**0.0007**	**0.0000**	**0.0002**	**0.0002**	0.0160
	0.56							
Source Description		**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck**	**Alton to Facilities area**	
Area (m^2)		1,255,880	303,991	264,387	152,856			
Emissions (g/s)		0 0099	0 0050	0 0007	0 0000	0 0002	0 0002	
Initial Lateral Width (m)						45 77	45 77	
Road Segment Length (m)								
Model Emission Rate (g/s-m2)		7 88455E-09	1 65062E-08	2 53601E-09	0			
Road Segments						66	143	
Volume Source Emission Rate (g/s)						0 000004	0 000001	
						0 000005	Haul road and access road overlap	

Appendix C: AP-42 Emission Factor Sections

Background Document for Revisions to Fine Fraction Ratios Used for AP-42 Fugitive Dust Emission Factors

Prepared by

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For
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MRI Project No. 110397

February 1, 2006
Finalized November 1, 2006

Responses to Comments Received on Proposed AP-42 Revisions

Commenter and Date	Source Category	Comment	Response
John Hayden, National Stone, Sand and Gravel Association (NSSGA); June 14, 2006	Unpaved Roads	NSSGA-sponsored tests (report dated Oct. 15, 2004) at California aggregate producing plants support the proposed fine fractions.	This comment reference a test report prepared by Air Control Techniques for the National Stone, Sand & Gravel Association, dated October 4, 2004. The report gives the results of tests to determine unpaved road emissions factors for controlled (wet suppression only) haul roads at two aggregate processing plants. A variation of the plume profiling method using TEOM continuous monitors with PM-2.5 and PM-10 inlets was employed. Tests with road surface moisture content below 1.5 percent were considered to be uncontrolled. Based on the example PM-10 concentration profiles presented in the report, the maximum roadside PM-10 dust concentrations in the subject study were in the range of 300 micrograms per cubic meter. This is an order of magnitude lower than the concentrations typically found in other unpaved road emission factor studies. For the range of plume concentrations measured in the NSSGA-sponsored test program, an average fine fraction (PM-2.5/PM-10 ratio) of 0.15 was reported. This fine fraction value is consistent with the results of the MRI dust tunnel testing in the same concentration range. At plume concentrations more typical of unpaved road emission factor studies, the proposed value of 0.1 is applicable. There is no need for any revisions to the proposed changes to AP-42 as a result of the cited study.
Hao Quinn, Sacramento Metro AQMD; July 20, 2006	Paved vs. unpaved roads	For a particular industrial facility, the PM-10 emission factor equations show higher emissions from paved roads rather than unpaved roads.	***This comment does not relate to the proposed changes to the fine particle fractions***. It is possible that the emissions from a heavily loaded paved road can exceed emissions from an unpaved road with a low-to-moderate silt content at the same industrial facility, even if traveled by the same vehicles. This is the case in the cited example, for which the paved road silt loading is 70 g/m^2.

Commenter and Date	Source Category	Comment	Response
Brian Leahy, Horizon Environmental; July 26, 2006	Unpaved roads	The k value for PM-2.5 does not appear to have changed in the proposed revision.	The latest (2003) approved AP-42 k values for PM-2.5 in Table 13.2.2-2 are 0.23 and 0.27 lb/VMT for industrial and public roads, respectively. The proposed values are 0.15 and 0.18 lb/VMT, which are equivalent to 10 percent of the respective k values for PM-10. There is no need for revisions to the proposed changes to AP-42 as a result of this comment.
Shengxin Jin, NYSDOT Environmental Analysis Bureau; undated	Paved roads	The conversion of proposed k values from g/VMT to g/VKT does not appear correct	Regarding the revised k values for PM-2.5, when the k value of 0.66 g/VKT is multiplied by 1.6 km/mi, it becomes 1.06 g/VMT, which rounds to 1.1 g/VKT given in the proposed revision. Because the k values are given only to two significant figures, the converted values can vary by up to five digits in the second figure, depending on which direction the units conversion is made. For example, when k value of 1.1 g/VKT is divided by 1.6 km/mi, the resulting value rounds to 0.69 g/VKT, but if 1.06 g/VKT is divided by 1.6 km/mi, the resulting value rounds to 0.66 g/VKT. There is no need for revisions to the proposed changes to AP-42 as a result of this comment.
		The stated silt loading impact of antiskid abrasive does not appear correct	***This comment does not relate to the proposed changes to the fine particle fractions***. The commenter is correct in that 500 lb/mi of antiskid abrasive with a 1% silt content produces a silt loading in the range of 0.5 g/m^2 rather than 2 g/m^2. EPA may elect to make a separate modification to correct this discrepancy at a later time.

Proposed Revisions to Fine Fraction Ratios Used for AP-42 Fugitive Dust Emission Factors

ABSTRACT

A number of fugitive dust studies have indicated that the $PM_{2.5}$ / PM_{10} ratios measured by US EPA federal reference method (FRM) samplers are significantly lower than predicted by AP-42 emission factors. As a result, the $PM_{2.5}$ emission estimates are biased high. The controlled exposure study described in this report was conducted to compare fine fraction ratios derived from FRM samplers to those derived from the cyclone/impactor method that had been used to develop AP-42 emission factors for fugitive dust sources. The study was conducted by the Midwest Research Institute using the same cyclone/impactor samplers and operating method that generated the original AP-42 emission factors and associated $PM_{2.5}$ / PM_{10} ratios. This study was sponsored by the Western Regional Air Partnership.

The study found that concentration measurements used to develop $PM_{2.5}$ emission factors in AP-42 were biased high by a factor of two, as compared to $PM_{2.5}$ measurements from FRM samplers. This factor-of-two bias helps to explain why researchers have often seen a discrepancy in the proportion of fugitive dust found in $PM_{2.5}$ emission inventories and modeled ambient air impacts, as compared to the proportion on ambient filter samples. This study also shows that the $PM_{2.5}$ / PM_{10} ratios for fugitive dust should be in the range of 0.1 to 0.15. Currently, the ratios in AP-42 range from 0.15 to 0.4 for most fugitive dust sources.

It is recommended that the results of this study be used to revise the AP-42 $PM_{2.5}$ emission factors for the following four fugitive dust source categories: paved roads, unpaved roads (public and industrial), aggregate handling and storage piles, and industrial wind erosion (AP-42 Sections 13.2.1, 13.2.2, 13.2.4, & 13.2.5, respectively). Emission estimates for other fugitive dust producing activities, such as construction and demolition will also be affected since they are based on these four source categories.

INTRODUCTION

The Dust Emissions Joint Forum (DEJF) of the Western Regional Air Partnership (WRAP) is engaged in gathering and improving data pertaining to the $PM_{2.5}$ and PM_{10} components of fugitive dust emissions. Most of the $PM_{2.5}$ emission factors in EPA's AP-42 guidance for fugitive dust sources (USEPA, 2005) were determined by using high-volume samplers, each fitted with a cyclone precollector and cascade impactor. Typically, AP-42 recommends that $PM_{2.5}$ emission factors for dust sources be calculated

by using PM_{10} emission factor equations along with $PM_{2.5}/PM_{10}$ ratios that have been published by EPA in AP-42.

Beginning with the introduction of the cyclone/impactor method, it was realized particle bounce from the cascade impactor stages to the backup filter may have resulted in inflated $PM_{2.5}$ concentrations, even though steps were taken to minimize particle bounce. This led to an EPA-funded field study in the late 1990s (MRI, 1997) to gather comparative particle sizing data in dust plumes downwind of paved and unpaved roads around the country. The test results indicated that dichotomous samplers produced consistently lower $PM_{2.5}/PM_{10}$ ratios than generated with the cyclone/impactor system. Dichotomous samplers are federal reference method (FRM) samplers that are used to measure compliance with federal air quality standards for particulate matter measured as $PM_{2.5}$ and PM_{10}. Pending the eventual collection of additional data, the decision was made that the true ratios would best be represented by an averaging of the cyclone/impactor data with the dichotomous sampler data.

Based on the results of the EPA-funded field program, modifications were made to the appropriate sections of AP-42 for dust emissions from paved and unpaved roads. The $PM_{2.5}/PM_{10}$ ratio for emissions from unpaved roads (dominated by fugitive dust) was reduced from 0.26 to 0.15, and the $PM_{2.5}/PM_{10}$ ratio for the dust component of emissions from paved roads was reduced from 0.46 to 0.25. In the 2003 revision to AP-42, the non-dust component of paved road emissions was assigned a $PM_{2.5}/PM_{10}$ ratio of 0.76, accounting for vehicle exhaust and brake and tire wear.

Subsequent to the modifications of the $PM_{2.5}/PM_{10}$ ratios in AP-42, additional field test results (mostly from ambient air samplers) indicated that further reductions to the ratios were warranted (Pace, 2005). For example, ambient air monitoring data suggested that the fine fraction dust mass is of the order of 10 percent of the PM_{10} mass, based on chemical fingerprinting of the collected fine and coarse fractions of PM_{10} impacted by dust sources. It is important to note, however, that particle size data applicable to fugitive dust emission factors should be gathered either from the emissions plume or near the point where emissions are generated (within 10 m of the downwind edge of the source).

METHODOLOGY

This led DEJF to fund Midwest Research Institute (MRI) in conducting a controlled study of particle sizing in dust plumes. The objective of the study was to resolve the fine particle bias in the cyclone/impactor system, so that reliable $PM_{2.5}/PM_{10}$ ratios could be developed for as many dust source categories as possible. For this purpose, an air exposure chamber connected to a recirculating supply air stream was used in conjunction with a fluidization system for generating well-mixed dust plumes from a variety of western soils and road surface materials. R&P Model 2000 Partisol samplers were selected as the ground-truthing FRM samplers for PM_{10} and $PM_{2.5}$.

This study was performed in two phases (see below), as described in the attached test report (Cowherd and Donaldson, 2005). The test report serves as the background document to support the recommended revisions to AP-42, and it contains all the quality assurance procedures and results of the testing.

Phase I – Compare $PM_{2.5}$ Measured by Cyclone/Impactor to FRM Sampler

In the first testing phase of the project, $PM_{2.5}$ measurements using the high-volume cascade impactors were compared to simultaneous measurements obtained with EPA FRM samplers for $PM_{2.5}$. As stated above, these tests were conducted in a flow-through wind tunnel and exposure chamber, where the PM_{10} concentration level and uniformity were controlled. The results of the tests provided the basis for quantifying more effectively any sampling bias associated with the cascade impactor system.

Phase 2 – Compare $PM_{2.5}$ to PM_{10} Ratios for Different Geologic Soils

With the same test setup, a second phase of testing was performed with reference method samplers, for the purpose of measuring $PM_{2.5}$ to PM_{10} ratios for fugitive dust from different geologic sources in the West. This testing provided needed information on the magnitude and variability of this ratio, especially for source materials that are recognized as problematic with regard to application of mitigative dust control measures.

RESULTS

The tests that were performed are listed in Tables 6 and 7 of the attached report. The Phase I tests were performed in March and April of 2005. The Phase II tests were performed in June through August of 2005. A total of 100 individual tests were performed, including 17 blank runs (for quality assurance purposes). The raw and intermediate test data are summarized in the tables presented in Appendix A of the attached report.

Based on the 100 wind tunnel tests that were performed in the wind tunnel study, the findings support the following conclusions:

1. $PM_{2.5}$ concentrations measured by the high-volume cyclone/impactor system used to develop AP-42 emission factors for fugitive dust sources have a positive bias by a factor of 2, as compared to the $PM_{2.5}$ concentration measurements from reference-method samplers (see Figure 1). The geometric mean bias is 2.01 and the arithmetic mean bias is 2.15.
2. The $PM_{2.5}$ bias associated with the cyclone/impactor system, as measured under controlled laboratory conditions with dust concentrations held at nearly steady values, closely replicates the bias observed in the prior EPA-funded field study at distributed geographic locations across the country.

3. The $PM_{2.5}/PM_{10}$ ratios measured by the FRM samplers in the current study for a variety of western soils show a decrease in magnitude with increasing PM_{10} concentration (see Figure 2). Soils with a nominally spherical shape are observed to have somewhat lower ratios (at given PM_{10} concentrations) than soils with angular shape. A very similar dependence of $PM_{2.5}/PM_{10}$ ratio on PM_{10} concentration was also observed in the prior field study that used dichotomous samplers as FRM devices.
4. The test data from the current study support a $PM_{2.5}/PM_{10}$ ratio in the range of 0.1 to 0.15 for typical uncontrolled fugitive dust sources (see Figure 2). The $PM_{2.5}/PM_{10}$ ratio of 0.1 is also supported by numerous other studies including the prior EPA-funded field study that used dichotomous samplers as reference devices. It is possible that a ratio as low as 0.05 (as was found in the prior field tests of unpaved road emission factors) might be appropriate for very dusty sources, but this would require extrapolation of the current test data from the wind tunnel study.

DISCUSSION

Peer Review

The test report on the wind tunnel study (Cowherd and Donaldson, 2005) was issued first in draft form for external peer review. Three peer reviewers (having no prior contact with the study) were selected by the DEJF: Patrick Gaffney (California Air Resources Board), John Kinsey (U.S. Environmental Protection Agency), and Mel Zeldin (Private Consultant). In addition, peer review comments were provided by Duane Ono (Great Basin UAPCD) and Richard Countess (Countess Environmental) who helped to develop this study. After the review comments on the draft test report were received, comment/ response logs were prepared by MRI, listing each comment and the response to each comment. The next step was to modify the draft test report in accordance with the responses to the review comments. The final test report was issued on October 12, 2005.

Recommended Particle Size Ratios

Based on the results of the WRAP/DEJF study (see attached test report) and the prior EPA-funded field study, it is proposed that new $PM_{2.5}/PM_{10}$ ratios be adopted for several categories of (uncontrolled) fugitive dust sources, as addressed in AP-42. The proposed ratios (given to the nearest 0.05) are summarized in Table 1. It should be noted that these fine fraction ratios and the emission factors could change in the future if field studies show other differences than those identified through this study.

The proposed $PM_{2.5}/PM_{10}$ ratios in Table 1, apply to dry surface materials, having moisture contents in the range of 1% or less. Such materials when exposed to energetic disturbances produce dust plumes with core PM_{10} concentrations in the range of 5,000 micrograms per cubic meter, near the point of emissions generation. The wind tunnel test data show that dust plumes with lower core concentrations have higher $PM_{2.5}/PM_{10}$

ratios. This might occur, for example, at higher soil (or other surface material) moisture contents. However, the emissions from such sources typically are substantially lower with correspondingly less impact on the ambient environment.

Table 1. Proposed Particle Size Ratios for AP-42

Fugitive dust source category	AP-42 section	$PM_{2.5}/PM_{10}$ Ratio	
		Current	Proposed
Paved Roads	13.2.1	0.25	0.15
Unpaved Roads (Public & Industrial)	13.2.2	0.15	0.1
Construction & Demolition	–	0.208 [1]	0.1
Aggregate Handling & Storage Piles	13.2.4	0.314	0.1 (traffic) 0.15 (transfer)
Industrial Wind Erosion	13.2.5	0.40	0.15
Agricultural Tilling	–	0.222 [2]	0.2 (no change)
Open Area Wind Erosion	–	-	0.15

Notes:

[1] AP-42 Section 13.2.3 suggests using emission factors for individual dust producing activities, e.g., materials handling and unpaved roads. The WRAP Fugitive Dust Handbook recommends using a fine fraction ratio of 0.208 from a report prepared for the US EPA, Estimating Particulate Matter Emissions from Construction Operations (MRI, 1999).

[2] Agricultural tilling was dropped from the 5th edition of AP-42. The WRAP Fugitive Dust Handbook recommends using a fine fraction ratio of 0.222 from Section 7.4 of the California Air Resources Board's Emission Inventory Methodology (CARB, 2003).

The justification for each proposed ratio in Table 1 is provided by source category in the sections below. In each case, reference is made to test reports that contain supporting data.

Paved Roads

For the dust component of particulate emissions from paved roads, a $PM_{2.5}/PM_{10}$ ratio of 0.15 is recommended. The proposed ratio is based on the factor-of-two bias in the cyclone/impactor data for the wind tunnel study, which tested western soils and road surface materials. As shown in Table 1, the current AP-42 ratio is 0.25. It should be recalled that the nondust component of paved road particulate emissions has been assigned a much higher ratio of 0.76, based on inputs from the EPA's MOBILE 6 model.

Unpaved Roads

For the dust component of particulate emissions from unpaved roads, which dominates the total particulate emissions from this source category, a $PM_{2.5}/PM_{10}$ ratio of 0.1 is recommended. The proposed ratio is justified from the test results of the wind tunnel study for a variety of western surface materials. It is also consistent with the factor-of-two bias in the cyclone/impactor data from the wind tunnel study and with the results of the prior field study that used dichotomous samplers as FRM devices (MRI, 1997).

Construction and Demolition

The dust component of particulate emissions from construction and demolition dominate the total particulate emissions from this source category. A $PM_{2.5}/PM_{10}$ ratio of 0.1 is recommended for dust emissions from construction and demolition. The proposed ratio is justified by the fact that the dominant dust source associated with construction and demolition projects is emissions from vehicle travel over unpaved surfaces. This is shown by case studies that calculate particulate emissions from representative construction activities (road, building, and nonbuilding construction). For example, the fine fraction ratio for scraper travel averages about 0.2 (Muleski et al., 2005), before correcting for the factor-of- two bias in the cyclone/impactor system. Moreover this includes the diesel emissions that are contained within the fine fraction component.

It should be noted that if large open areas are disturbed (such as in land clearing) and left unprotected, and the areas are exposed to high winds, open area wind erosion can also be an important contributor to dust emissions from this source category. The recommended fine fraction ratio identified below should be used for the open area wind erosion component.

Aggregate Handling and Storage Piles

Although usually not a major source in comparison with traffic around storage piles, the transfer of aggregate associated with bucket loaders and unloaders or conveyor transfer points is addressed directly in this section of AP-42. A $PM_{2.5}/PM_{10}$ ratio of 0.15 is recommended for transfer operations. This is half the current value in AP-42 and reflects adjustment for the factor-of-two bias in the cyclone/impactor test results.

The dominant dust component of particulate emissions from aggregate handling and storage piles typically consists of loader and truck traffic around the storage piles. AP-42 refers the reader to the unpaved roads section to find appropriate emission factors. A $PM_{2.5}/PM_{10}$ ratio of 0.1 is recommended for this source. The proposed ratio is consistent with that recommended above for traffic on unpaved surfaces.

Industrial Wind Erosion

For the dust component of particulate emissions from industrial wind erosion, a $PM_{2.5}/PM_{10}$ ratio of 0.15 is recommended. Industrial wind erosion is associated with crushed aggregate materials, such as coal or metallic ore piles. Examples would include open storage piles at mining operations. The proposed ratio is justified by portable wind tunnel tests of industrial aggregate materials which produced $PM_{2.5}/PM_{10}$ ratios averaging 0.4, as indicated by the current AP-42 fine fraction ratio given in Table 1. When these results are corrected for the bias associated with the cyclone/impactor system at very high PM_{10} concentrations observed in the effluent from the portable wind tunnel (exceeding 10,000 $\mu g/m^3$), the result is 0.15.

Agricultural Tilling

For the dust component of particulate emissions from agricultural tilling and related land preparation activities, which dominates the total particulate emissions from this source category, no new $PM_{2.5}/PM_{10}$ ratio can be recommended at this time, because of the lack of published test data. However, the current factor of 0.2, as listed in Table 1, appears to be generally consistent with the results of the current wind tunnel tests. It was found that the agricultural soils tested in the wind tunnel produced slightly higher ratios than the other test materials. In addition, the dust plume core concentrations from agricultural operations are generally observed to be less intense because of the lower equipment speeds involved and the lack of repeated travel over the same routes.

Open Area Wind Erosion

For the dust component of particulate emissions from open area wind erosion (not currently addressed in AP-42), a $PM_{2.5}/PM_{10}$ ratio of 0.15 is recommended. Open area wind erosion is associated with exposed soils that have been disturbed, removing the protection afforded by natural crusting. Examples would include freshly tilled agricultural fields prior to planting of crops. The proposed ratio is justified by wind tunnel tests of exposed soils (MRI, 1994), which produced $PM_{2.5}/PM_{10}$ ratios averaging 0.3. When these results are corrected for the bias associated with the cyclone/impactor system, the ratio becomes 0.15. This is consistent with the $PM_{2.5}/PM_{10}$ ratios in the range of 0.12 measured during dust storms on Owens Dry Lake (Ono, 2005).

Specific Revisions to AP-42

This section presents a listing of specific revisions to AP-42, for the purpose of incorporating the proposed $PM_{2.5}/PM_{10}$ ratios. As shown in Table 2, five subsections of AP-42 Section 13.2, Fugitive Dust, are impacted by the proposed changes. However, one of the five sections (13.2.3, Heavy Construction Operations) is impacted only indirectly because it refers to other sections of AP-42 for fugitive dust emission factors.

In most cases, the change in the $PM_{2.5}/PM_{10}$ ratio is accomplished by changing the appropriate PM-2.5 particle size multiplier (k-factor) for the respective emission factor equation. In addition, the changes need to be referenced to the WRAP test report (Cowherd and Donaldson, 2005).

Table 2. Specific revisions to AP-42 that are incorporated into the AP-42 sections included in Attachment A.

Source category	Sub-section	Title	Revision	Comments
13.2.1 Paved Roads	13.2.1.3	*Predictive Emission Factor Equation*	In Table 13.2.1-1, reduce k values for PM-2.5 by 40 percent, e.g., the new value is 1.1 g/VMT (and equivalent values for the other units)	Add ref. number for WRAP test report
	13.2.1.5	*Changes since Fifth Edition*	Modify statement (1) to reflect change in fine fraction	
		References	Add WRAP test report as Ref. 22	
13.2.2 Unpaved Roads	13.2.2.2	*Emission Calculation and Correction Parameters*	In Table 13.2.2-2, reduce k values for PM-2.5 by 33%, e.g., the new value is 0.15 lb/VMT for industrial roads and 0.18 lb/VMT for public roads (and equivalent values for the other units)	Add ref. number for WRAP test report
	13.2.2.4	*Updates since Fifth Edition*	Add sentences describing change in fine fraction	
		References	Add WRAP test report	
13.2.3 Heavy Construction Operations	–	–	No changes required	Refers to other AP-42 sections for emission factors
13.2.4 Aggregate Handling and Storage Piles	13.2.4.3	*Predictive Emission Factor Equations*	In k-factor table for Equation 1 for transfer operations, change PM-2.5 multiplier to 0.053 (dimensionless)	Add ref. number for WRAP test report
		References	Add WRAP test report	
13.2.5 Industrial Wind Erosion	13.2.5.2	*Emissions and Correction Parameters*	In k-factor table for Equation 1, change PM-2.5 multiplier to 0.075 (dimensionless)	Add ref. number for WRAP test report
		References	Add WRAP test report	

CONCLUSION

This study found that concentration measurements used to develop $PM_{2.5}$ emission factors for AP-42 were biased high by a factor of two, as compared to $PM_{2.5}$ measurements from FRM samplers. This factor-of-two bias helps to explain why researchers have often seen a similar discrepancy in the proportion of fugitive dust found in $PM_{2.5}$ emission inventories and modeled ambient impacts, as compared to the proportion observed on ambient filter samples. This study also shows that the $PM_{2.5}$ / PM_{10} ratios for fugitive dust should be in the range of 0.1 to 0.15. Currently, the fine fraction ratios in AP-42 range from 0.15 to 0.4 for most fugitive dust sources.

It is recommended that the results of this study by used to revise the AP-42 $PM_{2.5}$ emission factors for the following four fugitive dust source categories: paved roads, unpaved roads (public and industrial), aggregate handling and storage piles, and industrial wind erosion (AP-42 Sections 13.2.1, 13.2.2, 13.2.4, & 13.2.5, respectively). Emission estimates for other fugitive dust producing activities, such as construction and demolition, will also be affected since they are based on these four source categories. It is recommended that revisions to the current AP-42 sections for these fugitive dust sources be adopted as shown in Attachment A to this report.

IMPLICATIONS

The proposed revisions to AP-42 are needed to ensure the most accurate $PM_{2.5}$ and PM_{10} fugitive dust emissions inventories that are possible for regional haze regulatory purposes, given the available resources and the significant contribution of fugitive dust to visibility impairment. In particular, the revisions will affect the quantity of dust apportioned to the fine ($PM_{2.5}$) versus coarse ($PM_{2.5-10}$) size modes, which have significantly different effects on visibility and long-range transport potentials. This will reduce $PM_{2.5}$ emission estimates for fugitive dust sources to about half their current level. It will also increase the coarse-mode size fraction for fugitive dust, which would be important in the event that a PM coarse standard is adopted by the US EPA and emission inventories are developed.

The revisions will be helpful in developing accurate emission inventories for PM nonattainment, maintenance, and action plan areas throughout the country. Finally, the proposed modifications to the fine fractions associated with EPA's AP-42 emission factors will ensure widespread availability of the most recent and accurate scientific information.

References

Cowherd, C. and J. Donaldson. 2005. *Analysis of the Fine Fraction of Particulate Matter in Fugitive Dust.* Final report prepared for the Western Governors' Association, Western Regional Air Partnership (WRAP), MRI Project No. 110397, October 12, 2005. **[Describes wind tunnel study to determine fine fraction ratios]**

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Figure 1. Phase I test results show that the Cyclone/ Impactor method measured $PM_{2.5}$ concentrations that were two times higher than those measured by Federal Reference Method samplers when simultaneously exposed to the well-mixed dust environment in the wind tunnel.

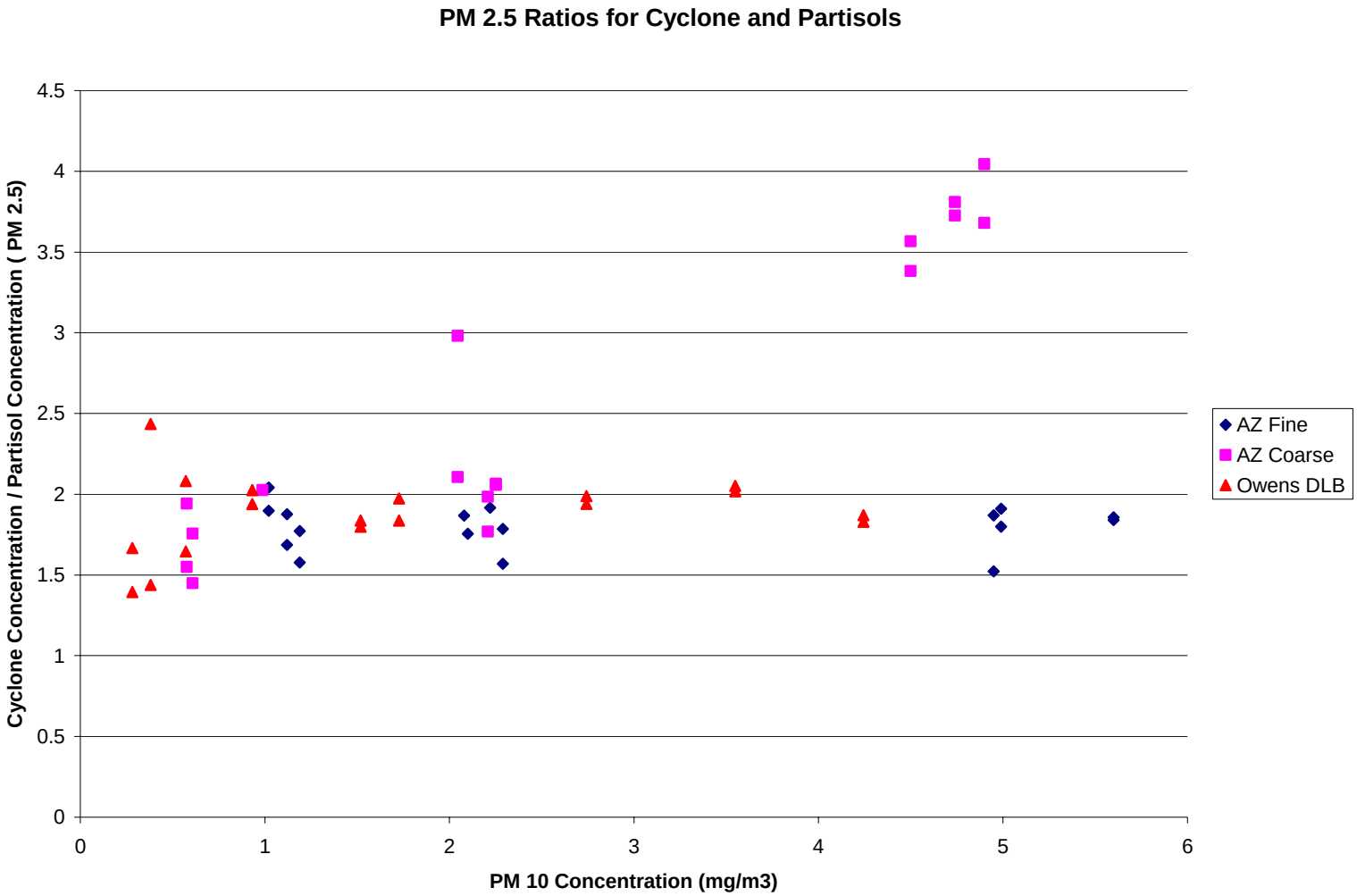
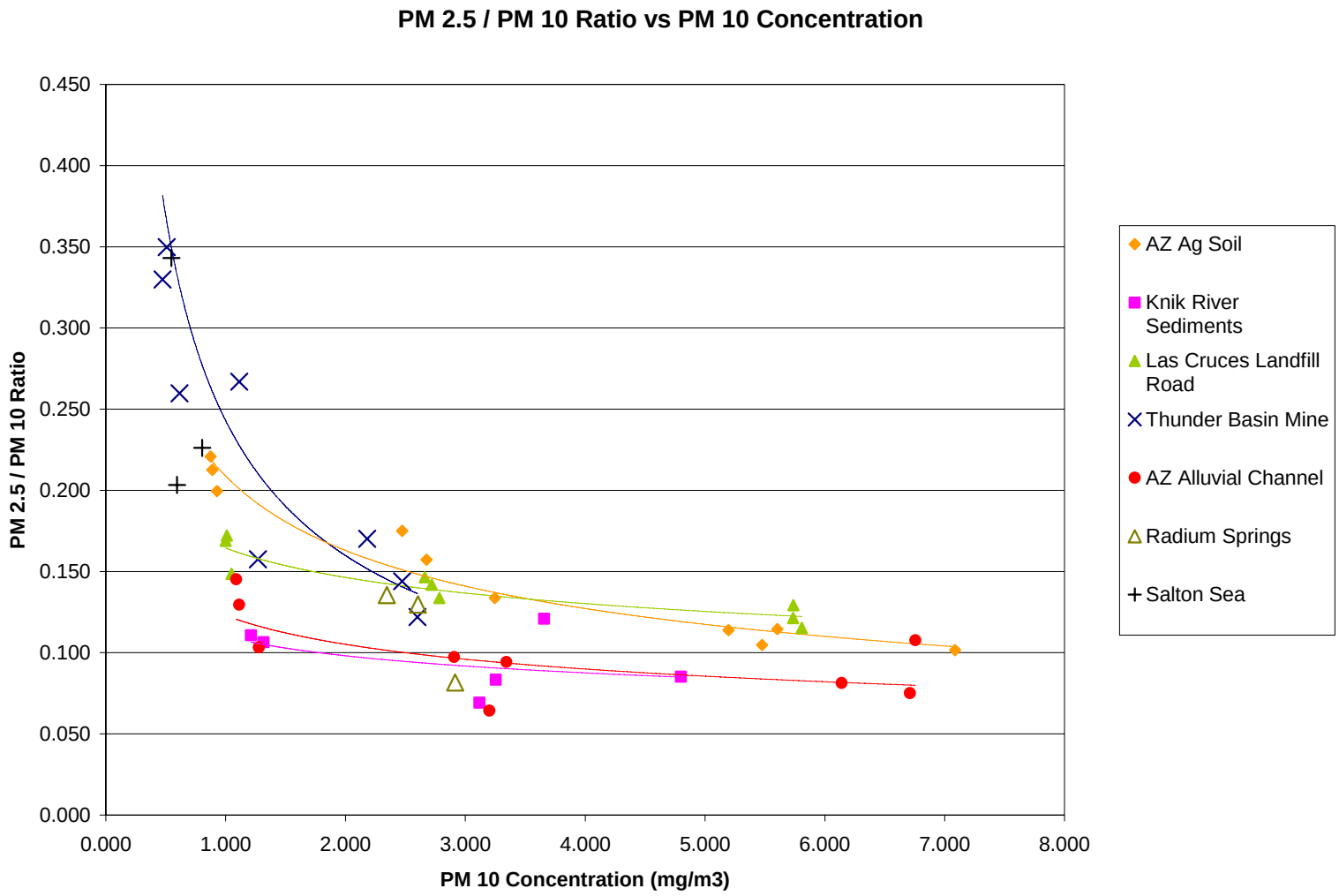


Figure 2. Phase II tests show that the $PM_{2.5}/PM_{10}$ ratio decreased with increasing PM concentrations, and could be expected to be in the range of 0.1 at concentrations that are typical of fugitive dust emission plumes.



11.9 Western Surface Coal Mining

11.9.1 General[1]

There are 12 major coal fields in the western states (excluding the Pacific Coast and Alaskan fields), as shown in Figure 11.9-1. Together, they account for more than 64 percent of the surface minable coal reserves in the United States.[2] The 12 coal fields have varying characteristics that may influence fugitive dust emission rates from mining operations including overburden and coal seam thicknesses and structure, mining equipment, operating procedures, terrain, vegetation, precipitation and surface moisture, wind speeds, and temperatures. The operations at a typical western surface mine are shown in Figure 11.9-2. All operations that involve movement of soil or coal, or exposure of erodible surfaces, generate some amount of fugitive dust.

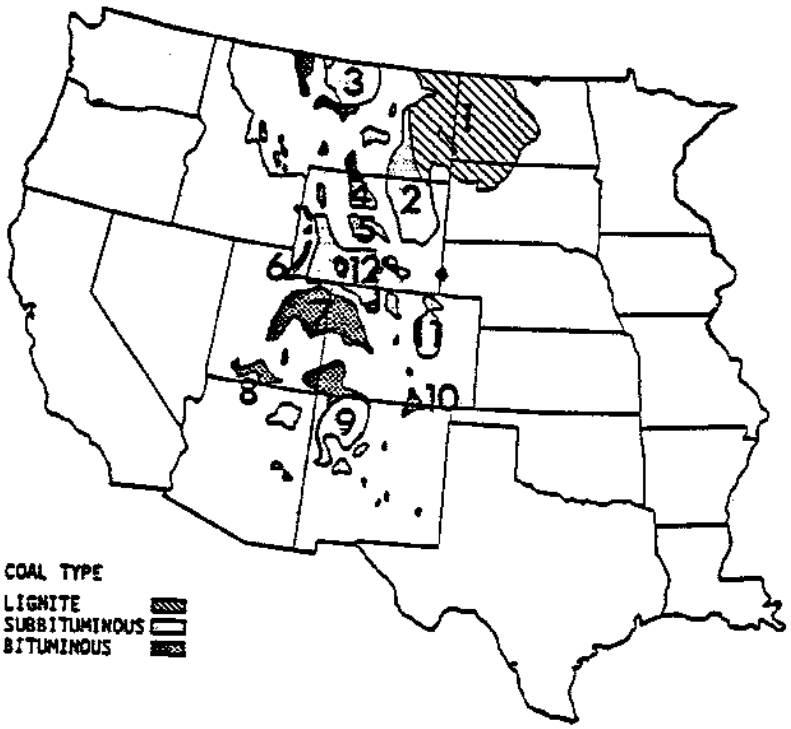
The initial operation is removal of topsoil and subsoil with large scrapers. The topsoil is carried by the scrapers to cover a previously mined and regraded area as part of the reclamation process or is placed in temporary stockpiles. The exposed overburden, the earth that is between the topsoil and the coal seam, is leveled, drilled, and blasted. Then the overburden material is removed down to the coal seam, usually by a dragline or a shovel and truck operation. It is placed in the adjacent mined cut, forming a spoils pile. The uncovered coal seam is then drilled and blasted. A shovel or front end loader loads the broken coal into haul trucks, and it is taken out of the pit along graded haul roads to the tipple, or truck dump. Raw coal sometimes may be dumped onto a temporary storage pile and later rehandled by a front end loader or bulldozer.

At the tipple, the coal is dumped into a hopper that feeds the primary crusher, then is conveyed through additional coal preparation equipment such as secondary crushers and screens to the storage area. If the mine has open storage piles, the crushed coal passes through a coal stacker onto the pile. The piles, usually worked by bulldozers, are subject to wind erosion. From the storage area, the coal is conveyed to a train loading facility and is put into rail cars. At a captive mine, coal will go from the storage pile to the power plant.

During mine reclamation, which proceeds continuously throughout the life of the mine, overburden spoils piles are smoothed and contoured by bulldozers. Topsoil is placed on the graded spoils, and the land is prepared for revegetation by furrowing, mulching, etc. From the time an area is disturbed until the new vegetation emerges, all disturbed areas are subject to wind erosion.

11.9.2 Emissions

Predictive emission factor equations for open dust sources at western surface coal mines are presented in Tables 11.9-1 and 11.9-2. Each equation applies to a single dust-generating activity, such as vehicle traffic on haul roads. The predictive equation explains much of the observed variance in emission factors by relating emissions to three sets of source parameters: (1) measures of source activity or energy expended (e. g., speed and weight of a vehicle traveling on an unpaved road); (2) properties of the material being disturbed (e. g., suspendable fines in the surface material of an unpaved road); and (3) climate (in this case, mean wind speed).



	Coal field	Strippable reserves (10^6 tons)
1	Fort Union	23,529
2	Powder River	56,727
3	North Central	All underground
4	Bighorn Basin	All underground
5	Wind River	3
6	Hams Fork	1,000
7	Uinta	308
8	Southwestern Utah	224
9	San Juan River	2,318
10	Raton Mesa	All underground
11	Denver	All underground
12	Green River	2,120

Figure 11.9-1. Coal fields of the western United States.[3]

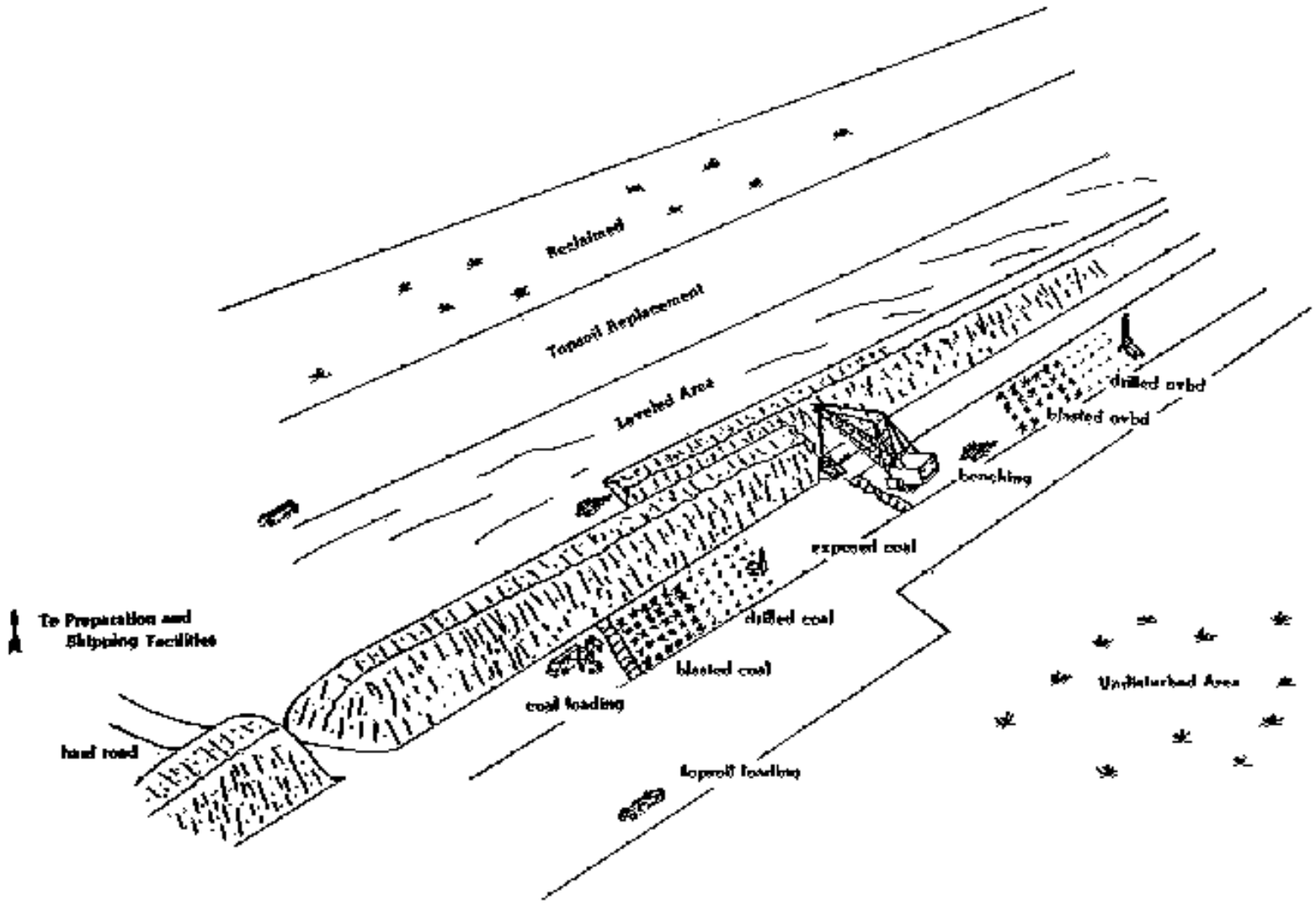


Figure 11.9-2. Operations at typical western surface coal mines.

The equations may be used to estimate particulate emissions generated per unit of source extent or activity (e. g., distance traveled by a haul truck or mass of material transferred). The equations were developed through field sampling of various western surface mine types and are thus applicable to any of the surface coal mines located in the western United States.

In Tables 11.9-1 and 11.9-2, the assigned quality ratings apply within the ranges of source conditions that were tested in developing the equations given in Table 11.9-3. However, the equations should be derated 1 letter value (e. g., A to B) if applied to eastern surface coal mines.

In using the equations to estimate emissions from sources found in a specific western surface mine, it is necessary that reliable values for correction parameters be determined for the specific sources of interest if the assigned quality ratings of the equations are to be applicable. For example, actual silt content of coal or overburden measured at a facility should be used instead of estimated values. In the event that site-specific values for correction parameters cannot be obtained, the appropriate geometric mean values from Table 11.9-3 may be used, but the assigned quality rating of each emission factor equation should be reduced by 1 level (e. g., A to B).

Emission factors for open dust sources not covered in Table 11.9-3 are in Table 11.9-4. These factors were determined through source testing at various western coal mines.

The factors in Table 11.9-4 for mine locations I through V were developed for specific geographical areas. Tables 11.9-5 and 11.9-6 present characteristics of each of these mines (areas). A "mine-specific" emission factor should be used only if the characteristics of the mine for which an emissions estimate is needed are very similar to those of the mine for which the emission factor was developed. The other (nonspecific) emission factors were developed at a variety of mine types and thus are applicable to any western surface coal mine.

As an alternative to the single valued emission factors given in Table 11.9-4 for train or truck loading and for truck or scraper unloading, two empirically derived emission factor equations are presented in Section 13.2.4 of this document. Each equation was developed for a source operation (i. e., batch drop and continuous drop, respectively) comprising a single dust-generating mechanism that crosses industry lines.

Because the predictive equations allow emission factor adjustment to specific source conditions, the equations should be used in place of the single-valued factors in Table 11.9-4 for the sources identified above, if emission estimates for a specific western surface coal mine are needed. However, the generally higher quality ratings assigned to the equations are applicable only if: (1) reliable values of correction parameters have been determined for the specific sources of interest, and (2) the correction parameter values lie within the ranges tested in developing the equations. Caution must be exercised so that only the unbound (sorbed) moisture (i. e., not any bound moisture) is used in determining the moisture content for input to the Chapter 13 equations.

Table 11.9-1 (English Units). EMISSION FACTOR EQUATIONS FOR UNCONTROLLED OPEN DUST SOURCES AT WESTERN SURFACE COAL MINES[a]

Operation	Material	Emissions By Particle Size Range (Aerodynamic Diameter)[b,c]				Units	EMISSION FACTOR RATING
		Emission Factor Equations		Scaling Factors			
		TSP ≤30 µm	≤15 µm	≤10 µm[d]	≤2.5 µm/TSP[e]		
Blasting[f]	Coal or overburden	$0.000014(A)^{1.5}$	ND	0.52[e]	0.03	lb/blast	C_DD
Truck loading	Coal	$\frac{1.16}{(M)^{1.2}}$	$\frac{0.119}{(M)^{0.9}}$	0.75	0.019	lb/ton	BBCC
Bulldozing	Coal	$\frac{78.4\ (s)^{1.2}}{(M)^{1.3}}$	$\frac{18.6\ (s)^{1.5}}{(M)^{1.4}}$	0.75	0.022	lb/hr	CCDD
	Overburden	$\frac{5.7\ (s)^{1.2}}{(M)^{1.3}}$	$\frac{1.0\ (s)^{1.5}}{(M)^{1.4}}$	0.75	0.105	lb/hr	BCDD
Dragline	Overburden	$\frac{0.0021\ (d)^{1.1}}{(M)^{0.3}}$	$\frac{0.0021\ (d)^{0.7}}{(M)^{0.3}}$	0.75	0.017	lb/yd^3	BCDD
Vehicle traffic[g]							
Grading		$0.040\ (S)^{2.5}$	$0.051\ (S)^{2.0}$	0.60	0.031	lb/VMT	CCDD
Active storage pile[h] (wind erosion and maintenance)	Coal	0.72 u	ND	ND	ND	$\frac{\text{lb}}{(\text{acre})(\text{hr})}$	C[i]_ _ _

[a] Reference 1, except as noted. VMT = vehicle miles traveled. ND = no data. Quality ratings coded where "Q, X, Y, Z" are ratings for ≤30 µm, ≤15 µm, ≤10 µm, and ≤2.5 µm, respectively. See also note below.

[b] Particulate matter less than or equal to 30 µm in aerodynamic diameter is sometimes termed "suspendable particulate" and is often used as a surrogate for TSP (total suspended particulate). TSP denotes what is measured by a standard high volume sampler (see Section 13.2).

[c] Symbols for equations:

A = horizontal area (ft^2), with blasting depth ≤ 70 ft. Not for vertical face of a bench.
M = material moisture content (%)
s = material silt content (%)
u = wind speed (mph)
d = drop height (ft)
W = mean vehicle weight (tons)
S = mean vehicle speed (mph)
w = mean number of wheels

Table 11.9-1 (cont.).

[d] Multiply the ≤15-µm equation by this fraction to determine emissions, except as noted.
[e] Multiply the TSP predictive equation by this fraction to determine emissions.
[f] Blasting factor taken from a reexamination of field test data reported in Reference 1. See Reference 4.
[g] To estimate emissions from traffic on unpaved surfaces by vehicles such as haul trucks, light-to-medium duty vehicles, or scrapers in the travel mode, see the unpaved road emission factor equation in AP-42 Section 13.2.2.
[h] Coal storage pile factor taken from Reference 5. To estimate emissions on a shorter time scale (e. g., worst-case day), see the procedure presented in Section 13.2.5.
[i] Rating applicable to mine types I, II, and IV (see Tables 11.9-5 and 11.9-6).

Note: Section 234 of the Clean Air Act of 1990 required EPA to review and revise the emission factors in this Section (and models used to evaluate ambient air quality impact), to ensure that they did not overestimate emissions from western surface coal mines. Due to resource and technical limitations, the haul road emission factors were isolated to receive the most attention during these studies, as the largest contributor to emissions. Resultant model evaluation with revised emission factors have improved model prediction for total suspended particulate (TSP); however, there is still a tendency for overprediction of particulate matter impact for PM-10, for as yet undetermined causes, prompting the Agency to make a policy decision not to use them for regulatory applications to these sources. However, the technical consideration exists that no better alternative data are currently available and the information should be made known. Users should accordingly use these factors with caution and awareness of their likely limitations.

Table 11.9-2 (Metric Units). EMISSION FACTOR EQUATIONS FOR UNCONTROLLED OPEN DUST SOURCES AT WESTERN SURFACE COAL MINES[a]

Operation	Material	Emissions By Particle Size Range (Aerodynamic Diameter)[b,c]				Units	EMISSION FACTOR RATING
		Emission Factor Equations		Scaling Factors			
		TSP ≤30 µm	≤15 µm	≤10 µm[d]	≤2.5 µm/TSP[e]		
Blasting[f]	Coal or overburden	$0.00022(A)^{1.5}$	ND	0.52[e]	0.03	kg/blast	C_DD
Truck loading	Coal	$\frac{0.580}{(M)^{1.2}}$	$\frac{0.0596}{(M)^{0.9}}$	0.75	0.019	kg/Mg	BBCC
Bulldozing	Coal	$\frac{35.6\ (s)^{1.2}}{(M)^{1.4}}$	$\frac{8.44\ (s)^{1.5}}{(M)^{1.4}}$	0.75	0.022	kg/hr	CCDD
	Overburden	$\frac{2.6\ (s)^{1.2}}{(M)^{1.3}}$	$\frac{0.45\ (s)^{1.5}}{(M)^{1.4}}$	0.75	0.105	kg/hr	BCDD
Dragline	Overburden	$\frac{0.0046\ (d)^{1.1}}{(M)^{0.3}}$	$\frac{0.0029\ (d)^{0.7}}{(M)^{0.3}}$	0.75	0.017	kg/m^3	BCDD
Vehicle traffic[g]							
Grading		$0.0034\ (S)^{2.5}$	$0.0056\ (S)^{2.0}$	0.60	0.031	kg/VKT	CCDD
Active storage pile[h] (wind erosion and maintenance)	Coal	1.8 u	ND	ND	ND	$\frac{kg}{(hectare)(hr)}$	C[i]_ _ _

[a] Reference 1, except as noted. VKT = vehicle kilometers traveled. ND = no data. Quality ratings coded as "QXYZ", where Q, X, Y, and Z are quality ratings for ≤30 µm, ≤15 µm, ≤10 µm, and ≤2.5 µm, respectively. See also note below.

[b] Particulate matter less than or equal to 30 µm in aerodynamic diameter is sometimes termed "suspendable particulate" and is often used as a surrogate for TSP (total suspended particulate). TSP denotes what is measured by a standard high volume sampler (see Section 13.2).

[c] Symbols for equations:

A = horizontal area (m^2), with blasting depth ≤ 21 m. Not for vertical face of a bench.
M = material moisture content (%)
s = material silt content (%)
u = wind speed (m/sec)
d = drop height (m)
W = mean vehicle weight (Mg)
S = mean vehicle speed (kph)
w = mean number of wheels

Table 11.9-2 (cont.).

[d] Multiply the ≤ 15-µm equation by this fraction to determine emissions, except as noted.
[e] Multiply the TSP predictive equation by this fraction to determine emissions.
[f] Blasting factor taken from a reexamination of field test data reported in Reference 1. See Reference 4.
[g] To estimate emissions from traffic on unpaved surfaces by vehicles such as haul trucks, light-to-medium duty vehicles, or scrapers in the travel mode, see the unpaved road emission factor equation in AP-42 Section 13.2.2
[h] Coal storage pile factor taken from Reference 5. To estimate emissions on a shorter time scale (e. g., worst-case day), see the procedure presented in Section 13.2.5.
[i] Rating applicable to mine types I, II, and IV (see Tables 11.9-5 and 11.9-6).

Note: Section 234 of the Clean Air Act of 1990 required EPA to review and revise the emission factors in this Section (and models used to evaluate ambient air quality impact), to ensure that they did not overestimate emissions from western surface coal mines. Due to resource and technical limitations, the haul road emission factors were isolated to receive the most attention during these studies, as the largest contributor to emissions. Resultant model evaluation with revised emission factors have improved model prediction for total suspended particulate (TSP); however, there is still a tendency for overprediction of particulate matter impact for PM-10, for as yet undetermined causes, prompting the Agency to make a policy decision not to use them for regulatory applications to these sources. However, the technical consideration exists that no better alternative data are currently available and the information should be made known. Users should accordingly use these factors with caution and awareness of their likely limitations.

Table 11.9-3 (Metric And English Units). TYPICAL VALUES FOR CORRECTION FACTORS APPLICABLE TO THE PREDICTIVE EMISSION FACTOR EQUATIONS[a]

Source	Correction Factor	Number Of Test Samples	Range	Geometric Mean	Units
Blasting	Area blasted	17	100 – 6,800	1,590	m^2
	Area blasted	17	1100 – 73,000	17,000	ft^2
Coal loading	Moisture	7	6.6 - 38	17.8	%
Bulldozers					
Coal	Moisture	3	4.0 - 22.0	10.4	%
	Silt	3	6.0 - 11.3	8.6	%
Overburden	Moisture	8	2.2 - 16.8	7.9	%
	Silt	8	3.8 - 15.1	6.9	%
Dragline	Drop distance	19	1.5 - 30	8.6	m
	Drop distance	19	5 - 100	28.1	ft
	Moisture	7	0.2 - 16.3	3.2	%
Scraper	Silt	10	7.2 - 25.2	16.4	%
	Weight	15	33 - 64	48.8	Mg
	Weight	15	36 - 70	53.8	ton
Grader	Speed	7	8.0 - 19.0	11.4	kph
	Speed		5.0 - 11.8	7.1	mph
Haul truck	Silt content	61	1.2 – 19.2	4.3	%
	Moisture	60	0.3 – 20.1	2.4	%
	Weight	61	20.9 – 260	110	mg
	Weight	61	23.0 – 290	120	ton

[a] Reference 1,6.

Table 11.9-4 (English And Metric Units). UNCONTROLLED PARTICULATE EMISSION FACTORS FOR OPEN DUST SOURCES AT WESTERN SURFACE COAL MINES

Source	Material	Mine Location[a]	TSP Emission Factor[b]	Units	EMISSION FACTOR RATING
Drilling	Overburden	Any	1.3 0.59	lb/hole kg/hole	C C
	Coal	V	0.22 0.10	lb/hole kg/hole	E E
Topsoil removal by scraper	Topsoil	Any	0.058 0.029	lb/ton kg/Mg	E E
		IV	0.44 0.22	lb/ton kg/Mg	E E
Overburden replacement	Overburden	Any	0.012 0.0060	lb/ton kg/Mg	C C
Truck loading by power shovel (batch drop)[c]	Overburden	V	0.037 0.018	lb/ton kg/Mg	E E
Train loading (batch or continuous drop)[c]	Coal	Any	0.028 0.014	lb/ton kg/Mg	E E
		III	0.0002 0.0001	lb/ton kg/Mg	E E
Bottom dump truck unloading (batch drop)[c]	Overburden	V	0.002 0.001	lb/ton kg/Mg	E E
	Coal	IV	0.027 0.014	lb/ton kg/Mg	E E
		III	0.005 0.002	lb/ton kg/Mg	E E
		II	0.020 0.010	lb/ton kg/Mg	E E
		I	0.014 0.0070	lb/T kg/Mg	E E
		Any	0.066 0.033	lb/T kg/Mg	D D

Table 11.9-4 (cont.).

Source	Material	Mine Location[a]	TSP Emission Factor[b]	Units	EMISSION FACTOR RATING
End dump truck unloading (batch drop)[c]	Coal	V	0.007 0.004	lb/T kg/Mg	E E
Scraper unloading (batch drop)[c]	Topsoil	IV	0.04 0.02	lb/T kg/Mg	E E
Wind erosion of exposed areas[d]	Seeded land, stripped overburden, graded overburden	Any	0.38 0.85	$\frac{T}{(acre)(yr)}$ $\frac{Mg}{(hectare)(yr)}$	C C

[a] Roman numerals I through V refer to specific mine locations for which the corresponding emission factors were developed (Reference 5). Tables 11.9-4 and 11.9-5 present characteristics of each of these mines. See text for correct use of these "mine-specific" emission factors. The other factors (from Reference 7, except for overburden drilling from Reference 1) can be applied to any western surface coal mine.

[b] Total suspended particulate (TSP) denotes what is measured by a standard high volume sampler (see Section 13.2).

[c] Predictive emission factor equations, which generally provide more accurate estimates of emissions, are presented in Chapter 13.

[d] To estimate wind erosion on a shorter time scale (e. g., worst-case day), see Section 13.2.5.

Table 11.9-5 (Metric And English Units). GENERAL CHARACTERISTICS OF SURFACE COAL MINES REFERRED TO IN TABLE 11.9-4[a]

Mine	Location	Type Of Coal Mined	Terrain	Vegetative Cover	Surface Soil Type And Erodibility Index	Mean Wind Speed		Mean Annual Precipitation	
						m/s	mph	cm	in.
I	N.W. Colorado	Subbitum.	Moderately steep	Moderate, sagebrush	Clayey loamy (71)	2.3	5.1	38	15
II	S.W. Wyoming	Subbitum.	Semirugged	Sparse, sagebrush	Arid soil with clay and alkali or carbonate accumulation (86)	6.0	13.4	36	14
III	S.E. Montana	Subbitum.	Gently rolling to semirugged	Sparse, moderate, prairie grassland	Shallow clay loamy deposits on bedrock (47)	4.8	10.7	28 - 41	11 - 16
IV	Central North Dakota	Lignite	Gently rolling	Moderate, prairie grassland	Loamy, loamy to sandy (71)	5.0	11.2	43	17
V	N.E. Wyoming	Subbitum.	Flat to gently rolling	Sparse, sagebrush	Loamy, sandy, clayey, and clay loamy (102)	6.0	13.4	36	14

[a] Reference 4.

Table 11.9-6 (English Units). OPERATING CHARACTERISTICS OF THE COAL MINES REFERRED TO IN TABLE 11.9-4[a]

Parameter	Required Information	Units	Mine I	Mine II	Mine III	Mine IV	Mine V
Production rate	Coal mined	10^6 ton/yr	1.13	5.0	9.5	3.8	12.0[b]
Coal transport	Avg. unit train frequency	per day	NA	NA	2	NA	2
Stratigraphic data	Overburden thickness	ft	21	80	90	65	35
	Overburden density	lb/yd^3	4000	3705	3000	ND	ND
	Coal seam thicknesses	ft	9,35	15,9	27	2,4,8	70
	Parting thicknesses	ft	50	15	NA	32,16	NA
	Spoils bulking factor	%	22	24	25	20	ND
	Active pit depth	ft	52	100	114	80	105
Coal analysis data	Moisture	%	10	18	24	38	30
	Ash	%, wet	8	10	8	7	6
	Sulfur	%, wet	0.46	0.59	0.75	0.65	0.48
	Heat content	Btu/lb	11000	9632	8628	8500	8020
Surface disposition	Total disturbed land	acre	168	1030	2112	1975	217
	Active pit	acre	34	202	87	ND	71
	Spoils	acre	57	326	144	ND	100
	Reclaimed	acre	100	221	950	ND	100
	Barren land	acre	ND	30	455	ND	ND
	Associated disturbances	acre	12	186	476	ND	46
Storage	Capacity	ton	NA	NA	ND	NA	48000
Blasting	Frequency, total	per week	4	4	3	7	7[b]
	Frequency, overburden	per week	3	0.5	3	NA	7[b]
	Area blasted, coal	ft^2	16000	40000	ND	30000	ND
	Area blasted, overburden	ft^2	20000	ND	ND	NA	ND

[a] Reference 5. NA = not applicable. ND = no data.
[b] Estimate.

11.9.3 Updates Since the Fifth Edition

The Fifth Edition which was released in January 1995 reformatted the section that was dated September 1988. Revisions to this section since these dates are summarized below. For further detail, consult the memoranda describing each supplement or the background report for this section. These and other documents can be found on the CHIEF WEB site (home page http://www.epa.gov/ttn/chief/).

Supplement E

- The predictive equations for emission factors for haul trucks and light/medium duty vehicles were removed and replaced with a footnote refering users to the recently revised unpaved road section in the Miscellaneous Sources chapter.

- The emission factor quality ratings were revised based upon a revised predictive equation and single value criteria.

- The typographical errors for the TSP equation and the omission of the PM-2.5 scaling factor for blasting were corrected.

References For Section 11.9

1. K. Axetell and C. Cowherd, *Improved Emission Factors For Fugitive Dust From Western Surface Coal Mining Sources*, 2 Volumes, EPA Contract No. 68-03-2924, U. S. Environmental Protection Agency, Cincinnati, OH, July 1981.

2. *Reserve Base Of U. S. Coals By Sulfur Content: Part 2, The Western States*, IC8693, Bureau Of Mines, U. S. Department Of The Interior, Washington, DC, 1975.

3. *Bituminous Coal And Lignite Production And Mine Operations - 1978*, DOE/EIA-0118(78), U. S. Department Of Energy, Washington, DC, June 1980.

4. G. E. Muleski, *Update Of AP-42 Emission Factors For Western Surface Coal Mines And Related Sections*, Summary Report, Prepared for Emission Factors And Inventory Group (MD-14), Emissions, Modeling And Analysis Division, Office Of Air Quality, Planning, And Standards, U. S. Environmental Protection Agency, Research Triangle Park, NC 27711.

5. K. Axetell, *Survey Of Fugitive Dust From Coal Mines*, EPA-908/1-78-003, U. S. Environmental Protection Agency, Denver, CO, February 1978.

6. G. E. Muleski, *et al.*, *Surface Coal Mine Emission Factor Field Study*, EPA-454/R-95-010, U. S. Environmental Protection Agency, Research Triangle Park, NC, January 1994.

7. D. L. Shearer, *et al.*, *Coal Mining Emission Factor Development And Modeling Study*, Amax Coal Company, Carter Mining Company, Sunoco Energy Development Company, Mobil Oil Corporation, and Atlantic Richfield Company, Denver, CO, July 1981.

13.2.1 Paved Roads

13.2.1.1 General

Particulate emissions occur whenever vehicles travel over a paved surface such as a road or parking lot. Particulate emissions from paved roads are due to direct emissions from vehicles in the form of exhaust, brake wear and tire wear emissions and resuspension of loose material on the road surface. In general terms, resuspended particulate emissions from paved roads originate from, and result in the depletion of, the loose material present on the surface (i.e., the surface loading). In turn, that surface loading is continuously replenished by other sources. At industrial sites, surface loading is replenished by spillage of material and trackout from unpaved roads and staging areas. Figure 13.2.1-1 illustrates several transfer processes occurring on public streets.

Various field studies have found that public streets and highways, as well as roadways at industrial facilities, can be major sources of the atmospheric particulate matter within an area.[1-9] Of particular interest in many parts of the United States are the increased levels of emissions from public paved roads when the equilibrium between deposition and removal processes is upset. This situation can occur for various reasons, including application of granular materials for snow and ice control, mud/dirt carryout from construction activities in the area, and deposition from wind and/or water erosion of surrounding unstabilized areas. In the absence of continuous addition of fresh material (through localized trackout or application of antiskid material), paved road surface loading should reach an equilibrium value in which the amount of material resuspended matches the amount replenished. The equilibrium surface loading value depends upon numerous factors. It is believed that the most important factors are: mean speed of vehicles traveling the road; the average daily traffic (ADT); the number of lanes and ADT per lane; the fraction of heavy vehicles (buses and trucks); and the presence/absence of curbs, storm sewers and parking lanes.[10]

The particulate emission factors presented in the previous version of this section of AP-42, dated October 2002, implicitly included the emissions from vehicles in the form of exhaust, brake wear, and tire wear as well as resuspended road surface material. EPA included these sources in the emission factor equation for paved roads since the field testing data used to develop the equation included both the direct emissions from vehicles and emissions from resuspension of road dust.

This version of the paved road emission factor equation only estimates particulate emissions from resuspended road surface material [28]. The particulate emissions from vehicle exhaust, brake wear, and tire wear are now estimated separately using EPA's MOBILE6.2 [27]. This approach eliminates the possibility of double counting emissions. Double counting results when employing the previous version of the emission factor equation in this section and MOBILE6.2 to estimate particulate emissions from vehicle traffic on paved roads. It also incorporates the decrease in exhaust emissions that has occurred since the paved road emission factor equation was developed. The previous version of the paved road emission factor equation includes estimates of emissions from exhaust, brake wear, and tire wear based on emission rates for vehicles in the 1980 calendar year fleet. The amount of PM released from vehicle exhaust has decreased since 1980 due to lower new vehicle emission standards and changes in fuel characteristics.

13.2.1.2 Emissions And Correction Parameters

Dust emissions from paved roads have been found to vary with what is termed the "silt loading" present on the road surface as well as the average weight of vehicles traveling the road. The term silt loading (sL) refers to the mass of silt-size material (equal to or less than 75 micrometers [μm] in physical diameter) per unit area of the travel surface. The total road surface dust loading consists of loose material that can be collected by broom sweeping and vacuuming of the traveled portion of the paved road. The silt fraction is determined by measuring the proportion of the loose dry surface dust that passes through a 200-mesh screen, using the ASTM-C-136 method. Silt loading is the product of the silt fraction and the total loading, and is abbreviated "sL". Additional details on the sampling and analysis of such material are provided in AP-42 Appendices C.1 and C.2.

The surface sL provides a reasonable means of characterizing seasonal variability in a paved road emission inventory. In many areas of the country, road surface loadings [11-21] are heaviest during the late winter and early spring months when the residual loading from snow/ice controls is greatest. As noted earlier, once replenishment of fresh material is eliminated, the road surface loading can be expected to reach an equilibrium value, which is substantially lower than the late winter/early spring values.

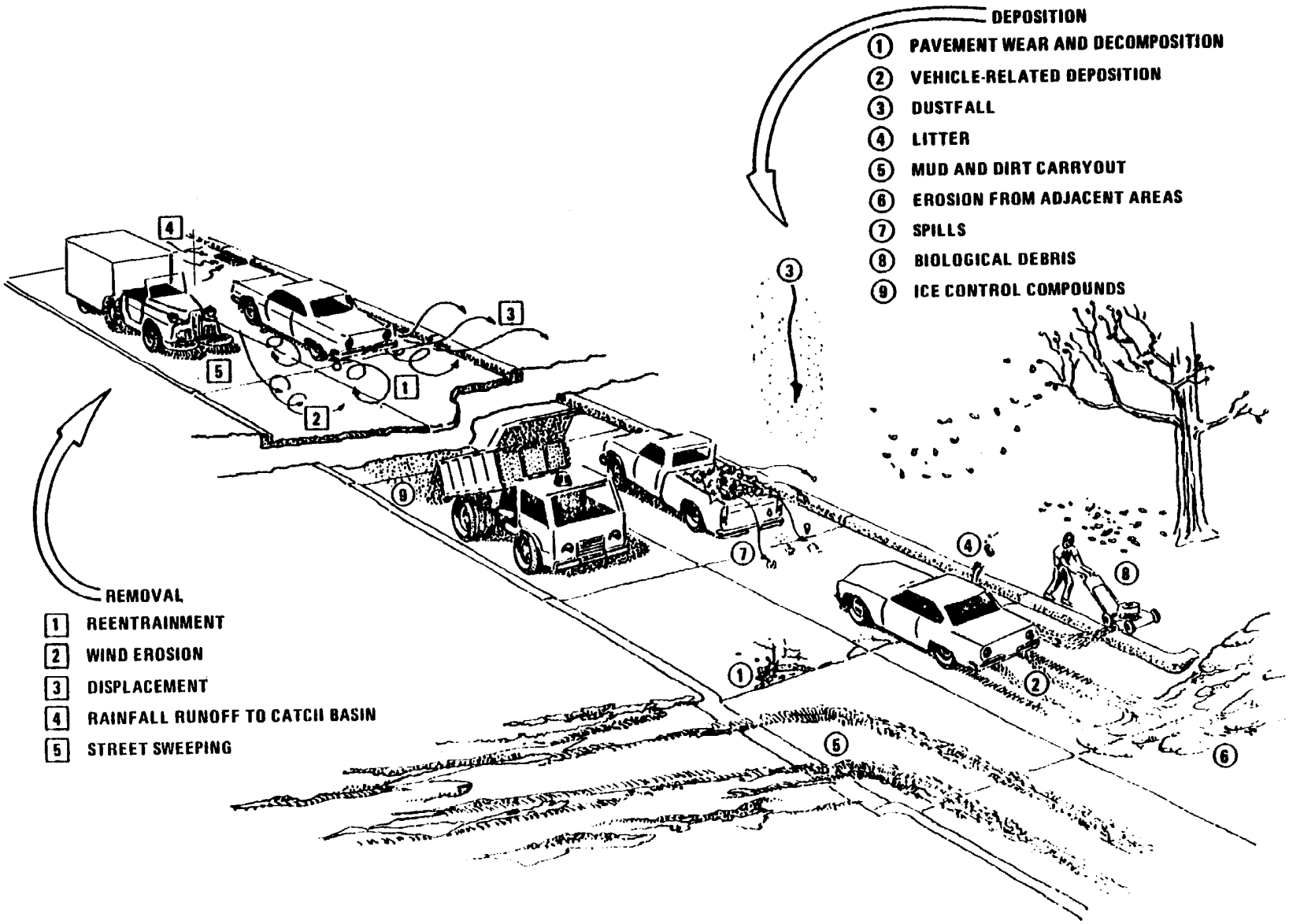


Figure 13.2.1-1. Deposition and removal processes.

13.2.1.3 Predictive Emission Factor Equations [10]

The quantity of particulate emissions from resuspension of loose material on the road surface due to vehicle travel on a dry paved road may be estimated using the following empirical expression:

$$E = k\left(\frac{sL}{2}\right)^{0.65} \times \left(\frac{W}{3}\right)^{1.5} - C \qquad (1)$$

where: E = particulate emission factor (having units matching the units of k),
k = particle size multiplier for particle size range and units of interest (see below),
sL = road surface silt loading (grams per square meter) (g/m^2),
W = average weight (tons) of the vehicles traveling the road, and
C = emission factor for 1980's vehicle fleet exhaust, brake wear and tire wear.

It is important to note that Equation 1 calls for the average weight of all vehicles traveling the road. For example, if 99 percent of traffic on the road are 2 ton cars/trucks while the remaining 1 percent consists of 20 ton trucks, then the mean weight "W" is 2.2 tons. More specifically, Equation 1 is *not* intended to be used to calculate a separate emission factor for each vehicle weight class. Instead, only one emission factor should be calculated to represent the "fleet" average weight of all vehicles traveling the road.

The particle size multiplier (k) above varies with aerodynamic size range as shown in Table 13.2.1-1. To determine particulate emissions for a specific particle size range, use the appropriate value of k shown in Table 13.2.1-1.

The emission factors for the exhaust, brake wear and tire wear of a 1980's vehicle fleet (C) was obtained from EPA's MOBILE6.2 model [28]. The emission factor also varies with aerodynamic size range

Table 13.2-1.1. PARTICLE SIZE MULTIPLIERS FOR PAVED ROAD EQUATION

Size range[a]	Particle Size Multiplier k[b]		
	g/VKT	g/VMT	lb/VMT
PM-2.5[c]	0.66	1.1	0.0024
PM-10	4.6	7.3	0.016
PM-15	5.5	9.0	0.020
PM-30[d]	24	38	0.082

[a] Refers to airborne particulate matter (PM-x) with an aerodynamic diameter equal to or less than x micrometers.

[b] Units shown are grams per vehicle kilometer traveled (g/VKT), grams per vehicle mile traveled (g/VMT), and pounds per vehicle mile traveled (lb/VMT). The multiplier k includes unit conversions to produce emission factors in the units shown for the indicated size range from the mixed units required in Equation 1.

[c] Ratio of PM-2.5 to PM-10 taken from Reference 22.

[d] PM-30 is sometimes termed "suspendable particulate" (SP) and is often used as a surrogate for TSP.

as shown in Table 13.2.1-2.

Table 13.2.1-2. EMISSION FACTOR FOR 1980'S VEHICLE FLEET EXHAUST, BRAKE WEAR AND TIRE WEAR

Particle Size Range[a]	*C*, Emission Factor for Exhaust, Brake Wear and Tire Wear[b]		
	g/VMT	g/VKT	lb/VMT
$PM_{2.5}$	0.1617	0.1005	0.00036
PM_{10}	0.2119	0.1317	0.00047
PM_{15}	0.2119	0.1317	0.00047
PM_{30}[c]	0.2119	0.1317	0.00047

[a] Refers to airborne particulate matter (PM-x) with an aerodynamic diameter equal to or less than x micrometers.

[b] Units shown are grams per vehicle kilometer traveled (g/VKT), grams per vehicle mile traveled (g/VMT), and pounds per vehicle mile traveled (lb/VMT).

[c] PM-30 is sometimes termed "suspendable particulate" (SP) and is often used as a surrogate for TSP.

Equation 1 is based on a regression analysis of numerous emission tests, including 65 tests for PM-10.[10] Sources tested include public paved roads, as well as controlled and uncontrolled industrial paved roads. All sources tested were of freely flowing vehicles traveling at constant speed on relatively level roads. No tests of "stop-and-go" traffic or vehicles under load were available for inclusion in the data base. The equations retain the quality rating of A (B for PM-2.5), if applied within the range of source conditions that were tested in developing the equation as follows:

Silt loading:	0.03 - 400 g/m^2 0.04 - 570 grains/square foot (ft^2)
Mean vehicle weight:	1.8 - 38 megagrams (Mg) 2.0 - 42 tons
Mean vehicle speed:	16 - 88 kilometers per hour (kph) 10 - 55 miles per hour (mph)

Note: There may be situations where low silt loading and/or low average weight will yield calculated negative emissions from equation 1. If this occurs, the emissions calculated from equation 1 should be set to zero.

Users are cautioned that application of equation 1 outside of the range of variables and operating conditions specified above, e.g., application to roadways or road networks with speeds below 10 mph and with stop-and-go traffic, will result in emission estimates with a higher level

of uncertainty. In these situations, users are encouraged to consider alternative methods that are equally or more plausible in light of local emissions data and/or ambient concentration or compositional data.

To retain the quality rating for the emission factor equation when it is applied to a specific paved road, it is necessary that reliable correction parameter values for the specific road in question be determined. With the exception of limited access roadways, which are difficult to sample, the collection and use of site-specific silt loading (sL) data for public paved road emission inventories are strongly recommended. The field and laboratory procedures for determining surface material silt content and surface dust loading are summarized in Appendices C.1 and C.2. In the event that site-specific values cannot be obtained, an appropriate value for a paved public road may be selected from the values in Table 13.2.1-3, but the quality rating of the equation should be reduced by 2 levels. Also, recall that Equation 1 refers to emissions due to freely flowing (not stop-and-go) traffic at constant speed on level roads.

Equation 1 may be extrapolated to average uncontrolled conditions (but including natural mitigation) under the simplifying assumption that annual (or other long-term) average emissions are inversely proportional to the frequency of measurable (> 0.254 mm [0.01 inch]) precipitation by application of a precipitation correction term. The precipitation correction term can be applied on a daily or an hourly basis [26].

For the daily basis, Equation 1 becomes:

$$E_{ext} = \left[k \left(\frac{sL}{2} \right)^{0.65} \left(\frac{W}{3} \right)^{1.5} - C \right] \left(1 - \frac{P}{4N} \right) \qquad (2)$$

where *k*, *sL*, *W*, *and C* are as defined in Equation 1 and

E_{ext} = annual or other long-term average emission factor in the same units as *k*,
P = number of "wet" days with at least 0.254 mm (0.01 in) of precipitation during the averaging period, and
N = number of days in the averaging period (e.g., 365 for annual, 91 for seasonal, 30 for monthly).

Note that the assumption leading to Equation 2 is based on analogy with the approach used to develop long-term average unpaved road emission factors in Section 13.2.2. However, Equation 2 above incorporates an additional factor of "4" in the denominator to account for the fact that paved roads dry more quickly than unpaved roads and that the precipitation may not occur over the complete 24-hour day.

For the hourly basis, equation 1 becomes:

$$E_{ext} = \left[k \left(\frac{sL}{2} \right)^{0.65} \left(\frac{W}{3} \right)^{1.5} - C \right] \left(1 - \frac{1.2P}{N} \right) \qquad (3)$$

where k, sL, and W, and *C* are as defined in Equation 1 and

E_{ext} = annual or other long-term average emission factor in the same units as *k*,
P = number of hours with at least 0.254 mm (0.01 in) of precipitation during the averaging period, and
N = number of hours in the averaging period (e.g., 8760 for annual, 2124 for season 720 for monthly).

Note: In the hourly moisture correction term (1-1.2P/N) for equation 3, the 1.2 multiplier is applied to account for the residual mitigative effect of moisture. For most applications, this equation will produce satisfactory results. However, if the time interval for which the equation is applied is short, e.g., for one hour or one day, the application of this multiplier makes it possible for the moisture correction term to become negative. This will result in calculated negative emissions which is not realistic. Users should expand the time interval to include sufficient "dry" hours such that negative emissions are not calculated. For the special case where this equation is used to calculate emissions on an hour by hour basis, such as would be done in some emissions modeling situations, the moisture correction term should be modified so that the moisture correction "credit" is applied to the first hours following cessation of precipitation. In this special case, it is suggested that this 20% "credit" be applied on a basis of one hour credit for each hour of precipitation up to a maximum of 12 hours.

Note that the assumption leading to Equation 3 is based on analogy with the approach used to develop long-term average unpaved road emission factors in Section 13.2.2.

Figure 13.2.1-2 presents the geographical distribution of "wet" days on an annual basis for the United States. Maps showing this information on a monthly basis are available in the *Climatic Atlas of the United States*[23] . Alternative sources include other Department of Commerce publications (such as local climatological data summaries). The National Climatic Data Center (NCDC) offers several products that provide hourly precipitation data. In particular, NCDC offers *Solar and Meteorological Surface Observation Network 1961-1990* (SAMSON) CD-ROM, which contains 30 years worth of hourly meteorological data for first-order National Weather Service locations. Whatever meteorological data are used, the source of that data and the averaging period should be clearly specified.

It is emphasized that the simple assumption underlying Equations 2 and 3 has not been verified in any rigorous manner. For that reason, the quality ratings for Equations 2 and 3 should be downgraded one letter from the rating that would be applied to Equation 1.

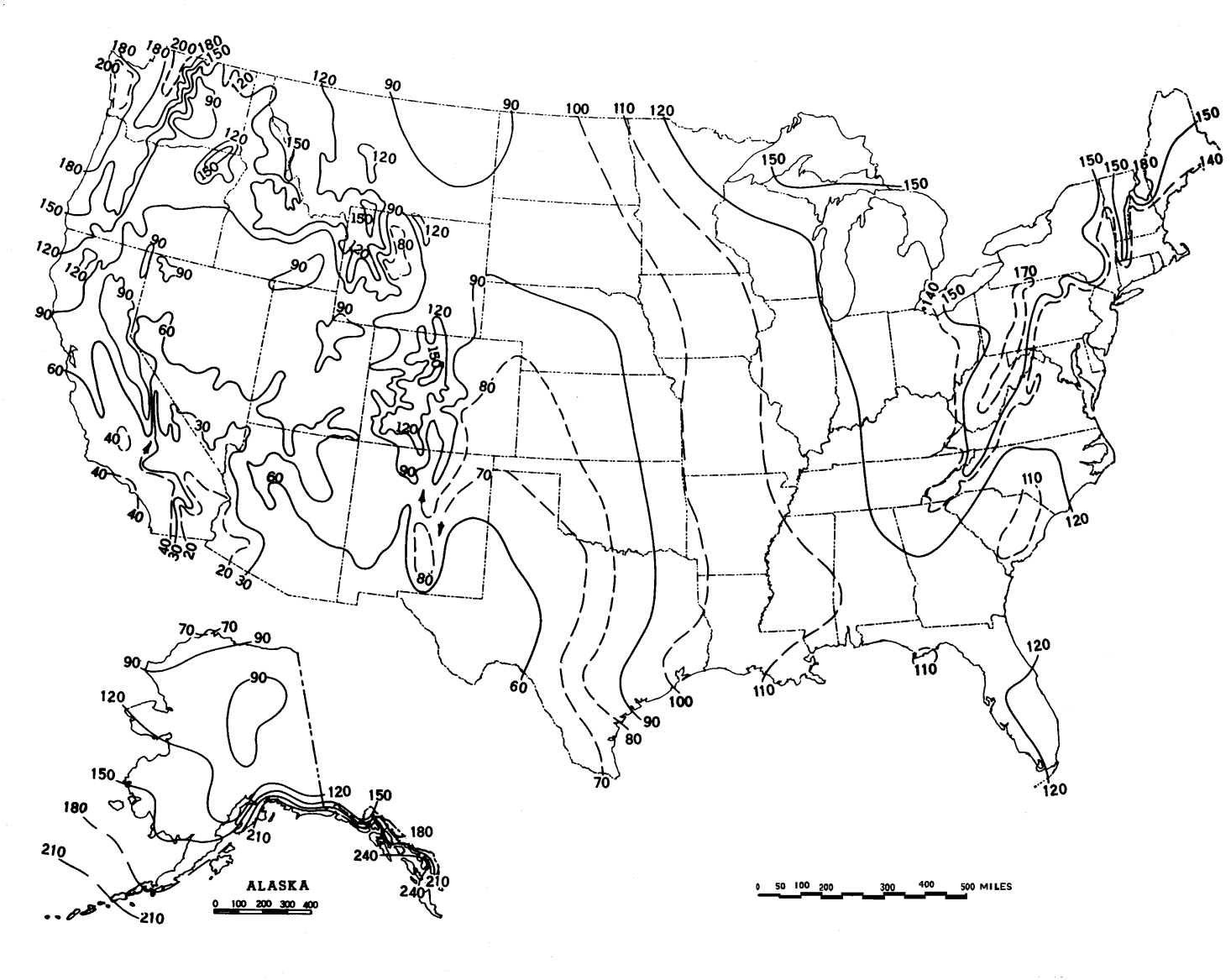


Figure 13.2.1-2. Mean number of days with 0.01 inch or more of precipitation in the United States.

Table 13.2.1-3 presents recommended default silt loadings for normal baseline conditions and for wintertime baseline conditions in areas that experience frozen precipitation with periodic application of antiskid material[24]. The winter baseline is represented as a multiple of the non-winter baseline, depending on the ADT value for the road in question. As shown, a multiplier of 4 is applied for low volume roads (< 500 ADT) to obtain a wintertime baseline silt loading of 4 X 0.6 = 2.4 g/m^2.

Table 13.2.1-3. Ubitiguous Silt Loading Default Values with Hot Spot Contributions from Anti-Skid Abrasives (g/m^2)

ADT Category	< 500	500-5,000	5,000-10,000	> 10,000
Ubiquitous Baseline g/m^2	0.6	0.2	0.06	0.03 0.015 limited access
Ubitiguous Winter Baseline Multiplier during months with frozen precipitation	X4	X3	X2	X1
Initial peak additive contribution from application of antiskid abrasive (g/m^2)	2	2	2	2
Days to return to baseline conditions (assume linear decay)	7	3	1	0.5

It is suggested that an additional (but temporary) silt loading contribution of 2 g/m^2 occurs with each application of antiskid abrasive for snow/ice control. This was determined based on a typical application rate of 500 lb per lane mile and an initial silt content of 1 % silt content. Ordinary rock salt and other chemical deicers add little to the silt loading, because most of the chemical dissolves during the snow/ice melting process.

To adjust the baseline silt loadings for mud/dirt trackout, the number of trackout points is required. It is recommended that in calculating PM-10 emissions, six additional miles of road be added for each active trackout point from an active construction site, to the paved road mileage of the specified category within the county. In calculating PM-2.5 emissions, it is recommended that three additional miles of road be added for each trackout point from an active construction site.

It is suggested the number of trackout points for activities other than road and building construction areas be related to land use. For example, in rural farming areas, each mile of paved road would have a specified number of trackout points at intersections with unpaved roads. This value could be estimated from the unpaved road density (mi/sq. mi.).

The use of a default value from Table 13.2.1-3 should be expected to yield only an order-of-magnitude estimate of the emission factor. Public paved road silt loadings are dependent

upon: traffic characteristics (speed, ADT, and fraction of heavy vehicles); road characteristics (curbs, number of lanes, parking lanes); local land use (agriculture, new residential construction) and regional/seasonal factors (snow/ice controls, wind blown dust). As a result, the collection and use of site-specific silt loading data is highly recommended. In the event that default silt loading values are used, the quality ratings for the equation should be downgraded 2 levels.

Limited access roadways pose severe logistical difficulties in terms of surface sampling, and few silt loading data are available for such roads. Nevertheless, the available data do not suggest great variation in silt loading for limited access roadways from one part of the country to another. For annual conditions, a default value of 0.015 g/m^2 is recommended for limited access roadways.[9,22] Even fewer of the available data correspond to worst-case situations, and elevated loadings are observed to be quickly depleted because of high traffic speeds and high ADT rates. A default value of 0.2 g/m^2 is recommended for short periods of time following application of snow/ice controls to limited access roads.[22]

The limited data on silt loading values for industrial roads have shown as much variability as public roads. Because of the variations of traffic conditions and the use of preventive mitigative controls, the data probably do not reflect the full extent of the potential variation in silt loading on industrial roads. However, the collection of site specific silt loading data from industrial roads is easier and safer than for public roads. Therefore, the collection and use of site-specific silt loading data is preferred and is highly recommended. In the event that site-specific values cannot be obtained, an appropriate value for an industrial road may be selected from the mean values given in Table 13.2.1-4, but the quality rating of the equation should be reduced by 2 levels.

Table 13.2.1-4 (Metric And English Units). TYPICAL SILT CONTENT AND LOADING VALUES FOR PAVED ROADS AT INDUSTRIAL FACILITIES [a]

Industry	No. Of Sites	No. Of Samples	Silt Content (%)		No. Of Travel Lanes	Total Loading x 10^{-3}			Silt Loading (g/m^2)	
			Range	Mean		Range	Mean	Units[b]	Range	Mean
Copper smelting	1	3	15.4-21.7	19.0	2	12.9-19.5 45.8-69.2	15.9 55.4	kg/km lb/mi	188-400	292
Iron and steel production	9	48	1.1-35.7	12.5	2	0.006-4.77 0.020-16.9	0.495 1.75	kg/km lb/mi	0.09-79	9.7
Asphalt batching	1	3	2.6-4.6	3.3	1	12.1-18.0 43.0-64.0	14.9 52.8	kg/km lb/mi	76-193	120
Concrete batching	1	3	5.2-6.0	5.5	2	1.4-1.8 5.0-6.4	1.7 5.9	kg/km lb/mi	11-12	12
Sand and gravel processing	1	3	6.4-7.9	7.1	1	2.8-5.5 9.9-19.4	3.8 13.3	kg/km lb/mi	53-95	70
Municipal solid waste landfill	2	7	—	—	2	—	—	—	1.1-32.0	7.4
Quarry	1	6	—	—	2	—	—	—	2.4-14	8.2

[a] References 1-2,5-6,11-13. Values represent samples collected from *industrial* roads. Public road silt loading values are presented in Table-13.2.1-2. Dashes indicate information not available.

[b] Multiply entries by 1000 to obtain stated units; kilograms per kilometer (kg/km) and pounds per mile (lb/mi).

13.2.1.4 Controls[6,25]

Because of the importance of the silt loading, control techniques for paved roads attempt either to prevent material from being deposited onto the surface (preventive controls) or to remove from the travel lanes any material that has been deposited (mitigative controls). Covering of loads in trucks, and the paving of access areas to unpaved lots or construction sites, are examples of preventive measures. Examples of mitigative controls include vacuum sweeping, water flushing, and broom sweeping and flushing. Actual control efficiencies for any of these techniques can be highly variable. Locally measured silt loadings before and after the application of controls is the preferred method to evaluate controls. It is particularly important to note that street sweeping of gutters and curb areas may actually increase the silt loading on the traveled portion of the road. Redistribution of loose material onto the travel lanes will actually produce a short-term increase in the emissions.

In general, preventive controls are usually more cost effective than mitigative controls. The cost-effectiveness of mitigative controls falls off dramatically as the size of an area to be treated increases. The cost-effectiveness of mitigative measures is also unfavorable if only a short period of time is required for the road to return to equilibrium silt loading condition. That is to say, the number and length of public roads within most areas of interest preclude any widespread and routine use of mitigative controls. On the other hand, because of the more limited scope of roads at an industrial site, mitigative measures may be used quite successfully (especially in situations where truck spillage occurs). Note, however, that public agencies could make effective use of mitigative controls to remove sand/salt from roads after the winter ends.

Because available controls will affect the silt loading, controlled emission factors may be obtained by substituting controlled silt loading values into the equation. (Emission factors from controlled industrial roads were used in the development of the equation.) The collection of surface loading samples from treated, as well as baseline (untreated), roads provides a means to track effectiveness of the controls over time.

13.2.1.5 Changes since Fifth Edition

The following changes were made since the publication of the Fifth Edition of AP-42:

1) The particle size multiplier was reduced by approximately 55% as a result of emission testing specifically to evaluate the PM-2.5 component of the emissions.

2) Default silt loading values were included in Table 13.2.1-2 replacing the Tables and Figures containing silt loading statistical information.

3) Editorial changes within the text were made indicating the possible causes of variations in the silt loading between roads within and among different locations. The uncertainty of using the default silt loading value was discussed.

4) Section 13.2.1.1 was revised to clarify the role of dust loading in resuspension. Additional minor text changes were made.

5) Equations 2 and 3, Figure 13.2.1-2, and text were added to incorporate natural mitigation into annual or other long-term average emission factors.

6) The emission factor equation was adjusted to remove the component of particulate emissions from exhaust, brake wear, and tire wear. The parameter *C* in the new equation varies with aerodynamic size range of the particulate matter. Table 13.2.1-2 was added to present the new coefficients.

7) The default silt loading values in Table 13.2.1-3 were revised to incorporate the results from a recent analysis of silt loading data.

8) The PM-2.5 particle size multiplier was reduced by 40% as the result of wind tunnel studies of a variety of dust emitting surface materials.

9) References were rearranged and renumbered.

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13.2.2 Unpaved Roads

13.2.2.1 General

When a vehicle travels an unpaved road, the force of the wheels on the road surface causes pulverization of surface material. Particles are lifted and dropped from the rolling wheels, and the road surface is exposed to strong air currents in turbulent shear with the surface. The turbulent wake behind the vehicle continues to act on the road surface after the vehicle has passed.

The particulate emission factors presented in the previous draft version of this section of AP-42, dated October 2001, implicitly included the emissions from vehicles in the form of exhaust, brake wear, and tire wear as well as resuspended road surface material[25]. EPA included these sources in the emission factor equation for unpaved public roads (equation 1b in this section) since the field testing data used to develop the equation included both the direct emissions from vehicles and emissions from resuspension of road dust.

This version of the unpaved public road emission factor equation only estimates particulate emissions from resuspended road surface material [23, 26]. The particulate emissions from vehicle exhaust, brake wear, and tire wear are now estimated separately using EPA's MOBILE6.2 [24]. This approach eliminates the possibility of double counting emissions. Double counting results when employing the previous version of the emission factor equation in this section and MOBILE6.2 to estimate particulate emissions from vehicle traffic on unpaved public roads. It also incorporates the decrease in exhaust emissions that has occurred since the unpaved public road emission factor equation was developed. The previous version of the unpaved public road emission factor equation includes estimates of emissions from exhaust, brake wear, and tire wear based on emission rates for vehicles in the 1980 calendar year fleet. The amount of PM released from vehicle exhaust has decreased since 1980 due to lower new vehicle emission standards and changes in fuel characteristics.

13.2.2.2 Emissions Calculation And Correction Parameters[1-6]

The quantity of dust emissions from a given segment of unpaved road varies linearly with the volume of traffic. Field investigations also have shown that emissions depend on source parameters that characterize the condition of a particular road and the associated vehicle traffic. Characterization of these source parameters allow for "correction" of emission estimates to specific road and traffic conditions present on public and industrial roadways.

Dust emissions from unpaved roads have been found to vary directly with the fraction of silt (particles smaller than 75 micrometers [μm] in diameter) in the road surface materials.[1] The silt fraction is determined by measuring the proportion of loose dry surface dust that passes a 200-mesh screen, using the ASTM-C-136 method. A summary of this method is contained in Appendix C of AP-42. Table 13.2.2-1 summarizes measured silt values for industrial unpaved roads. Table 13.2.2-2 summarizes measured silt values for public unpaved roads. It should be noted that the ranges of silt content vary over two orders of magnitude. Therefore, the use of data from this table can potentially introduce considerable error. Use of this data is strongly discouraged when it is feasible to obtain locally gathered data.

Since the silt content of a rural dirt road will vary with geographic location, it should be measured for use in projecting emissions. As a conservative approximation, the silt content of the parent soil in the area can be used. Tests, however, show that road silt content is normally lower than in the surrounding parent soil, because the fines are continually removed by the vehicle traffic, leaving a higher percentage of coarse particles.

Other variables are important in addition to the silt content of the road surface material. For example, at industrial sites, where haul trucks and other heavy equipment are common, emissions are highly correlated with vehicle weight. On the other hand, there is far less variability in the weights of cars and pickup trucks that commonly travel publicly accessible unpaved roads throughout the United States. For those roads, the moisture content of the road surface material may be more dominant in determining differences in emission levels between, for example a hot, desert environment and a cool, moist location.

The PM-10 and TSP emission factors presented below are the outcomes from stepwise linear regressions of field emission test results of vehicles traveling over unpaved surfaces. Due to a limited amount of information available for PM-2.5, the expression for that particle size range has been scaled against the result for PM-10. Consequently, the quality rating for the PM-2.5 factor is lower than that for the PM-10 expression.

Table 13.2.2-1. TYPICAL SILT CONTENT VALUES OF SURFACE MATERIAL ON INDUSTRIAL UNPAVED ROADS[a]

Industry	Road Use Or Surface Material	Plant Sites	No. Of Samples	Silt Content (%)	
				Range	Mean
Copper smelting	Plant road	1	3	16 - 19	17
Iron and steel production	Plant road	19	135	0.2 - 19	6.0
Sand and gravel processing	Plant road	1	3	4.1 - 6.0	4.8
	Material storage area	1	1	-	7.1
Stone quarrying and processing	Plant road	2	10	2.4 - 16	10
	Haul road to/from pit	4	20	5.0-15	8.3
Taconite mining and processing	Service road	1	8	2.4 - 7.1	4.3
	Haul road to/from pit	1	12	3.9 - 9.7	5.8
Western surface coal mining	Haul road to/from pit	3	21	2.8 - 18	8.4
	Plant road	2	2	4.9 - 5.3	5.1
	Scraper route	3	10	7.2 - 25	17
	Haul road (freshly graded)	2	5	18 - 29	24
Construction sites	Scraper routes	7	20	0.56-23	8.5
Lumber sawmills	Log yards	2	2	4.8-12	8.4
Municipal solid waste landfills	Disposal routes	4	20	2.2 - 21	6.4

[a]References 1,5-15.

The following empirical expressions may be used to estimate the quantity in pounds (lb) of size-specific particulate emissions from an unpaved road, per vehicle mile traveled (VMT):

For vehicles traveling on unpaved surfaces at industrial sites, emissions are estimated from the following equation:

$$E = k\,(s/12)^a (W/3)^b \quad (1a)$$

and, for vehicles traveling on publicly accessible roads, dominated by light duty vehicles, emissions may be estimated from the following:

$$E = \frac{k\,(s/12)^a (S/30)^d}{(M/0.5)^c} - C \quad (1b)$$

where k, a, b, c and d are empirical constants (Reference 6) given below and

E = size-specific emission factor (lb/VMT)
s = surface material silt content (%)
W = mean vehicle weight (tons)
M = surface material moisture content (%)
S = mean vehicle speed (mph)
C = emission factor for 1980's vehicle fleet exhaust, brake wear and tire wear.

The source characteristics s, W and M are referred to as correction parameters for adjusting the emission estimates to local conditions. The metric conversion from lb/VMT to grams (g) per vehicle kilometer traveled (VKT) is as follows:

1 lb/VMT = 281.9 g/VKT

The constants for Equations 1a and 1b based on the stated aerodynamic particle sizes are shown in Tables 13.2.2-2 and 13.2.2-4. The PM-2.5 particle size multipliers (k-factors) are taken from Reference 27.

Table 13.2.2-2. CONSTANTS FOR EQUATIONS 1a AND 1b

Constant	Industrial Roads (Equation 1a)			Public Roads (Equation 1b)		
	PM-2.5	PM-10	PM-30*	PM-2.5	PM-10	PM-30*
k (lb/VMT)	0.15	1.5	4.9	0.18	1.8	6.0
a	0.9	0.9	0.7	1	1	1
b	0.45	0.45	0.45	-	-	-
c	-	-	-	0.2	0.2	0.3
d	-	-	-	0.5	0.5	0.3
Quality Rating	B	B	B	B	B	B

*Assumed equivalent to total suspended particulate matter (TSP)
"-" = not used in the emission factor equation

Table 13.2.2-2 also contains the quality ratings for the various size-specific versions of Equation 1a and 1b. The equation retains the assigned quality rating, if applied within the ranges of source conditions, shown in Table 13.2.2-3, that were tested in developing the equation:

Table 13.2.2-3. RANGE OF SOURCE CONDITIONS USED IN DEVELOPING EQUATION 1a AND 1b

Emission Factor	Surface Silt Content, %	Mean Vehicle Weight		Mean Vehicle Speed		Mean No. of Wheels	Surface Moisture Content, %
		Mg	ton	km/hr	mph		
Industrial Roads (Equation 1a)	1.8-25.2	1.8-260	2-290	8-69	5-43	4-17[a]	0.03-13
Public Roads (Equation 1b)	1.8-35	1.4-2.7	1.5-3	16-88	10-55	4-4.8	0.03-13

[a] See discussion in text.

As noted earlier, the models presented as Equations 1a and 1b were developed from tests of traffic on unpaved surfaces. Unpaved roads have a hard, generally nonporous surface that usually dries quickly after a rainfall or watering, because of traffic-enhanced natural evaporation. (Factors influencing how fast a road dries are discussed in Section 13.2.2.3, below.) The quality ratings given above pertain to the mid-range of the measured source conditions for the equation. A higher mean vehicle weight and a higher than normal traffic rate may be justified when performing a worst-case analysis of emissions from unpaved roads.

The emission factors for the exhaust, brake wear and tire wear of a 1980's vehicle fleet (*C*) was obtained from EPA's MOBILE6.2 model [23]. The emission factor also varies with aerodynamic size range

as shown in Table 13.2.2-4

Table 13.2.2-4. EMISSION FACTOR FOR 1980'S VEHICLE FLEET EXHAUST, BRAKE WEAR AND TIRE WEAR

Particle Size Range[a]	*C*, Emission Factor for Exhaust, Brake Wear and Tire Wear[b] lb/VMT
$PM_{2.5}$	0.00036
PM_{10}	0.00047
PM_{30}[c]	0.00047

[a] Refers to airborne particulate matter (PM-x) with an aerodynamic diameter equal to or less than x micrometers.
[b] Units shown are pounds per vehicle mile traveled (lb/VMT).
[c] PM-30 is sometimes termed "suspendable particulate" (SP) and is often used as a surrogate for TSP.

It is important to note that the vehicle-related source conditions refer to the average weight, speed, and number of wheels for all vehicles traveling the road. For example, if 98 percent of traffic on the road are 2-ton cars and trucks while the remaining 2 percent consists of 20-ton trucks, then the mean weight is 2.4 tons. More specifically, Equations 1a and 1b are *not* intended to be used to calculate a separate emission factor for each vehicle class within a mix of traffic on a given unpaved road. That is, in the example, one should *not* determine one factor for the 2-ton vehicles and a second factor for the 20-ton trucks. Instead, only one emission factor should be calculated that represents the "fleet" average of 2.4 tons for all vehicles traveling the road.

Moreover, to retain the quality ratings when addressing a group of unpaved roads, it is necessary that reliable correction parameter values be determined for the road in question. The field and laboratory procedures for determining road surface silt and moisture contents are given in AP-42 Appendices C.1 and C.2. Vehicle-related parameters should be developed by recording visual observations of traffic. In some cases, vehicle parameters for industrial unpaved roads can be determined by reviewing maintenance records or other information sources at the facility.

In the event that site-specific values for correction parameters cannot be obtained, then default values may be used.In the absence of site-specific silt content information, an appropriate mean value from Table 13.2.2-1 may be used as a default value, but the quality rating of the equation is reduced by two letters. Because of significant differences found between different types of road surfaces and between different areas of the country, use of the default moisture content value of 0.5 percent in Equation 1b is discouraged. The quality rating should be downgraded two letters when the default moisture content value is used. (It is assumed that readers addressing industrial roads have access to the information needed to develop average vehicle information in Equation 1a for their facility.)

The effect of routine watering to control emissions from unpaved roads is discussed below in Section 13.2.2.3, “Controls”. However, all roads are subject to some natural mitigation because of rainfall and other precipitation. The Equation 1a and 1b emission factors can be extrapolated to annual

average uncontrolled conditions (but including natural mitigation) under the simplifying assumption that annual average emissions are inversely proportional to the number of days with measurable (more than 0.254 mm [0.01 inch]) precipitation:

$$E_{ext} = E\ [(365 - P)/365] \quad (2)$$

where:

E_{ext} = annual size-specific emission factor extrapolated for natural mitigation, lb/VMT

E = emission factor from Equation 1a or 1b

P = number of days in a year with at least 0.254 mm (0.01 in) of precipitation (see below)

Figure 13.2.2-1 gives the geographical distribution for the mean annual number of "wet" days for the United States.

Equation 2 provides an estimate that accounts for precipitation on an annual average basis for the purpose of inventorying emissions. It should be noted that Equation 2 does not account for differences in the temporal distributions of the rain events, the quantity of rain during any event, or the potential for the rain to evaporate from the road surface. In the event that a finer temporal and spatial resolution is desired for inventories of public unpaved roads, estimates can be based on a more complex set of assumptions. These assumptions include:

1. The moisture content of the road surface material is increased in proportion to the quantity of water added;
2. The moisture content of the road surface material is reduced in proportion to the Class A pan evaporation rate;
3. The moisture content of the road surface material is reduced in proportion to the traffic volume; and
4. The moisture content of the road surface material varies between the extremes observed in the area. The CHIEF Web site (http://www.epa.gov/ttn/chief/ap42/ch13/related/c13s02-2.html) has a file which contains a spreadsheet program for calculating emission factors which are temporally and spatially resolved. Information required for use of the spreadsheet program includes monthly Class A pan evaporation values, hourly meteorological data for precipitation, humidity and snow cover, vehicle traffic information, and road surface material information.

It is emphasized that the simple assumption underlying Equation 2 and the more complex set of assumptions underlying the use of the procedure which produces a finer temporal and spatial resolution have not been verified in any rigorous manner. For this reason, the quality ratings for either approach should be downgraded one letter from the rating that would be applied to Equation 1.

13.2.2.3 Controls[18-22]

A wide variety of options exist to control emissions from unpaved roads. Options fall into the following three groupings:

1. Vehicle restrictions that limit the speed, weight or number of vehicles on the road;

2. Surface improvement, by measures such as (a) paving or (b) adding gravel or slag to a dirt road; and
3. Surface treatment, such as watering or treatment with chemical dust suppressants.

Available control options span broad ranges in terms of cost, efficiency, and applicability. For example, traffic controls provide moderate emission reductions (often at little cost) but are difficult to enforce. Although paving is highly effective, its high initial cost is often prohibitive. Furthermore, paving is not feasible for industrial roads subject to very heavy vehicles and/or spillage of material in transport. Watering and chemical suppressants, on the other hand, are potentially applicable to most industrial roads at moderate to low costs. However, these require frequent reapplication to maintain an acceptable level of control. Chemical suppressants are generally more cost-effective than water but not in cases of temporary roads (which are common at mines, landfills, and construction sites). In summary, then, one needs to consider not only the type and volume of traffic on the road but also how long the road will be in service when developing control plans.

Vehicle restrictions. These measures seek to limit the amount and type of traffic present on the road or to lower the mean vehicle speed. For example, many industrial plants have restricted employees from driving on plant property and have instead instituted bussing programs. This eliminates emissions due to employees traveling to/from their worksites. Although the heavier average vehicle weight of the busses increases the base emission factor, the decrease in vehicle-miles-traveled results in a lower overall emission rate.

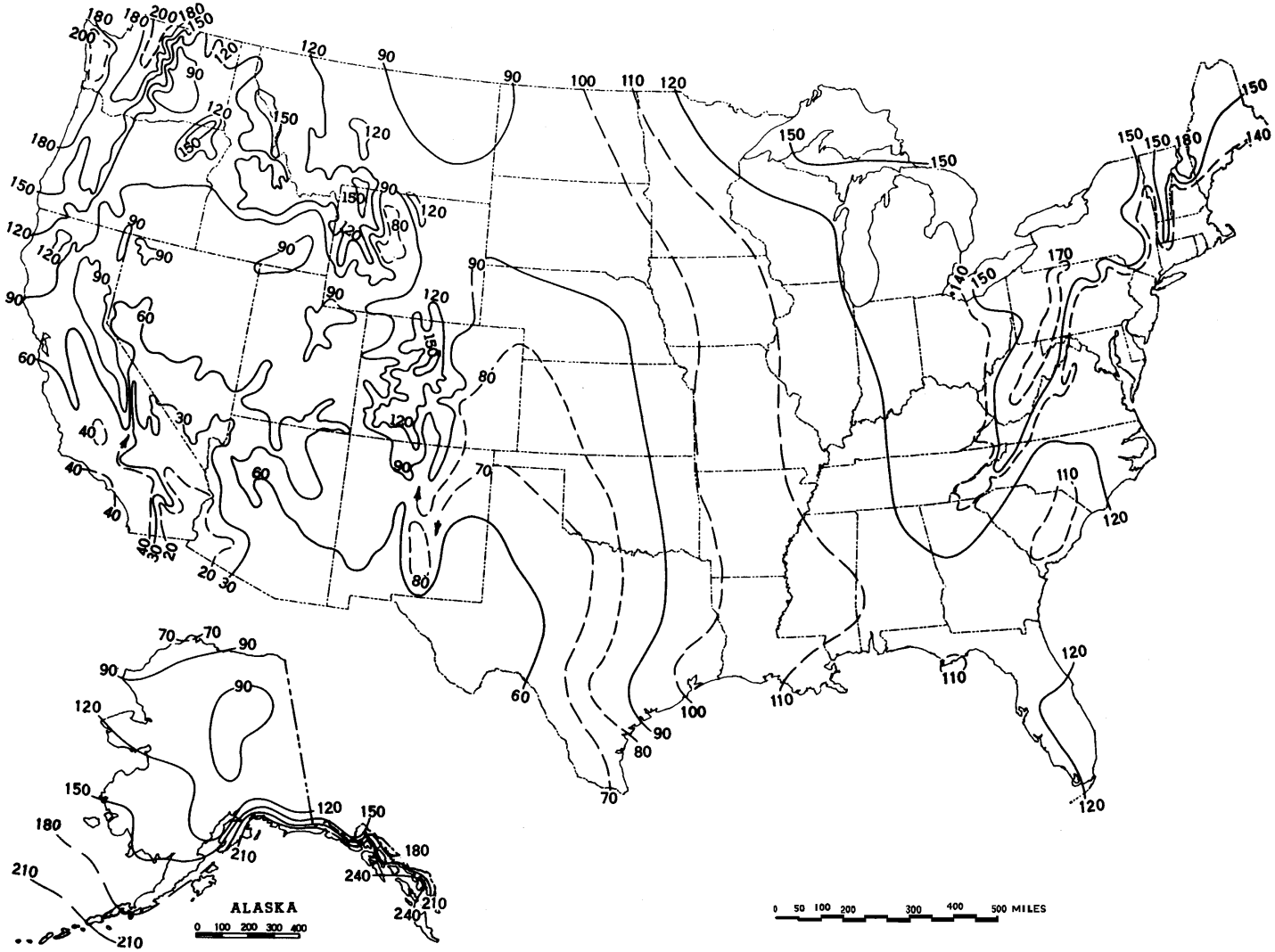

Figure 13.2.2-1. Mean number of days with 0.01 inch or more of precipitation in United States.

Surface improvements. Control options in this category alter the road surface. As opposed to the "surface treatments" discussed below, improvements are relatively "permanent" and do not require periodic retreatment.

The most obvious surface improvement is paving an unpaved road. This option is quite expensive and is probably most applicable to relatively short stretches of unpaved road with at least several hundred vehicle passes per day. Furthermore, if the newly paved road is located near unpaved areas or is used to transport material, it is essential that the control plan address routine cleaning of the newly paved road surface.

The control efficiencies achievable by paving can be estimated by comparing emission factors for unpaved and paved road conditions. The predictive emission factor equation for paved roads, given in Section 13.2.1, requires estimation of the silt loading on the traveled portion of the paved surface, which in turn depends on whether the pavement is periodically cleaned. Unless curbing is to be installed, the effects of vehicle excursion onto unpaved shoulders (berms) also must be taken into account in estimating the control efficiency of paving.

Other improvement methods cover the road surface with another material that has a lower silt content. Examples include placing gravel or slag on a dirt road. Control efficiency can be estimated by comparing the emission factors obtained using the silt contents before and after improvement. The silt content of the road surface should be determined after 3 to 6 months rather than immediately following placement. Control plans should address regular maintenance practices, such as grading, to retain larger aggregate on the traveled portion of the road.

Surface treatments refer to control options which require periodic reapplication. Treatments fall into the two main categories of (a) "wet suppression" (i. e., watering, possibly with surfactants or other additives), which keeps the road surface wet to control emissions and (b) "chemical stabilization/ treatment", which attempts to change the physical characteristics of the surface. The necessary reapplication frequency varies from several minutes for plain water under summertime conditions to several weeks or months for chemical dust suppressants.

Watering increases the moisture content, which conglomerates particles and reduces their likelihood to become suspended when vehicles pass over the surface. The control efficiency depends on how fast the road dries after water is added. This in turn depends on (a) the amount (per unit road surface area) of water added during each application; (b) the period of time between applications; (c) the weight, speed and number of vehicles traveling over the watered road during the period between applications; and (d) meteorological conditions (temperature, wind speed, cloud cover, etc.) that affect evaporation during the period.

Figure 13.2.2-2 presents a simple bilinear relationship between the instantaneous control efficiency due to watering and the resulting increase in surface moisture. The moisture ratio "M" (i.e., the x-axis in Figure 13.2.2-2) is found by dividing the surface moisture content of the watered road by the surface moisture content of the uncontrolled road. As the watered road surface dries, both the ratio M and the predicted instantaneous control efficiency (i.e., the y-axis in the figure) decrease. The figure shows that between the uncontrolled moisture content and a value twice as large, a small increase in moisture content results in a large increase in control efficiency. Beyond that, control efficiency grows slowly with increased moisture content.

Given the complicated nature of how the road dries, characterization of emissions from watered roadways is best done by collecting road surface material samples at various times between water truck passes. (Appendices C.1 and C.2 present the sampling and analysis procedures.) The moisture content measured can then be associated with a control efficiency by use of Figure 13.2.2-2. Samples that reflect average conditions during the watering cycle can take the form of either a series of samples between water applications or a single sample at the midpoint. It is essential that samples be collected during periods with active traffic on the road. Finally, because of different evaporation rates, it is recommended that samples be collected at various times during the year. If only one set of samples is to be collected, these must be collected during hot, summertime conditions.

When developing watering control plans for roads that do not yet exist, it is strongly recommended that the moisture cycle be established by sampling similar roads in the same geographic area. If the moisture cycle cannot be established by similar roads using established watering control plans, the more complex methodology used to estimate the mitigation of rainfall and other precipitation can be used to estimate the control provided by routine watering. An estimate of the maximum daytime Class A pan evaporation (based upon daily evaporation data published in the monthly Climatological Data for the state by the National Climatic Data Center) should be used to insure that adequate watering capability is available during periods of highest evaporation. The hourly precipitation values in the spreadsheet should be replaced with the equivalent inches of precipitation (where the equivalent of 1 inch of precipitation is provided by an application of 5.6 gallons of water per square yard of road). Information on the long term average annual evaporation and on the percentage that occurs between May and October was published in the Climatic Atlas (Reference 16). Figure 13.2.2-3 presents the geographical distribution for "Class A pan evaporation" throughout the United States. Figure 13.2.2-4 presents the geographical distribution of the percentage of this evaporation that occurs between May and October. The U. S. Weather Bureau Class A evaporation pan is a cylindrical metal container with a depth of 10 inches and a diameter of 48 inches. Periodic measurements are made of the changes of the water level.

The above methodology should be used only for prospective analyses and for designing watering programs for existing roadways. The quality rating of an emission factor for a watered road that is based on this methodology should be downgraded two letters. Periodic road surface samples should be collected and analyzed to verify the efficiency of the watering program.

As opposed to watering, chemical dust suppressants have much less frequent reapplication requirements. These materials suppress emissions by changing the physical characteristics of the existing road surface material. Many chemical unpaved road dust suppressants form a hardened surface that binds particles together. After several applications, a treated road often resembles a paved road except that the surface is not uniformly flat. Because the improved surface results in more grinding of small particles, the silt content of loose material on a highly controlled surface may be substantially higher than when the surface was uncontrolled. For this reason, the models presented as Equations 1a and 1b cannot be used to estimate emissions from chemically stabilized roads. Should the road be allowed to return to an

uncontrolled state with no visible signs of large-scale cementing of material, the Equation 1a and 1b emission factors could then be used to obtain conservatively high emission estimates.

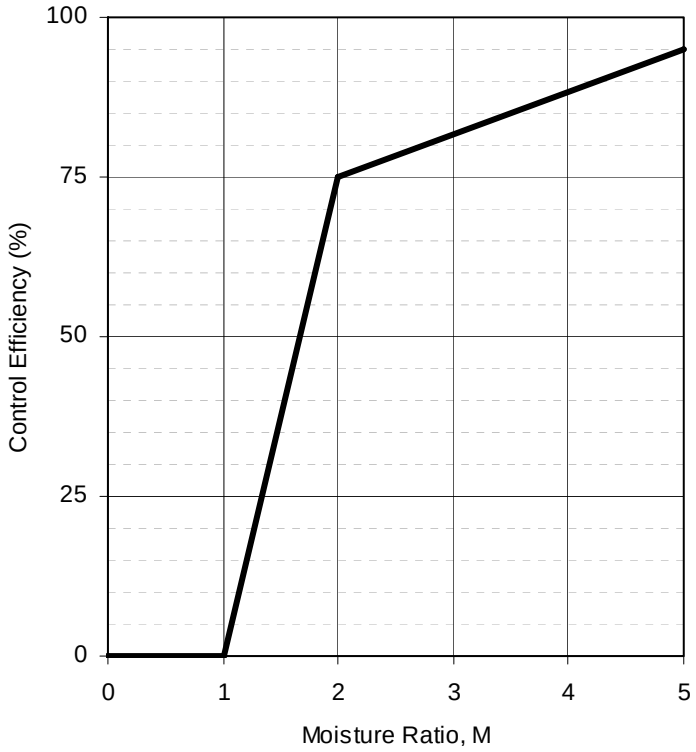

Figure 13.2.2-2. Watering control effectiveness for unpaved travel surfaces

The control effectiveness of chemical dust suppressants appears to depend on (a) the dilution rate used in the mixture; (b) the application rate (volume of solution per unit road surface area); (c) the time between applications; (d) the size, speed and amount of traffic during the period between applications; and (e) meteorological conditions (rainfall, freeze/thaw cycles, etc.) during the period. Other factors that affect the performance of dust suppressants include other traffic characteristics (e. g., cornering, track-on from unpaved areas) and road characteristics (e. g., bearing strength, grade). The variabilities in the above factors and differences between individual dust control products make the control efficiencies of chemical dust suppressants difficult to estimate. Past field testing of emissions from controlled unpaved roads has shown that chemical dust suppressants provide a PM-10 control efficiency of about 80 percent when applied at regular intervals of 2 weeks to 1 month.

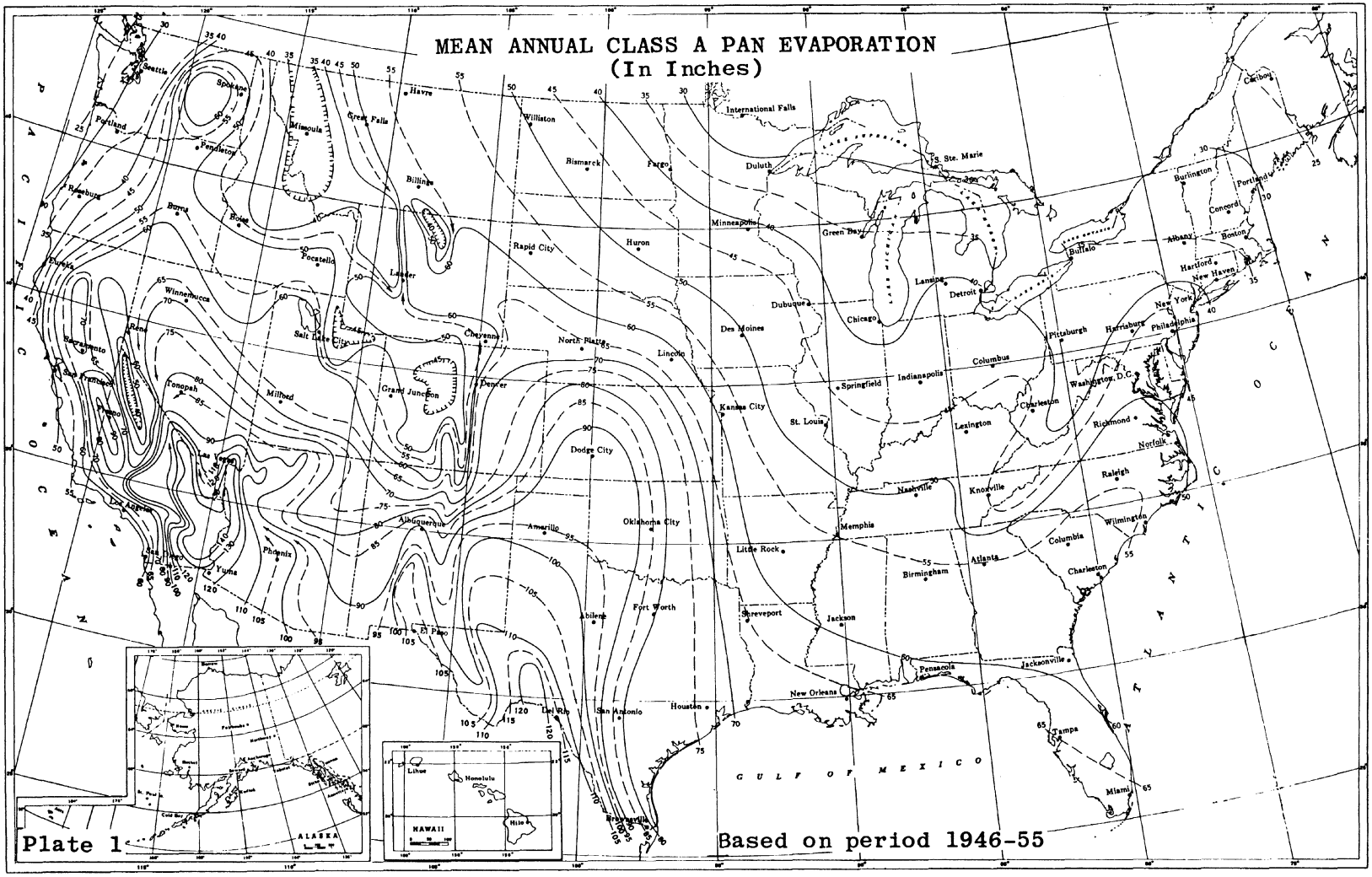

Figure 13.2.2-3. Annual evaporation data.

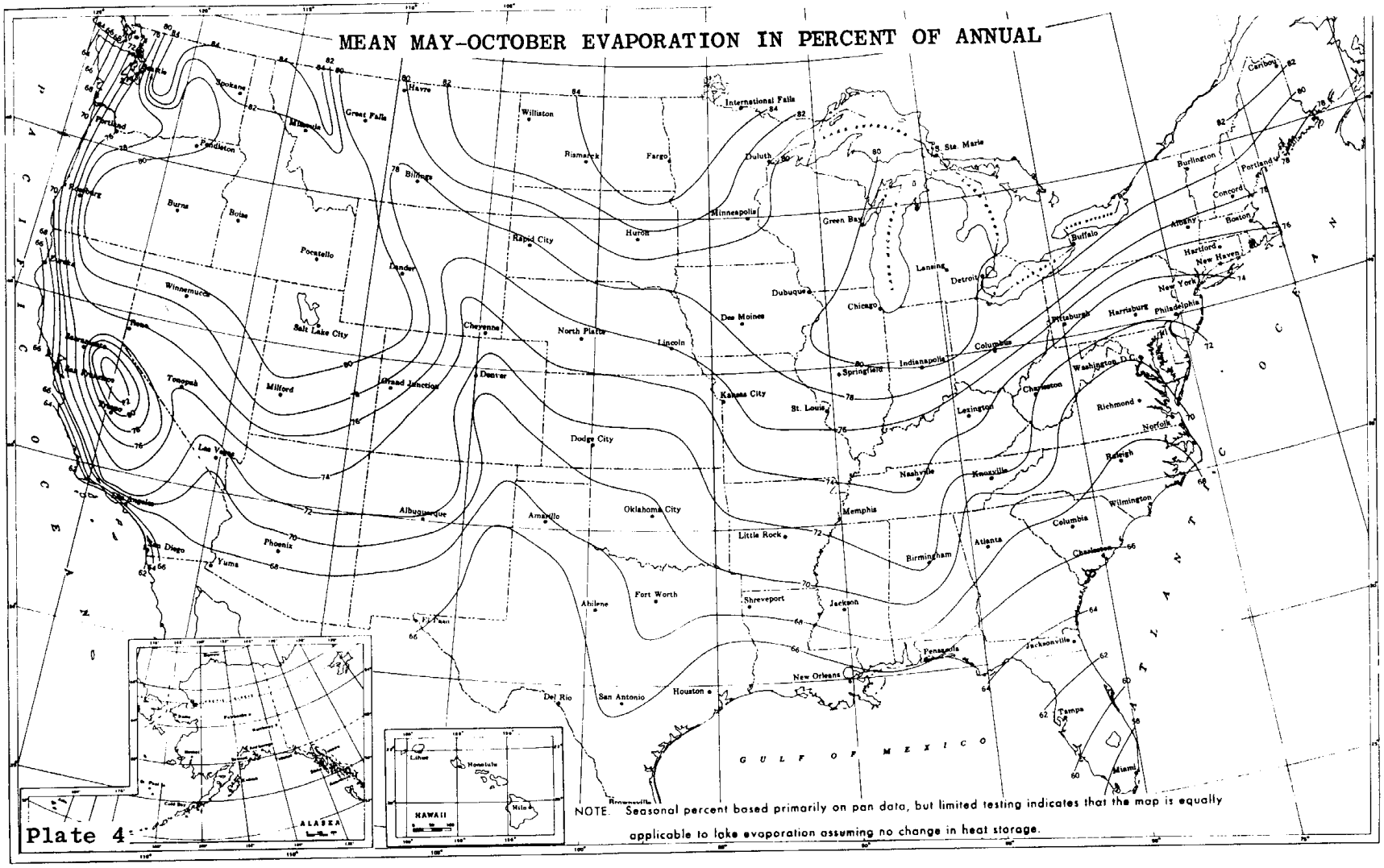

Figure 13.2.2-4. Geographical distribution of the percentage of evaporation occurring between May and October.

Petroleum resin products historically have been the dust suppressants (besides water) most widely used on industrial unpaved roads. Figure 13.2.2-5 presents a method to estimate average control efficiencies associated with petroleum resins applied to unpaved roads.[20] Several items should be noted:

1. The term "ground inventory" represents the total volume (per unit area) of petroleum resin concentrate (*not solution*) applied since the start of the dust control season.

2. Because petroleum resin products must be periodically reapplied to unpaved roads, the use of a time-averaged control efficiency value is appropriate. Figure 13.2.2-5 presents control efficiency values averaged over two common application intervals, 2 weeks and 1 month. Other application intervals will require interpolation.

3. Note that zero efficiency is assigned until the ground inventory reaches 0.05 gallon per square yard (gal/yd^2). Requiring a minimum ground inventory ensures that one must apply a reasonable amount of chemical dust suppressant to a road before claiming credit for emission control. Recall that the ground inventory refers to the amount of petroleum resin concentrate rather than the total solution.

As an example of the application of Figure 13.2.2-5, suppose that Equation 1a was used to estimate an emission factor of 7.1 lb/VMT for PM-10 from a particular road. Also, suppose that, starting on May 1, the road is treated with 0.221 gal/yd^2 of a solution (1 part petroleum resin to 5 parts water) on the first of each month through September. Then, the average controlled emission factors, shown in Table 13.2.2-5, are found.

Table 13.2-2-5. EXAMPLE OF AVERAGE CONTROLLED EMISSION FACTORS FOR SPECIFIC CONDITIONS

Period	Ground Inventory, gal/yd^2	Average Control Efficiency, %[a]	Average Controlled Emission Factor, lb/VMT
May	0.037	0	7.1
June	0.073	62	2.7
July	0.11	68	2.3
August	0.15	74	1.8
September	0.18	80	1.4

[a] From Figure 13.2.2-5, $\leq$10 µm. Zero efficiency assigned if ground inventory is less than 0.05 gal/yd^2. 1 lb/VMT = 281.9 g/VKT. 1 gal/yd^2 = 4.531 L/m^2.

Besides petroleum resins, other newer dust suppressants have also been successful in controlling emissions from unpaved roads. Specific test results for those chemicals, as well as for petroleum resins and watering, are provided in References 18 through 21.

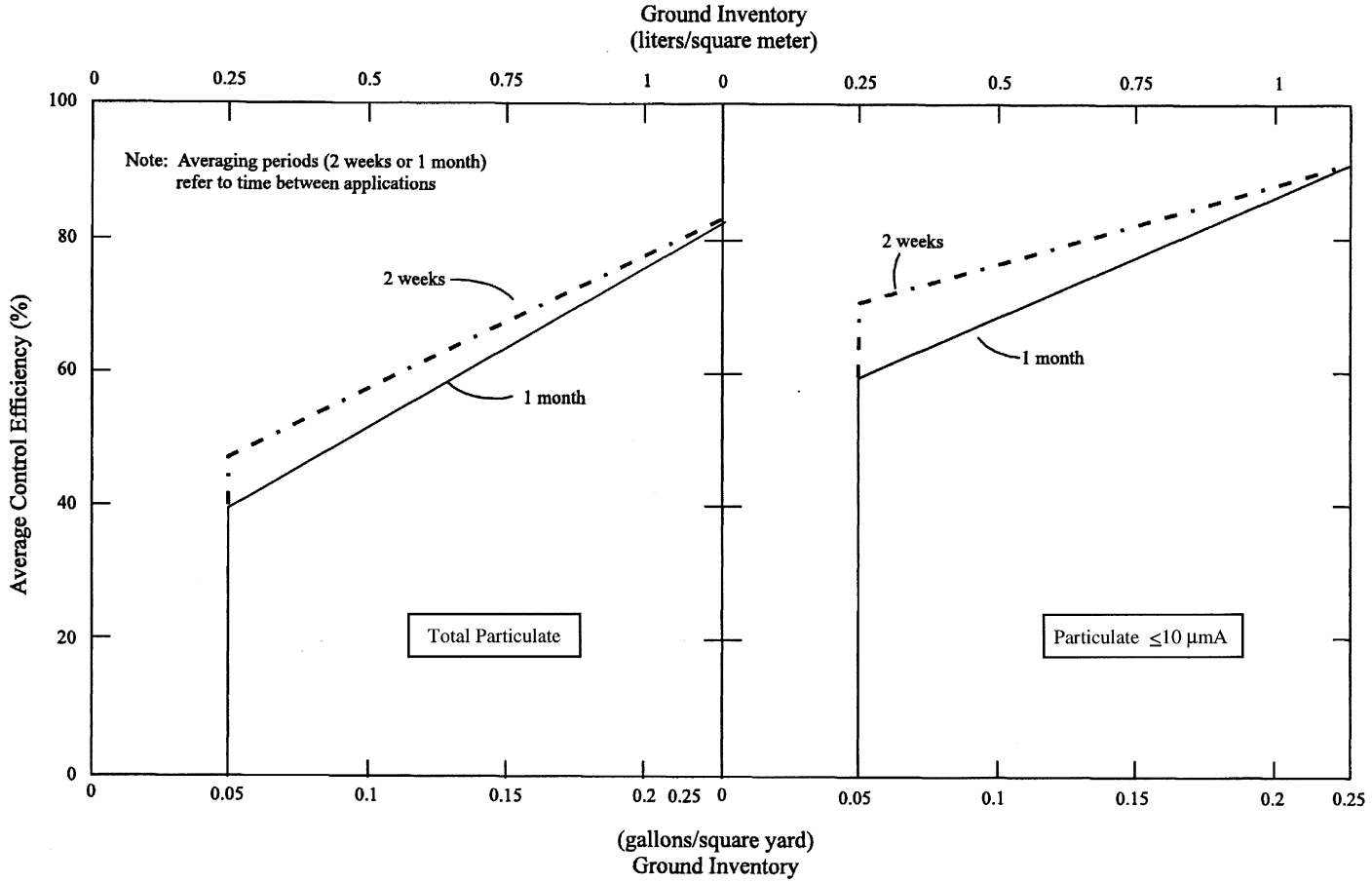

Figure 13.2.2-5. Average control efficiencies over common application intervals.

13.2.2.4 Updates Since The Fifth Edition

The Fifth Edition was released in January 1995. Revisions to this section since that date are summarized below. For further detail, consult the background report for this section (Reference 6).

October 1998 (Supplement E)– This was a major revision of this section. Significant changes to the text and the emission factor equations were made.

October 2001 – Separate emission factors for unpaved surfaces at industrial sites and publicly accessible roads were introduced. Figure 13.2.2-2 was included to provide control effectiveness estimates for watered roads.

December 2003 – The public road emission factor equation (equation 1b) was adjusted to remove the component of particulate emissions from exhaust, brake wear, and tire wear. The parameter C in the new equation varies with aerodynamic size range of the particulate matter. Table 13.2.2-4 was added to present the new coefficients.

January 2006 – The PM-2.5 particle size multipliers (i.e., factors) in Table 13.2.2-2 were modified and the quality ratings were upgraded from C to B based on the wind tunnel studies of a variety of dust emitting surface materials.

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24. MOBILE6 User Guide, United States Environmental Protection Agency, Office of Transportation and Air Quality. EPA420-R-02-028, October 2002.

25. Written communication (Technical Memorandum) from G. Muleski, Midwest Research Institute, Kansas City, MO, to B. Kuykendal, U. S. Environmental Protection Agency, Research Triangle Park, NC, Subject "Unpaved Roads", September 27, 2001.

26. Written communication (Technical Memorandum) from W. Kuykendal, U. S. Environmental Protection Agency, to File, Subject "Decisions on Final AP-42 Section 13.2.2 Unpaved Roads", November 24, 2003.

27. C. Cowherd, *Background Document for Revisions to Fine Fraction Ratios &sed for AP-42 Fugitive Dust Emission Factors*. Prepared by Midwest Research Institute for Western Governors Association, Western Regional Air Partnership, Denver, CO, February 1, 2006.

13.2.3 Heavy Construction Operations

13.2.3.1 General

Heavy construction is a source of dust emissions that may have substantial temporary impact on local air quality. Building and road construction are 2 examples of construction activities with high emissions potential. Emissions during the construction of a building or road can be associated with land clearing, drilling and blasting, ground excavation, cut and fill operations (i.e., earth moving), and construction of a particular facility itself. Dust emissions often vary substantially from day to day, depending on the level of activity, the specific operations, and the prevailing meteorological conditions. A large portion of the emissions results from equipment traffic over temporary roads at the construction site.

The temporary nature of construction differentiates it from other fugitive dust sources as to estimation and control of emissions. Construction consists of a series of different operations, each with its own duration and potential for dust generation. In other words, emissions from any single construction site can be expected (1) to have a definable beginning and an end and (2) to vary substantially over different phases of the construction process. This is in contrast to most other fugitive dust sources, where emissions are either relatively steady or follow a discernable annual cycle. Furthermore, there is often a need to estimate areawide construction emissions, without regard to the actual plans of any individual construction project. For these reasons, following are methods by which either areawide or site-specific emissions may be estimated.

13.2.3.2 Emissions And Correction Parameters

The quantity of dust emissions from construction operations is proportional to the area of land being worked and to the level of construction activity. By analogy to the parameter dependence observed for other similar fugitive dust sources,[1] one can expect emissions from heavy construction operations to be positively correlated with the silt content of the soil (that is, particles smaller than 75 micrometers [µm] in diameter), as well as with the speed and weight of the average vehicle, and to be negatively correlated with the soil moisture content.

13.2.3.3 Emission Factors

Only 1 set of field studies has been performed that attempts to relate the emissions from construction directly to an emission factor.[1-2] Based on field measurements of total suspended particulate (TSP) concentrations surrounding apartment and shopping center construction projects, the approximate emission factors for construction activity operations are:

E = 2.69 megagrams (Mg)/hectare/month of activity
E = 1.2 tons/acre/month of activity

These values are most useful for developing estimates of overall emissions from construction scattered throughout a geographical area. The value is most applicable to construction operations with: (1) medium activity level, (2) moderate silt contents, and (3) semiarid climate. Test data were not sufficient to derive the specific dependence of dust emissions on correction parameters. Because the above emission factor is referenced to TSP, use of this factor to estimate particulate matter (PM) no greater than 10 µm in aerodynamic diameter (PM-10) emissions will result in conservatively high

estimates. Also, because derivation of the factor assumes that construction activity occurs 30 days per month, the above estimate is somewhat conservatively high for TSP as well.

Although the equation above represents a relatively straightforward means of preparing an areawide emission inventory, at least 2 features limit its usefulness for specific construction sites. First, the conservative nature of the emission factor may result in too high an estimate for PM-10 to be of much use for a specific site under consideration. Second, the equation provides neither information about which particular construction activities have the greatest emission potential nor guidance for developing an effective dust control plan.

For these reasons, it is strongly recommended that when emissions are to be estimated for a particular construction site, the construction process be broken down into component operations. (Note that many general contractors typically employ planning and scheduling tools, such as critical path method [CPM], that make use of different sequential operations to allocate resources.) This approach to emission estimation uses a unit or phase method to consider the more basic dust sources of vehicle travel and material handling. That is to say, the construction project is viewed as consisting of several operations, each involving traffic and material movements, and emission factors from other AP-42 sections are used to generate estimates. Table 13.2.3-1 displays the dust sources involved with construction, along with the recommended emission factors.[3]

In addition to the on-site activities shown in Table 13.2.3-1, substantial emissions are possible because of material tracked out from the site and deposited on adjacent paved streets. Because all traffic passing the site (i. e., not just that associated with the construction) can resuspend the deposited material, this "secondary" source of emissions may be far more important than all the dust sources actually within the construction site. Furthermore, this secondary source will be present during all construction operations. Persons developing construction site emission estimates must consider the potential for increased adjacent emissions from off-site paved roadways (see Section 13.2.1, "Paved Roads"). High wind events also can lead to emissions from cleared land and material stockpiles. Section 13.2.5, "Industrial Wind Erosion", presents an estimation methodology that can be used for such sources at construction sites.

13.2.3.4 Control Measures[4]

Because of the relatively short-term nature of construction activities, some control measures are more cost effective than others. Wet suppression and wind speed reduction are 2 common methods used to control open dust sources at construction sites, because a source of water and material for wind barriers tend to be readily available on a construction site. However, several other forms of dust control are available.

Table 13.2.3-2 displays each of the preferred control measures, by dust source.[3-4] Because most of the controls listed in the table modify independent variables in the emission factor models, the effectiveness can be calculated by comparing controlled and uncontrolled emission estimates from Table 13.2.3-1. Additional guidance on controls is provided in the AP-42 sections from which the recommended emission factors were taken, as well as in other documents, such as Reference 4.

Table 13.2.3-1. RECOMMENDED EMISSION FACTORS FOR CONSTRUCTION OPERATIONS[a]

Construction Phase	Dust-generating Activities	Recommended Emission Factor	Comments	Rating Adjustment[b]
I. Demolition and debris removal	1. Demolition of buildings or other (natural) obstacles such as trees, boulders, etc.			
	a. Mechanical dismemberment ("headache ball") of existing structures	NA		—
	b. Implosion of existing structures	NA		—
	c. Drilling and blasting of soil	Drilling factor in Table 11.9-4		-1
		Blasting factor NA	Blasting factor in Tables 11.9-1 and 11.9-2 not considered appropriate for general construction activities	NA
	d. General land clearing	Dozer equation (overburden) in Tables 11.9-1 and 11.9-2		-1/-2[c]
	2. Loading of debris into trucks	Material handling emission factor equation in Section 13.2.4		-0/-1[c]
	3. Truck transport of debris	Unpaved road emission factor in Section 13.2.2, or paved road emission factor in Section 13.2.1		-0/-1[c]
	4. Truck unloading of debris	Material handling emission factor equation in Section 13.2.4	May occur offsite	-0/-1[c]

Table 13.2.3-1 (cont.).

Construction Phase	Dust-generating Activities	Recommended Emission Factor	Comments	Rating Adjustment[b]
II. Site Preparation (earth moving)	1. Bulldozing	Dozer equation (overburden) in Tables 11.9-1 and 11.9-2		-1/-2[c]
	2. Scrapers unloading topsoil	Scraper unloading factor in Table 11.9-4		-1
	3. Scrapers in travel	Scraper (travel mode) expression in Tables 11.9-1 and 11.9-2		-0/-1[c]
	4. Scrapers removing topsoil	5.7 kg/vehicle kilometer traveled (VKT) (20.2 lb/vehicle mile traveled [VMT])		E[d]
	5. Loading of excavated material into trucks	Material handling emission factor equation in Section 13.2.4		-0/-1[c]
	6. Truck dumping of fill material, road base, or other materials	Material handling emission factor equation in Section 13.2.4	May occur offsite	-0/-1[c]
	7. Compacting	Dozer equation in Tables 11.9-1 and 11.9-2	Emission factor downgraded because of differences in operating equipment	-1/-2[c]
	8. Motor grading	Grading equation in Tables 11.9-1 and 11.9-2		-1/-2[c]

Table 13.2.3-1 (cont.).

Construction Phase	Dust-generating Activities	Recommended Emission Factor	Comments	Rating Adjustment[b]
III. General Construction	1. Vehicular traffic	Unpaved road emission factor in Section 13.2.2, or paved road emission factor in Section 13.2.1		-0/-1[c] -0/-1[c]
	2. Portable plants			
	a. Crushing	Factors for similar material/operations in Section 11.19.2		-1/-2[c]
	b. Screening	Factors for similar material/operations in Section 11.19.2		-1/-2[c]
	c. Material transfers	Material handling emission factor equation in Section 13.2.4		-0/-1[c]
	3. Other operations	Factors for similar material/operations in the Mineral Products Industry, Chapter 11 of this document		—

[a] NA = not applicable.
[b] Refers to how many additional letters the emission factor should be downrated (beyond the guidance given in the other sections of AP-42) for application to construction activities. For example, "-2" means that an A-rated factor should be considered of C quality in estimating construction emissions. All emission factors assumed to have site-specific input values; otherwise, additional downgrading of one letter should be employed. Note that no rating can be lower than E.
[c] First value for cases with independent variables within range given in AP-42 section; second value for cases with at least 1 variable outside the range.
[d] Rating for emission factor given. Reference 5.
[e] In the event that individual operations cannot be identified, one may very conservatively overestimate PM-10 emissions by using Equation 1.

Table 13.2.3-2. CONTROL OPTIONS FOR GENERAL CONSTRUCTION OPEN SOURCES OF PM-10

Emission Source	Recommended Control Method(s)
Debris handling	Wind speed reduction Wet suppression[a]
Truck transport[b]	Wet suppression Paving Chemical stabilization[c]
Bulldozers	Wet suppression[d]
Pan scrapers	Wet suppression of travel routes
Cut/fill material handling	Wind speed reduction Wet suppression
Cut/fill haulage	Wet suppression Paving Chemical stabilization
General construction	Wind speed reduction Wet suppression Early paving of permanent roads

[a] Dust control plans should contain precautions against watering programs that confound trackout problems.

[b] Loads could be covered to avoid loss of material in transport, especially if material is transported offsite.

[c] Chemical stabilization usually cost-effective for relatively long-term or semipermanent unpaved roads.

[d] Excavated materials may already be moist and not require additional wetting. Furthermore, most soils are associated with an "optimum moisture" for compaction.

References For Section 13.2.3

1. C. Cowherd, Jr., *et al., Development Of Emissions Factors For Fugitive Dust Sources,* EPA-450/3-74-03, U. S. Environmental Protection Agency, Research Triangle Park, NC, June 1974.

2. G. A. Jutze, *et al., Investigation Of Fugitive Dust Sources Emissions And Control,* EPA-450/3-74-036a, U. S. Environmental Protection Agency, Research Triangle Park, NC, June 1974.

3. *Background Documentation For AP-42 Section 11.2.4, Heavy Construction Operations,* EPA Contract No. 69-D0-0123, Midwest Research Institute, Kansas City, MO, April 1993.

4. C. Cowherd, *et al., Control Of Open Fugitive Dust Sources,* EPA-450/3-88-008, U. S. Environmental Protection Agency, Research Triangle Park, NC, September 1988.

5. M. A. Grelinger, *et al., Gap Filling PM-10 Emission Factors For Open Area Fugitive Dust Sources*, EPA-450/4-88-003, U. S. Environmental Protection Agency, Research Triangle Park, NC, March 1988.

Appendix D: Cumulative Emission Sources

Dixie NF 20-Well Oil Field Development Verification Scenario
Model Sources and Source Parameters

Source ID	Source Description	Easting (X)	Northing (Y)	Base Elev.	Stk. Ht.	Temp.	Exit Vel.	Stk. Dia.	PM_{10}	$PM_{2.5}$ *	NO_x	SO_2
POINT SOURCES		(m)	(m)	(ft)	(ft)	(°F)	(fps)	(ft)	(lb/hr)	(lb/hr)	(lb/hr)	(lb/hr)
DRE	Drill Dig Engine	427831	4209861	9448	15	950.0	75	1.0	0.56	0.56	19.2	0.32
FLARE	Production Flare	427781	4209911	9480	100	1000.0	55	1.5	0	0	2.45	0
CM1	Compressor Engine	427831	4209961	9455	25	760.0	95	1.0	0.05	0.05	3.98	0
HT1	Heater Treater	426936	4208986	9472	20	180.0	15	0.7	0	0	0.05	0
HT2	Heater Treater	427489	4208796	9416	20	180.0	15	0.7	0	0	0.05	0
HT3	Heater Treater	428269	4208686	9431	20	180.0	15	0.7	0	0	0.05	0
HT4	Heater Treater	428861	4208911	9486	20	180.0	15	0.7	0	0	0.05	0
HT5	Heater Treater	429086	4209503	9524	20	180.0	15	0.7	0	0	0.05	0
HT6	Heater Treater	429086	4210319	9462	20	180.0	15	0.7	0	0	0.05	0
HT7	Heater Treater	428861	4210911	9542	20	180.0	15	0.7	0	0	0.05	0
HT8	Heater Treater	428269	4211136	9472	20	180.0	15	0.7	0	0	0.05	0
HT9	Heater Treater	427453	4211136	9538	20	180.0	15	0.7	0	0	0.05	0
HT10	Heater Treater	426861	4210911	9425	20	180.0	15	0.7	0	0	0.05	0
HT11	Heater Treater	426636	4210319	9409	20	180.0	15	0.7	0	0	0.05	0
HT12	Heater Treater	426636	4209508	9381	20	180.0	15	0.7	0	0	0.05	0
HT13	Heater Treater	427236	4209286	9383	20	180.0	15	0.7	0	0	0.05	0
HT14	Heater Treater	428486	4209286	9440	20	180.0	15	0.7	0	0	0.05	0
HT15	Heater Treater	428486	4210536	9527	20	180.0	15	0.7	0	0	0.05	0
HT16	Heater Treater	427236	4210536	9447	20	180.0	15	0.7	0	0	0.05	0
HT17	Heater Treater	427161	4209911	9373	20	180.0	15	0.7	0	0	0.05	0
HT18	Heater Treater	427861	4209211	9386	20	180.0	15	0.7	0	0	0.05	0
HT19	Heater Treater	428561	4209911	9464	20	180.0	15	0.7	0	0	0.05	0
HT20	Heater Treater	427861	4210611	9554	20	180.0	15	0.7	0	0	0.05	0
DHY1	Dehydrator	426906	4208956	9482	30	200.0	8	1.0	0	0	0.05	0
DHY4	Dehydrator	428831	4208881	9488	30	200.0	8	1.0	0	0	0.05	0
DHY7	Dehydrator	428831	4210881	9507	30	200.0	8	1.0	0	0	0.05	0
DHY10	Dehydrator	426831	4210881	9420	30	200.0	8	1.0	0	0	0.05	0
WP1	Well Pump	426906	4209016	9472	10	775.0	45	0.7	0.33	0.33	4.65	0.31
WP2	Well Pump	427459	4208826	9418	10	775.0	45	0.7	0.33	0.33	4.65	0.31
WP3	Well Pump	428239	4208716	9426	10	775.0	45	0.7	0.33	0.33	4.65	0.31
WP4	Well Pump	428831	4208941	9482	10	775.0	45	0.7	0.33	0.33	4.65	0.31
WP5	Well Pump	429056	4209533	9524	10	775.0	45	0.7	0.33	0.33	4.65	0.31
WP6	Well Pump	429056	4210349	9462	10	775.0	45	0.7	0.33	0.33	4.65	0.31
WP7	Well Pump	428831	4210941	9544	10	775.0	45	0.7	0.33	0.33	4.65	0.31
WP8	Well Pump	428239	4211166	9471	10	775.0	45	0.7	0.33	0.33	4.65	0.31
WP9	Well Pump	427423	4211166	9533	10	775.0	45	0.7	0.33	0.33	4.65	0.31
WP10	Well Pump	426831	4210941	9422	10	775.0	45	0.7	0.33	0.33	4.65	0.31
WP11	Well Pump	426606	4210349	9409	10	775.0	45	0.7	0.33	0.33	4.65	0.31
WP12	Well Pump	426606	4209538	9380	10	775.0	45	0.7	0.33	0.33	4.65	0.31
WP13	Well Pump	427206	4209316	9380	10	775.0	45	0.7	0.33	0.33	4.65	0.31
WP14	Well Pump	428456	4209316	9440	10	775.0	45	0.7	0.33	0.33	4.65	0.31
WP15	Well Pump	428456	4210566	9524	10	775.0	45	0.7	0.33	0.33	4.65	0.31
WP16	Well Pump	427206	4210566	9447	10	775.0	45	0.7	0.33	0.33	4.65	0.31
WP17	Well Pump	427131	4209941	9372	10	775.0	45	0.7	0.33	0.33	4.65	0.31
WP18	Well Pump	427831	4209241	9390	10	775.0	45	0.7	0.33	0.33	4.65	0.31
WP19	Well Pump	428531	4209941	9459	10	775.0	45	0.7	0.33	0.33	4.65	0.31
WP20	Well Pump	427831	4210641	9551	10	775.0	45	0.7	0.33	0.33	4.65	0.31

From Table 4.1-1 of the Technical report Dixie and Fishlake oil field development sources

* PM 2.5 was not included in the Dixie data. For combustion sources, PM2.5 assumed to equal PM10.

Dixie NF 20-Well Oil Field Development Verification Scenario
Model Sources and Source Parameters

Source ID	Source Description	Easting (X)	Northing (Y)	Base Elev.	Release Ht.	Horz. Dim.	Vert. Dim.	PM_{10}	$PM_{2.5}$ *	NO_x	SO_2
VOLUME SOURCES		(m)	(m)	(ft)	(ft)	(ft)	(ft)	(lb/hr)	(lb/hr)	(lb/hr)	(lb/hr)
ORD1	outer road	427831	4208536	9414	2.0	100	6.0	0.5705	0.0570	0.0560	
ORD2	outer road	427183	4208891	9445	2.0	75	6.0	0.5705	0.0570	0.0560	
ORD3	outer road	426719	4209207	9476	2.0	75	6.0	0.5705	0.0570	0.0560	
ORD4	outer road	426456	4209911	9427	2.0	100	6.0	0.5705	0.0570	0.0560	
ORD5	outer road	426719	4210615	9413	2.0	75	6.0	0.5705	0.0570	0.0560	
ORD6	outer road	427127	4211024	9483	2.0	75	6.0	0.5705	0.0570	0.0560	
ORD7	outer road	427831	4211286	9477	2.0	100	6.0	0.5705	0.0570	0.0560	
ORD8	outer road	428535	4211024	9469	2.0	75	6.0	0.5705	0.0570	0.0560	
ORD9	outer road	428944	4210615	9469	2.0	75	6.0	0.5705	0.0570	0.0560	
ORD10	outer road	429206	4209911	9471	2.0	100	6.0	0.5705	0.0570	0.0560	
ORD11	outer road	428944	4209207	9495	2.0	75	6.0	0.5705	0.0570	0.0560	
ORD12	outer road	428535	4208799	9460	2.0	75	6.0	0.5705	0.0570	0.0560	
IRD1	inner road	427519	4209249	9391	2.0	75	6.0	0.5705	0.0570	0.0560	
IRD2	inner road	427169	4209599	9367	2.0	75	6.0	0.5705	0.0570	0.0560	
IRD3	inner road	427169	4210224	9392	2.0	75	6.0	0.5705	0.0570	0.0560	
IRD4	inner road	427519	4210574	9511	2.0	75	6.0	0.5705	0.0570	0.0560	
IRD5	inner road	428144	4210574	9567	2.0	75	6.0	0.5705	0.0570	0.0560	
IRD6	inner road	428494	4210224	9521	2.0	75	6.0	0.5705	0.0570	0.0560	
IRD7	inner road	428494	4209599	9452	2.0	75	6.0	0.5705	0.0570	0.0560	
IRD8	inner road	428144	4209249	9393	2.0	75	6.0	0.5705	0.0570	0.0560	

From Table 4.1-1 of the Technical report Dixie and Fishlake oil field development sources

* PM 2.5 was not included in the Dixie data. For unpaved road sources, PM2.5 assumed to equal 10% of PM10

MRI, 2006 (Background document for Revisions to Fine Fraction Ratios Used in AP-42 - Table 1, unpaved roads)

Dixie NF 20-Well Oil Field Development Verification Scenario
Model Sources and Source Parameters

Source ID	Source Description	Easting (X)	Northing (Y)	Base Elev.	Release Ht.	Radius of Circle	Vert. Dim.	PM_{10}	$PM_{2.5}$ *	NO_x	SO_2
CIRCULAR SOURCES		(m)	(m)	(ft)	(ft)	(ft)	(ft)	(lb/hr)	(lb/hr)	(lb/hr)	(lb/hr)
WELLPAD1	Disturbed Area - Well Pad	426831	4208911	9491	0	282.7	2.00	0.02	0.002		
WELLPAD2	Disturbed Area - Well Pad	427423	4208686	9430	0	282.7	2.00	0.02	0.002		
WELLPAD3	Disturbed Area - Well Pad	428239	4208686	9428	0	282.7	2.00	0.02	0.002		
WELLPAD4	Disturbed Area - Well Pad	428831	4208911	9485	0	282.7	2.00	0.02	0.002		
WELLPAD5	Disturbed Area - Well Pad	429056	4209503	9524	0	282.7	2.00	0.02	0.002		
WELLPAD6	Disturbed Area - Well Pad	429056	4210319	9462	0	282.7	2.00	0.02	0.002		
WELLPAD7	Disturbed Area - Well Pad	428831	4210911	9526	0	282.7	2.00	0.02	0.002		
WELLPAD8	Disturbed Area - Well Pad	428239	4211136	9474	0	282.7	2.00	0.02	0.002		
WELLPAD9	Disturbed Area - Well Pad	427423	4211136	9533	0	282.7	2.00	0.02	0.002		
WELLPAD10	Disturbed Area - Well Pad	426831	4210911	9422	0	282.7	2.00	0.02	0.002		
WELLPAD11	Disturbed Area - Well Pad	426606	4210319	9409	0	282.7	2.00	0.02	0.002		
WELLPAD12	Disturbed Area - Well Pad	426606	4209508	9385	0	282.7	2.00	0.02	0.002		
WELLPAD13	Disturbed Area - Well Pad	427206	4209286	9385	0	282.7	2.00	0.02	0.002		
WELLPAD14	Disturbed Area - Well Pad	428456	4209286	9437	0	282.7	2.00	0.02	0.002		
WELLPAD15	Disturbed Area - Well Pad	428456	4210536	9532	0	282.7	2.00	0.02	0.002		
WELLPAD16	Disturbed Area - Well Pad	427206	4210536	9442	0	282.7	2.00	0.02	0.002		
WELLPAD17	Disturbed Area - Well Pad	427131	4209911	9372	0	282.7	2.00	0.02	0.002		
WELLPAD18	Disturbed Area - Well Pad	427831	4209211	9386	0	282.7	2.00	0.02	0.002		
WELLPAD19	Disturbed Area - Well Pad	428531	4209911	9458	0	282.7	2.00	0.02	0.002		
WELLPAD20	Disturbed Area - Well Pad	427831	4210611	9550	0	282.7	2.00	0.02	0.002		
CENTPROC	50 acres dist center proc	427831	4209911	9453	0	832.6	2.00	0.169	0.0169		

From Table 4.1-1 of the Technical report Dixie and Fishlake oil field development sources

* PM 2.5 was not included in the Dixie data. For construc & demolition, PM2.5 assumed to equal 10% of PM10.
MRI, 2006 (Background document for Revisions to Fine Fraction Ratios Used in AP-42 - Table 1, Construc & Demolition)

Fishlake NF Directional Drilling Oil Field Development Verification Scenario
Model Sources and Source Parameters

Source ID	Source Description	Easting (X)	Northing (Y)	Base Elev.	Stack Ht.	Temp.	Exit Vel.	Stk. Dia.	PM_{10}	$PM_{2.5}$ *	NO_x	SO_2
POINT SOURCES		(m)	(m)	(ft)	(ft)	(°F)	(fps)	(ft)	(lb/hr)	(lb/hr)	(lb/hr)	(lb/hr)
DRE	Drill Rig Engine	381262	4277427	8200	15	950.0	75	1.0	0.56	0.56	19.2	0.32
PFLAR	Production Flare	381212	4277417	8184	100	1000.0	55	1.5	0	0	2.45	0
COMPR	Compressor Engine	381312	4277417	8222	25	760.0	95	1.0	0.05	0.05	3.98	0
HT1	Heater Treater	380332	4276797	8081	20	180.0	15	0.67	0	0	0.05	0
HT2	Heater Treater	380392	4276797	8081	20	180.0	15	0.67	0	0	0.05	0
HT3	Heater Treater	380392	4276737	8081	20	180.0	15	0.67	0	0	0.05	0
HT4	Heater Treater	380332	4276737	8081	20	180.0	15	0.67	0	0	0.05	0
HT5	Heater Treater	382332	4277497	8521	20	180.0	15	0.67	0	0	0.05	0
HT6	Heater Treater	382392	4277497	8483	20	180.0	15	0.67	0	0	0.05	0
HT7	Heater Treater	382392	4277437	8481	20	180.0	15	0.67	0	0	0.05	0
HT8	Heater Treater	382332	4277437	8519	20	180.0	15	0.67	0	0	0.05	0
HT9	Heater Treater	381032	4278147	8162	20	180.0	15	0.67	0	0	0.05	0
HT10	Heater Treater	381092	4278147	8151	20	180.0	15	0.67	0	0	0.05	0
HT11	Heater Treater	381092	4278087	8163	20	180.0	15	0.67	0	0	0.05	0
HT12	Heater Treater	381032	4278087	8166	20	180.0	15	0.67	0	0	0.05	0
DHY1	Dehydrator	381262	4277467	8213	30	200.0	8	1.0	0	0	0.05	0
DHY2	Dehydrator	381262	4277367	8203	30	200.0	8	1.0	0	0	0.05	0
WP1	Well Pump	380312	4276817	8081	10	775.0	45	0.67	0.33	0.33	4.65	0.31
WP2	Well Pump	380412	4276817	8082	10	775.0	45	0.67	0.33	0.33	4.65	0.31
WP3	Well Pump	380412	4276717	8081	10	775.0	45	0.67	0.33	0.33	4.65	0.31
WP4	Well Pump	380312	4276717	8081	10	775.0	45	0.67	0.33	0.33	4.65	0.31
WP5	Well Pump	382312	4277517	8531	10	775.0	45	0.67	0.33	0.33	4.65	0.31
WP6	Well Pump	382412	4277517	8481	10	775.0	45	0.67	0.33	0.33	4.65	0.31
WP7	Well Pump	382412	4277417	8472	10	775.0	45	0.67	0.33	0.33	4.65	0.31
WP8	Well Pump	382312	4277417	8525	10	775.0	45	0.67	0.33	0.33	4.65	0.31
WP9	Well Pump	381012	4278167	8164	10	775.0	45	0.67	0.33	0.33	4.65	0.31
WP10	Well Pump	381112	4278167	8151	10	775.0	45	0.67	0.33	0.33	4.65	0.31
WP11	Well Pump	381112	4278067	8166	10	775.0	45	0.67	0.33	0.33	4.65	0.31
WP12	Well Pump	381012	4278067	8172	10	775.0	45	0.67	0.33	0.33	4.65	0.31

From Table 4.2-1 of the Technical report Dixie and Fishlake oil field development sources

* PM 2.5 was not included in the Fishlake data. For combustion sources, PM2.5 assumed to equal PM10.

Fishlake NF Directional Drilling Oil Field Development Verification Scenario
Model Sources and Source Parameters

Source ID	Source Description	Easting (X)	Northing (Y)	Base Elev.	Release Ht.	Horz. Dim.	Vert. Dim.	PM_{10}	$PM_{2.5}$ *	NO_x	SO_2
VOLUME SOURCES		(m)	(m)	(ft)	(ft)	(ft)	(ft)	(lb/hr)	(lb/hr)	(lb/hr)	(lb/hr)
ORD1	outer road	381262	4276042	8116	2.0	100	6.0	0.0443	0.0044	0.0588	
ORD2	outer road	380558	4276305	8097	2.0	75	6.0	0.0443	0.0044	0.0588	
ORD3	outer road	380150	4276713	8072	2.0	75	6.0	0.0443	0.0044	0.0588	
ORD4	outer road	379887	4277417	8052	2.0	100	6.0	0.0443	0.0044	0.0588	
ORD5	outer road	380150	4278121	8283	2.0	75	6.0	0.0443	0.0044	0.0588	
ORD6	outer road	380558	4278530	7977	2.0	75	6.0	0.0443	0.0044	0.0588	
ORD7	outer road	381262	4278792	8219	2.0	100	6.0	0.0443	0.0044	0.0588	
ORD8	outer road	381966	4278530	8318	2.0	75	6.0	0.0443	0.0044	0.0588	
ORD9	outer road	382375	4278121	8527	2.0	75	6.0	0.0443	0.0044	0.0588	
ORD10	outer road	382637	4277417	8468	2.0	100	6.0	0.0443	0.0044	0.0588	
ORD11	outer road	382375	4276713	8450	2.0	75	6.0	0.0443	0.0044	0.0588	
ORD12	outer road	381966	4276305	8200	2.0	75	6.0	0.0443	0.0044	0.0588	
IRD1	inner road	380950	4276755	8184	2.0	75	6.0	0.0443	0.0044	0.0588	
IRD2	inner road	380600	4277105	8144	2.0	75	6.0	0.0443	0.0044	0.0588	
IRD3	inner road	380600	4277730	8225	2.0	75	6.0	0.0443	0.0044	0.0588	
IRD4	inner road	380950	4278080	8194	2.0	75	6.0	0.0443	0.0044	0.0588	
IRD5	inner road	381575	4278080	8334	2.0	75	6.0	0.0443	0.0044	0.0588	
IRD6	inner road	381925	4277730	8439	2.0	75	6.0	0.0443	0.0044	0.0588	
IRD7	inner road	381925	4277105	8321	2.0	75	6.0	0.0443	0.0044	0.0588	
IRD8	inner road	381575	4276755	8249	2.0	75	6.0	0.0443	0.0044	0.0588	

From Table 4.2-1 of the Technical report Dixie and Fishlake oil field development sources

* PM 2.5 was not included in the Fishlake data. For unpaved road sources, PM2.5 assumed to equal 10% of PM10. MRI, 2006 (Background document for Revisions to Fine Fraction Ratios Used in AP-42 - Table 1, unpaved roads)

Fishlake NF Directional Drilling Oil Field Development Verification Scenario
Model Sources and Source Parameters

Source ID	Source Description	Easting (X)	Northing (Y)	Base Elev.	Release Ht.	Radius of Circle	Vert. Dim.	PM_{10}	$PM_{2.5}$ *	NO_x	SO_2
CIRCULAR SOURCES		(m)	(m)	(ft)	(ft)	(ft)	(ft)	(lb/hr)	(lb/hr)	(lb/hr)	(lb/hr)
WELLPAD1	Disturbed Area - Well Pad	380362	4276767	8081	0	282.7	2.00	0.1357	0.01357		
WELLPAD2	Disturbed Area - Well Pad	382362	4277467	8498	0	282.7	2.00	0.1357	0.01357		
WELLPAD3	Disturbed Area - Well Pad	381062	4278117	8156	0	282.7	2.00	0.1357	0.01357		
CENTPROC	50 acres dist center proc	381262	4277417	8199	0	832.6	2.00	1.1804	0.11804		

From Table 4.2-1 of the Technical report Dixie and Fishlake oil field development sources

* PM 2.5 was not included in the Fishlake data. For construc & demolition, PM2.5 assumed to equal 10% of PM10.
MRI, 2006 (Background document for Revisions to Fine Fraction Ratios Used in AP-42 - Table 1, Construc & Demolition)

KANAB RMP
EMISSIONS CALCULATIONS
SUMMARY OF ALL ACTIVITIES
LONG-TERM DEVELOPMENT

Kanab Field Office Emissions Summary
Difference between Alternative A and Baseline

Activity	PM_{10}	$PM_{2.5}$	NOx	SO2	CO	VOC	HAPs[b]
	Tons	Tons	Tons	Tons	Tons	Tons	Tons
Oil and Gas Well Development and Exploration							
Conventional Natural Gas -Construction	0	0	0	0	0	0	0
Conventional Natural Gas - Operations	6	1	5	0	2	4	0
Conventional Natural Gas - Maintenance	0	0	0	0	0	0	0
Sub-total: Conventional Natural Gas	**6**	**1**	**6**	**0**	**2**	**4**	**0**
Non-Oil and Gas Well Activities							
Coal Mining[a]	0	0	0	0	0	0	0
Lands & Reality	0	0	0	0	0	0	0
Livestock Grazing	0	0	0	0	0	0	0
Off-Highway Vehicles (OHV)[a]	8	8	4		690	254	25
Resource Roads	0	0	0	0	0	0	0
Saleable Minerals							
Vegetation	0	0	0	0	0	0	0
Prescribed burning	0	0	0	0	0	0	0
Sub-total: Non-Oil and Gas Well Activities	**8**	**8**	**4**	**0**	**690**	**254**	**25**
Total: Delta (Alternative A - Baseline)	**15**	**10**	**10**	**0**	**692**	**258**	**26**
	g/sec	**g/sec**	**g/sec**	**g/sec**	**g/sec**	**g/sec**	**g/sec**
Total: Delta (Alternative A - Baseline)	**0.425**	**0.273**	**0.291**	**0.003**	**19.896**	**7.424**	**0.742**

Assume Area Source **4.00** **sq mi** **(approximate area of oil and gas disturbance)**

RICHFIELD EIS-ALTERNATIVE A EMISSION CALCULATIONS SUMMARY OF ALL ACTIVITIES LONG TERM DEVELOPMENT

Richfield Difference between 2022 Alternative A and Baseline 2007.

Activity	PM10	PM2.5	NOx	SO2	CO	VOC	HAPsb
	Tons	Tons	Tons	Tons	Tons	Tons	Tons
Oil Well Development and Exploration							
Oil Welll - Construction	23.90	7.35	185.93	3.13	24.21	7.48	0.75
Oil Well- Operations	7.29	1.71	41.50	0.70	9.61	1.23	0.12
Oil Well - Maintenance	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sub-total: Oil Wells	**31.19**	**9.05**	**227.42**	**3.83**	**33.82**	**8.72**	**0.87**
Non-Oil Well Activities							
Coal Mining[a]	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lands & Reality	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Livestock Grazing	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Off-Highway Vehicles (OHV)[a]	5.75	5.75	3.08		524.20	168.41	16.84
Resource Roads	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Saleable Minerals	0.00	0.00					
Vegetation	21.01	3.15	0.00	0.00	0.00	0.00	0.00
Sub-total: Non-Oil Well Activities	**26.76**	**8.90**	**3.08**	**0.00**	**524.20**	**168.41**	**16.84**
Total: Delta (Alternative A - Baseline)	**57.95**	**17.96**	**230.50**	**3.83**	**558.03**	**177.13**	**17.71**
	g/sec	**g/sec**	**g/sec**	**g/sec**	**g/sec**	**g/sec**	**g/sec**
Total: Delta (Alternative A - Baseline)	**1.665**	**0.516**	**6.624**	**0.110**	**16.035**	**5.090**	**0.509**

Assume Area Source **24.00** **sq mi** **(estimated area of oil and gas disturbance)**

K.2. Supplement to Air Resources Impact Assessment Technical Report for the Alton Coal Lease by Application, Supplemental Draft Environmental Impact Statement

SUPPLEMENT TO
AIR RESOURCES IMPACT ASSESSMENT TECHNICAL REPORT
FOR THE ALTON COAL LEASE BY APPLICATION

SUPPLEMENTAL DRAFT ENVIRONMENTAL IMPACT STATEMENT

Prepared for

Bureau of Land Management
Kanab Field Office
Kanab, Utah

Bureau of Land Management
Utah State Office
Salt Lake City, Utah

Prepared by

Marquez Environmental Services, Inc.
Golden, Colorado

January 2014

In coordination with

SWCA Environmental Consultants
Salt Lake City, Utah

SUPPLEMENT TO
AIR RESOURCES IMPACT ASSESSMENT TECHNICAL REPORT FOR THE ALTON COAL LEASE BY APPLICATION SUPPLEMENTAL DRAFT ENVIRONMENTAL IMPACT STATEMENT

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Salt Lake City, Utah
SWCA Project 12033

January 2014

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ATTACHMENTS

Attachment A. Alton Coal Tract Emission Inventory

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ABBREVIATIONS

AQRV	air quality-related value
ARTAG	Air Resource Technical Advisory Group
BLM	Bureau of Land Management
DAT	deposition analysis thresholds
EIS	environmental impact statement
EC	elemental carbon
EPA	Environmental Protection Agency
GHG	greenhouse gas
HAP	hazardous air pollutants
HNO_3	nitric acid
km	kilometers
CO_2e	carbon dioxide equivalent
CH_4	methane
cm^3/g	cubic centimeter per gram
MM	million
MMTY	million metric tons/year
MOU	memorandum of understanding
MOVES	Motor Vehicle Emission Simulation
N	nitrogen
N/A	not applicable
NAAQS	National Ambient Air Quality Standards
NED	national elevation data
NO_2	nitrogen dioxide
NO_3	nitrate
NO_x	oxides of nitrogen
N_2O	nitrous oxide
NPS	National Park Service
O_3	ozone
PM	particulate matter
PM_{10}	particulate matter less than or equal to a nominal 10 microns in aerodynamic size
$PM_{2.5}$	particulate matter less than or equal to a nominal 2.5 microns in aerodynamic size
ppb	parts per billion
PSD	prevention of significant deterioration

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ROD	record of decision
S	sulfur
SO_2	sulfur dioxide
SO_4	sulfate
tpy	tons per year
UDAQ	Utah Department of Air Quality
$\mu g/m^3$	micrograms per cubic meter
USGS	U.S. Geological Survey
VOC	volatile organic compound

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1. INTRODUCTION

Marquez Environmental Services, Inc. (MESI) completed an *Air Resources Impact Assessment Technical Report for the Alton Coal Tract Lease by Application* (Technical Report) in September 2010 as part of the draft environmental impact statement (DEIS). Air quality impacts were analyzed for three alternatives (MESI 2010). Based on comments received on the DEIS, the Bureau of Land Management (BLM) decided to prepare a supplemental draft EIS (SDEIS) for public review prior to preparing and distributing a final EIS. As part of the analysis in the SDEIS, MESI has prepared this *Supplement to the Air Resources Impact Assessment Technical Report* (Supplement) to analyze the air quality impacts from an additional coal leasing alternative being considered in detail in the SDEIS and to respond to substantive air-related comments received on the DEIS.

The analysis provided herein was performed similarly to the analyses in the original Technical Report. This Supplement describes the additional analyses performed and summarizes the new results along with the previous results.

The air impact assessment used the Environmental Protection Agency's (EPA's) recommended guideline model, AERMOD, to analyze potential near-field impacts of mining operations on the Alton Coal Tract (tract) on ambient levels of criteria pollutants near the tract. The far-field analysis was also updated. Additional visibility analyses were performed using updated guidance, and an updated greenhouse gas (GHG) analysis is also included in this document.

1.1. Alternative K1

The BLM eliminated Alternative K1 from detailed analysis in the DEIS. However, based on public comments on the DEIS, the BLM has decided to consider Alternative K1 in detail in the SDEIS. Under Alternative K1, Block NW and Block S would be excluded from the tract (Map 1). The intent of Alternative K1 is to resolve, in part or in full, the following: issues related to the local Greater Sage-grouse (*Centrocercus urophasianus*) population; noise and visual impacts to the town of Alton; and issues related to conflicting land uses (agriculture versus surface mining). Alternative K1 may also reduce impacts to other resources such as springs and surface waters, wildlife, soils, public health and safety, paleontological resources, cultural resources, vegetation, and air quality. The primary purpose of this Supplement is to evaluate the air quality impacts from this alternative.

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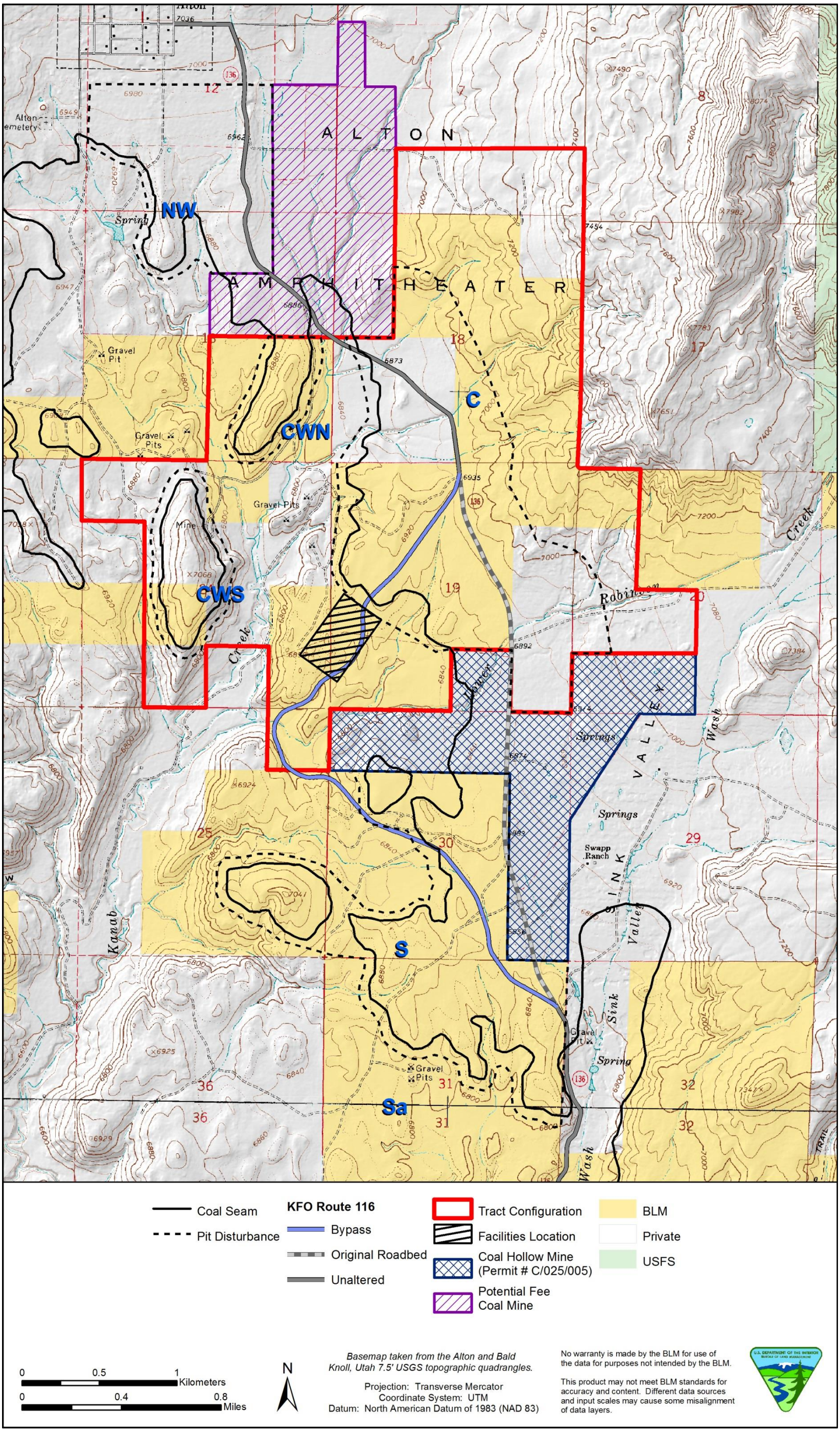

Map 1. Alton Coal Tract configuration and land ownership under Alternative K1.

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1.2. Work Tasks

The air resources analysis addressed the impacts to near-field ambient air quality from potential air emissions from coal mining on the tract for Alternative K1. Ambient air quality impacts were quantified and compared to applicable state and federal standards.

The assessment of impacts used data from the Technical Report, including the following:

- The Alternative B 200-foot overburden removal emission inventory for mining operations on the tract and coal haul transportation operations on the reasonably foreseeable coal haul transportation route
- Near-field ambient impacts from emissions resulting from mining operations on the tract and coal haul transportation operations on the reasonably foreseeable coal haul transportation route

Additional updates to the Technical Report are included in this Supplement, based on comments received on the DEIS, as well as updated guidance from Federal Land Managers' Air Quality Related Values Workgroup (FLAG) Phase I Report – Revised (2010). Work tasks include the following:

- Update particulate matter (PM) less a nominal 2.5 micrometers in aerodynamic diameter ($PM_{2.5}$) background concentrations
- Update the $PM_{2.5}$ annual National Ambient Air Quality Standard (NAAQS)
- Update the Level-2 VISCREEN analysis for Alternative B 200-foot overburden emissions, based on FLAG 2010
- Perform Level-2 VISCREEN analysis for Alternative C 200-foot overburden emissions
- Calculate PM exhaust emissions for the Alternative C 200-foot overburden scenario
- Calculate the portion of the exhaust emissions that is elemental carbon (EC)
- Update the near-field Class I and II area impacts
- Update far-field modeling results for the tract and other cumulative sources for both Alternative B and C 200-foot overburden emissions, using data and guidance from FLAG 2010
- Update GHG emissions to include methane (CH_4) emissions from the coal seam

2. EMISSION INVENTORY

The emission inventory included in the Technical Report considers emissions of oxides of nitrogen (NO_x), sulfur dioxide (SO_2), carbon monoxide (CO), PM_{10}, $PM_{2.5}$, volatile organic compounds (VOCs), hazardous air pollutants (HAPs) (i.e., acetaldehyde, acrolein, benzene, formaldehyde, toluene, and xylene for generators), and carbon dioxide (CO_2). Emission estimates were compiled for mining and related operations and for other existing and reasonably foreseeable future sources.

Although it is recognized that secondarily formed $PM_{2.5}$ and ozone emissions would be generated, only primary pollutant emissions were included as part of the emission inventory. The NO_x, SO_x, and VOC gases emitted have the potential to secondarily form $PM_{2.5}$ particles. $PM_{2.5}$ formation from these precursors is highly uncertain, and varies both regionally and seasonally due to atmospheric conditions.

Photochemical conversion of NO_x and VOCs to O_3 and the secondary formation of $PM_{2.5}$ concentrations from NO_x and SO_2 emissions were not included in the modeling. These chemical reactions cannot be simulated with the recommended far-field model (CALPUFF).

2.1. Project Emissions

For this Supplement, emissions from coal production activities were considered as project emissions. Primary sources are related either to fuel use in internal combustion engines or to dust emitted into the air from various sources. For coal production emissions, the maximum development year was considered representative of all years of mining. This approach results in a more conservative estimate of yearly emissions and a more conservative overall analysis. However, most years of mining would result in fewer emissions than the maximum development year.

2.1.1. Production Emissions

The production emissions for Alternative K1 are identical to the Alternative B 200-foot overburden thickness scenario previously evaluated. The emissions calculation methodology is summarized as follows:

> Sources of pollutant emissions during coal production include PM emissions and fuel-combustion emissions. Emissions were calculated based on operations 24 hours per day, 7 days per week, and 52 weeks per year. The total number of operating days per year was assumed to be 365.

PM emissions from surface mining (fugitive dust) would include

- topsoil loading, unloading, and hauling (two options: scrapers or front-end loader and trucks);
- overburden blasting, overburden truck loading, unloading, and hauling;
- coal loading, unloading, hauling, crushing, screening, conveying, and storage;
- vehicle traffic on improved and unimproved gravel or dirt roads as well as paved roads;
- wind erosion of disturbed areas;
- train loading; and
- bulldozer and front-end loading activities.

Design features (e.g., emission controls such as watering and chemical spraying) were included in the emission calculations.

Fuel-combustion emissions (NO_x, SO_2, CO, PM_{10}, $PM_{2.5}$, VOCs, HAPs, and CO_2) can come from generators and vehicles. The fraction of $PM_{2.5}$ emissions attributable to motor vehicle exhaust has been added to the emission calculations in Attachment A.

On-road vehicles would include coal haul trucks (see Attachment A) and employee vehicles. On-road motor vehicle emissions were calculated using the Utah Division of Air Quality (UDAQ) 2005 mobile source (Mobile 6) emission factors for Kane County. The Mobile 6 data did not include emission factors for HAPs. A more recent mobile source emission estimation program, the Motor Vehicle Emission Simulation (MOVES), has been developed by the EPA to replace the Mobile model. MOVES estimates the following HAP emissions: benzene, 1,3-butadiene, formaldehyde, acetaldehyde, acrolein, naphthalene, ethanol, and methyl tertiary butyl ether. However, UDAQ does not have MOVES model results for Kane County (personal communication, Black 2012).

As part of its own internal testing, EPA performed a preliminary comparison of MOVES2010 to MOBILE6.2 using approximate local data for several different urban counties, each with its own fleet age distribution, fraction of light- and heavy-duty vehicle miles traveled, local fuel specifications, meteorology, and other input factors. The differences between MOVES2010 and MOBILE6.2 are described below by criteria pollutant. Actual results would vary based on local inputs in a given area, with local variations in the fleet age distribution and composition having a significant influence on the final results.

- VOCs: For all the urban counties modeled, mobile source VOC emissions were lower using MOVES2010 than previously estimated using MOBILE6.2. This difference is most noticeable for Tier 1 and newer vehicles, especially for evaporative emissions.

- NO_x: Emissions from both light- and heavy-duty trucks are higher than previously estimated. Using MOVES2010 and assuming no change in extended idle activity as a fraction of total activity, EPA projects that uncontrolled extended idle emissions from heavy-duty vehicles will become a significant share of the on-road mobile source NO_x inventory in the future. In some urban areas of the country, extended idle emissions could comprise approximately one quarter of total heavy-duty NO_x emissions by 2020. This increase in the fraction of overall emissions represented by idling emissions is because new heavy-duty vehicle standards are driving down regular exhaust emissions, making the idle fraction bigger by comparison.

- $PM_{2.5}$: EPA's estimate of mobile source $PM_{2.5}$ emissions using MOVES2010 is significantly higher compared to MOBILE6.2 for both light- and heavy-duty vehicles and for all of the urban areas modeled. MOVES2010 also models the impact of vehicle speed and load on PM emissions, showing very high rates of PM generation in stop-and-go traffic conditions. This high emission rate consists of the emissions produced while the engine is under increased load while accelerating (i.e., the "go" phase of stop-and-go driving) as well as the emissions produced while the vehicle is stopped and therefore not accumulating any mileage, resulting in higher overall emissions per total mile driven.

Based on this comparison, the Mobile 6 modeling completed for the Alton Coal Tract air quality analysis may overestimate VOC emissions and underestimate NO_x and $PM_{2.5}$.

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3. CRITERIA POLLUTANT NEAR-FIELD MODELING

Near-field analysis was conducted to assess impacts to air quality, and as used here, means the airshed within a 50 × 50–km area with the Alton Coal Tract in the center. This Supplement uses the same methodology that was used in the Technical Report.

A near-field ambient air quality impact assessment was performed for Alternative K1 to quantify maximum-modeled pollutant impacts near the tract at the boundary of the two blocks removed as part of Alternative K1, and within the two blocks that would be removed under Alternative K1.

The most recent version of EPA's guideline model, AERMOD (version 12345), was the refined air dispersion model used to assess these near-field impacts and to verify compliance with the applicable NAAQS in the ambient airshed that encloses the Alton Coal Tract. As development of the lease spans a 19–23-year window with varying degrees of surface disturbance and associated air emissions, the modeling analysis focused on the reasonable maximum development year (therefore, the reasonable maximum emission year) for the mine. Using this anticipated maximum potential emission year, the AERMOD dispersion model was used to analyze potential near-field impacts from direct emissions of PM_{10}, $PM_{2.5}$, nitrogen dioxide (NO_2), CO, and SO_2.

3.1. Modeling Methodology

AERMOD was run in regulatory default mode and deposition was only considered for assessing the final PM_{10} modeled ambient air impacts. The deposition parameters for the model were obtained from the Colorado Department of Public Health and Environment (CDPHE) (CDPHE 2009) and are shown in Table 3.1. The Method 1 deposition option was selected for the modeling. The PM_{10} deposition parameters were used for the PM_{10} emission sources associated with the processing facility, reclaim area, three coal pits, three main mining pits, and the Kanab RMP sources. The $PM_{2.5}$ deposition parameters were used for the remaining PM_{10} emissions sources: generators, haul road, access road, and the paved road.

Table 3.1. CDPHE Recommended Depletion Parameters for Fugitive Dust Sources

Particle Size Category (µm)	Recommended AERMOD Inputs		
	Mass Mean Diameter (µm)[1]	PM_{10} Mass Weighted Size Fraction[2]	Particle Density (g/cm^3)[3]
0.0–1.0	0.5	0.19	2.5
1.0–2.5	1.75	0.24	2.5
2.5–5.0	3.75	0.24	2.5
5.0–10.0	7.5	0.33	2.5

[1] AERMOD SO Pathway, PARTDIAM keyword

[2] AERMOD SO Pathway, MASSFRAX keyword

[3] AERMOD SO Pathway, PARTDENS keyword

Deposition was not considered for any other pollutants, including $PM_{2.5}$. Base elevations for all sources associated with the Alton Coal Tract were determined using the AERMAP terrain processor. Thus, for consistency, the modeled receptors and modeled mine source elevations were determined using the same method by using the seamless National Elevation Data (NED) terrain files downloaded from the U.S. Geological Survey (USGS) as derived from satellite data.

Appropriate surface characteristics representative of the terrain surrounding the surface meteorological station, Cedar City, were provided by UDAQ as part of the AERMOD-ready dataset for the Technical Report. The first line of the meteorological files provided by UDAQ was changed to allow it to be used with the most recent version of AERMOD. Given the expansive nature of the surface-mining operations that may occur on the Alton Coal Tract, building downwash was not a factor in determining reasonable maximum development year potential impacts at the new receptors for Alternative K1.

The Alternative K1 scenario was modeled for this Supplement. This scenario is the Alternative B 200-foot overburden emissions with a modified fence line. Only the receptors that are new (those within the area between the old and the new fence lines) were included in the modeling.

For each pollutant and averaging period, if modeled concentrations within the Alternative K1 boundary are greater than what was already modeled for the Alternative B 200-foot overburden scenario, those concentrations will become the maximum values for the modeling. For those pollutants and averaging periods where the modeled Alternative K1 concentrations are less than previously modeled for the Alternative B 200-foot overburden scenario, the maximum for Alternative K1 will be the Alternative B 200-foot overburden result previously reported.

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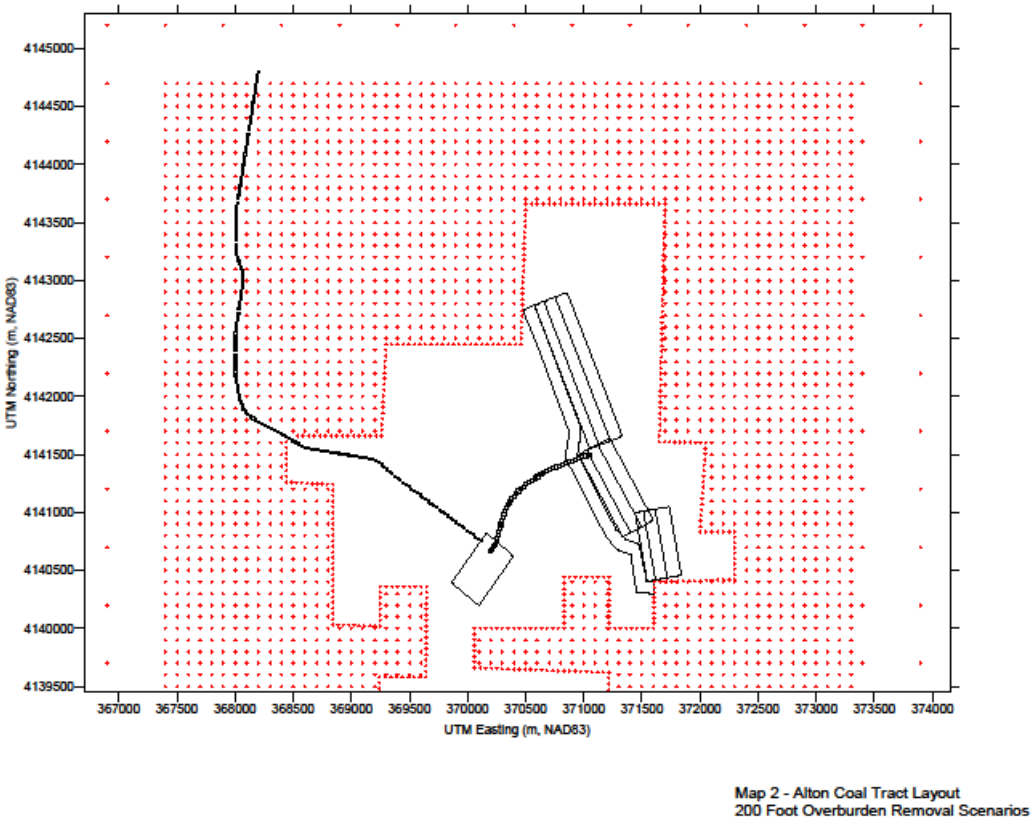
3.1.1. Receptors

The receptors included in the Alternative B and C modeling are presented in Map 2.

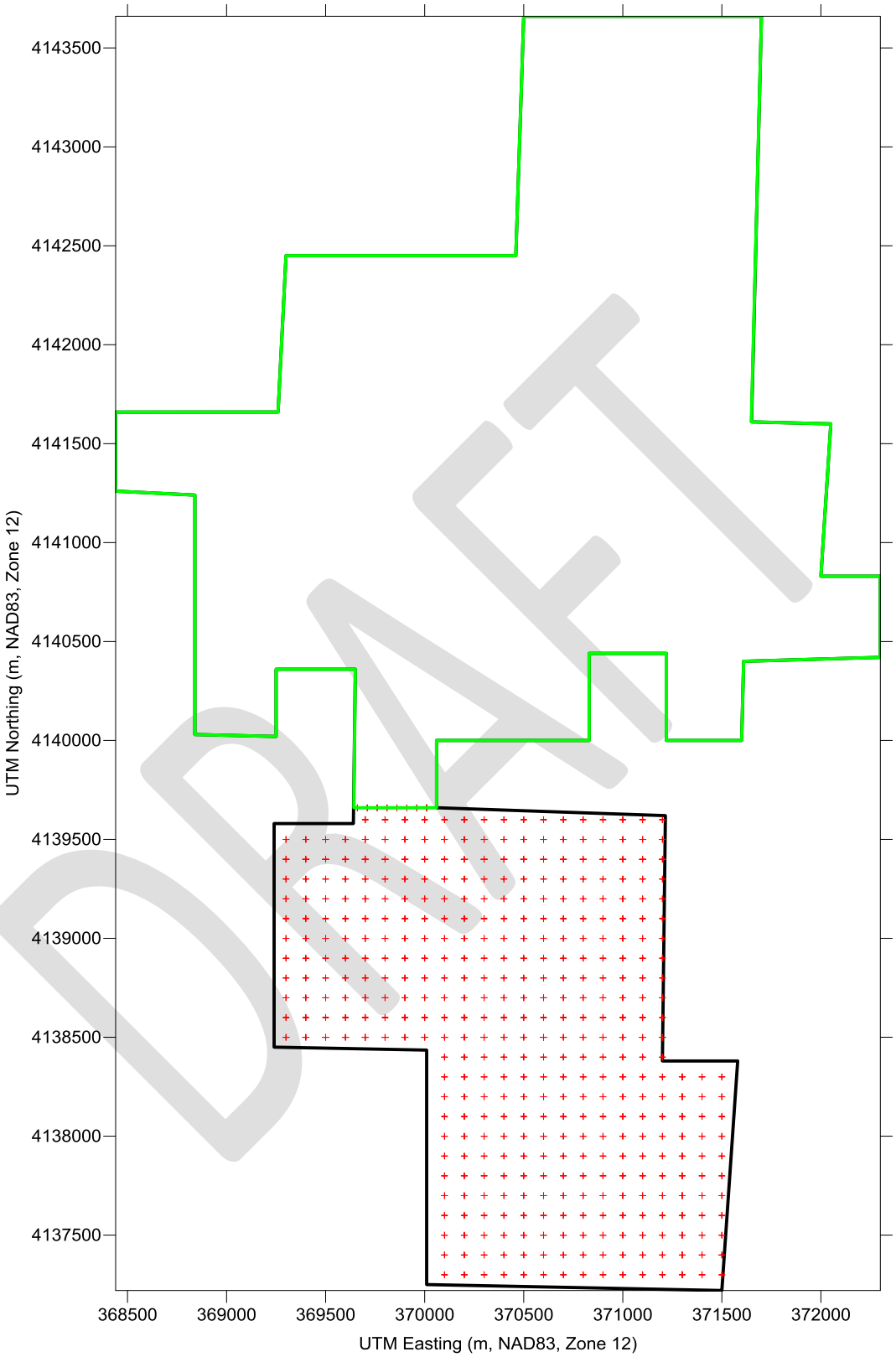


Map 2. Alternative B and C modeling receptors for the maximum development year (200-foot overburden).

Receptors for the Alternative K1 analysis include only those receptors in the area between the new Alternative K1 boundary and the Alternative B boundary. This area was not included in the Alternative B analysis and has been analyzed to assure that Alternative K1 would not result in higher impacts than those previously analyzed. The receptors modeled for the Alternative B 200-foot overburden scenario were not modeled again because impacts at those receptors are identical for the two scenarios.

As part of this near-field modeling analysis, 443 receptors were spaced at 100 meters within the two blocks removed as part of Alternative K1. Some of these receptors coincide with receptors modeled previously. An additional eight receptors were spaced at 50 meters along the southern boundary defined by Alternative K1 (Map 3).

Receptor elevations were determined using the seamless NED terrain files downloaded from the USGS website. Terrain data were processed with the AERMAP terrain processor using the NED files in GeoTIFF format, as required in the most recent version of AERMAP. This processor assigns an actual satellite-derived elevation to each receptor.



Map 3. Alternative K1 modeling receptors (green line = effective new boundary; black line = previous boundary).

3.1.2. Meteorological Data

The meteorological dataset used in the original analysis was also used for the Alternative K1 analysis and is summarized below.

Surface meteorological data most representative for this site are from Cedar City, Utah (Prey 2008). Although a meteorological station is located near the existing Coal Hollow Mine, data from this station are not adequate for use in a dispersion model. The Coal Hollow Mine meteorological station is 2 meters above ground, rather than the required 10 meters for data that will be used for modeling. In addition, only wind speed and wind direction are collected at this station. Estimation of hourly stability class for modeling would still require use of data from Cedar City.

The Cedar City surface meteorological data were processed with upper air data collected at Desert Rock, Nevada, which is the closest upper air station to Cedar City. For this near-field analysis, a four-year meteorological dataset (from 2005 to 2008) was used. The first line of the meteorological files was changed to allow it to be used with the most recent version of AERMOD. The AERMET system uses both surface and upper air measurements to estimate profiles of wind, turbulence, and temperature in the planetary boundary layer. Minimum meteorological data requirements to run AERMET generally include horizontal wind speed, horizontal wind direction, ambient temperature, surface characteristics (albedo, Bowen ratio, and surface roughness), solar radiation, temperature change with height or cloud cover, and a morning upper air sounding. The surface characteristics determinations were made by UDAQ as part of their processing of the four-year meteorological dataset. These surface characteristics are representative of the area around Cedar City, the surface meteorological station.

3.1.3. Alton Coal Lease Emission Inventory

The Alternative B 200-foot overburden removal emission inventory for the reasonable maximum development year of mining operations on the Alton Coal Tract is provided in Attachment A. Based on proposed development projections, the model year chosen for the emission inventory is the reasonable maximum development year of mine progression. It is anticipated that the maximum development year would occur near the end of overall tract development. However, the reasonable maximum development year of mine progression is intended to be representative of the potential emissions associated with any single year of mining.

Because the exact location of fugitive dust and tailpipe emissions from project traffic and coal removal is impossible to pinpoint, a series of area or volume sources was used to estimate emissions from these sources. The total annual fugitive dust and tailpipe emissions were apportioned equally to be representative of area sources in the tract. Travel distances were based on the assumptions in the inventory development. For the purpose of modeling the coal loading and overburden removal activities areas, the open pit source option in AERMOD was used given that both of these activities would occur well below grade in the main pit.

It was anticipated that some blasting would occur as part of the overburden and coal removal process. These emissions represent short-term sources of NO_x and PM_{10} that were modeled as area sources in this near-field analysis.

Electrical power generation for mining operations would be supplied through a combination of diesel generators. The two generators were modeled as point sources at the anticipated location within the facilities area.

Base elevations for all sources associated with the Alton Coal Tract were determined using the AERMAP terrain processor. Thus, the modeled receptor grid and modeled mine source elevations were determined using the same method and most recent NED data available from the USGS website for consistency.

3.1.4. Cumulative Sources (reasonably foreseeable development, reasonably foreseeable future actions, and existing source modifications)

The cumulative impacts modeling analysis considered both the maximum development year from the proposed Alton tract development sources as well as an inventory of proposed emission sources. For the purpose of this analysis, it is assumed that all existing permitted emission sources are included in the background concentration estimates presented in Table 3.2. The background $PM_{2.5}$ concentrations have been updated from those presented in the Technical Report.

Table 3.2. Near-Field Analysis Background Ambient Air Quality Concentrations (microgram per cubic meter [µg/m^3])

Pollutant	Averaging Period	Measured Background Concentration
CO[1]	1-hour	1 ppm (1,150 µg/m^3)
	8-hour	1 ppm (1,150 µg/m^3)
NO_2[1]	Annual	17 µg/m^3
PM_{10}[2]	24-hour	72 µg/m^3
$PM_{2.5}$[3]	24-hour	2.8 µg/m^3
	Annual	9.5 µg/m^3
SO_2[1]	3-hour	20 µg/m^3
	24-hour	10 µg/m^3
	Annual	5 µg/m^3

[1] Prey 2008. Data based on estimates from the UDAQ.

[2] UDAQ 2010. PM_{10} data from UDAQ used for private Alton Mine.

[3] Measured $PM_{2.5}$ data obtained from NPS website for Bryce Canyon National Park.

3.1.5. Criteria Pollutant NAAQS Analysis – AERMOD Results

Background pollutant concentrations were used as an indicator of existing conditions in the region, and were assumed to include those from industrial emission sources in operation and from mobile, urban, biogenic, and other non-industrial emission sources. These background concentrations were added to modeled near-field mining–related impacts to calculate total ambient air quality impacts.

The primary pollutants of concern for this analysis are PM_{10}, $PM_{2.5}$, CO, NO_2, and SO_2. Model-predicted concentrations resulting from emissions due to mining operations on the tract were added to the acceptable background levels, and the resulting cumulative concentrations were compared to the relevant NAAQS to determine potential health impacts at nearby receptors. Modeled concentrations using the indicated averaging periods were compared to the applicable thresholds in Table 3.3.

Table 3.3. Applicable Ambient Air Quality Criteria

Pollutant	Averaging Period	NAAQS ($\mu g/m^3$)[1]	Prevention of Significant Deterioration (PSD) Class II increment ($\mu g/m^3$)[2]
NO_2[3]	Annual	100	25
PM_{10}	24-hour	150	30
$PM_{2.5}$	Annual	12.0	n/a
	24-hour	35	n/a
CO	8-hour	10,000	n/a
	1-hour	40,000	n/a
SO_2[3]	Annual	80	20
	24-hour	365	91
	3-hour	1,300	512

[1] NAAQS from 40 Code of Federal Regulations 50 (parts per million and parts per billion values were converted to μg/m3)

[2] PSD increments from 40 Code of Federal Regulations 51.166

[3] The impacts assessment does not include the recently promulgated 1-hour NO_2 and SO_2 standards due to their promulgation dates.

The modeling results reported in this Supplement are presented in a different form than those in the Technical Report, per EPA request. Compliance with the respective NO_2 and SO_2 annual standards was based on the highest modeled annual average value (highest first-high [H1H]) for each year of the four-year meteorological added to the respective background concentrations.

Demonstration of compliance with the short-term NAAQS (24-hour, 8-hour, 3-hour, and 1-hour) for CO and SO_2 was based on the highest second-high (H2H) modeled concentration for each year of the four-year meteorological period added to the respective background concentrations.

Compliance with the 24-hour $PM_{2.5}$ standard used the 98th percentile 24-hour concentration (highest eighth-high or H8H) for each year of the four-year meteorological dataset. Three-year H8H average concentrations were calculated for each alternative. Compliance with the annual $PM_{2.5}$ standard was based on the H1H concentration for each year of the four-year meteorological dataset; three-year annual average concentrations were calculated for each alternative. Compliance with the 24-hour PM_{10} standard was verified with the H2H modeled concentration for each year of the four-year meteorological dataset; three-year H2H averages were calculated for each alternative.

Modeled concentrations were rounded to match the form of the appropriate NAAQS, as described in 40 CFR Part 50, National Primary and Secondary Ambient Air Quality Standards. A detailed description of the modeling results for each pollutant follows.

3.1.5.1. PM_{10} AERMOD RESULTS

The modeled PM_{10} concentrations associated with the maximum development year are summarized here. The 24-hour NAAQS is not to be exceeded more than once per year on average over three years. The H2H concentrations are presented in Table 3.4 for each year of the four-year meteorological period. The model results have been rounded to the form of the standard. As described in Section 1 of Appendix K to 40 CFR Part 50, *Interpretation of the National Ambient Air Quality Standards for Particulate Matter*, an exceedance is "a daily value that is above the level of the 24-hour standard after rounding to the nearest 10 $\mu g/m^3$ (i.e., values ending in 5 or greater are to be rounded up)." Results from the Technical Report and this analysis are included in the table.

Table 3.4. PM_{10} Modeling Results (highest second-high)

Alternative	Model Year	Averaging Period	Modeled PM_{10} ($\mu g/m^3$)	Background PM_{10} ($\mu g/m^3$)	Total PM_{10} ($\mu g/m^3$)	Rounded PM_{10} ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)
Proposed Action	2005	24-hour H2H	77.6	72	149.6	150	150
	2006	24-hour H2H	84.5	72	156.5	**160**	150
	2007	24-hour H2H	80.2	72	152.2	150	150
	2008	24-hour H2H	85.7	72	157.7	**160**	150
	2005–2007	Average	80.8	72	152.8	150	150
	2006–2008	Average	83.5	72	155.5	**160**	150
	2005–2008	Average	82.0	72	154.0	150	150
Alternative C	2005	24-hour H2H	77.7	72	149.7	150	150
	2006	24-hour H2H	84.9	72	156.9	**160**	150
	2007	24-hour H2H	80.5	72	152.5	150	150
	2008	24-hour H2H	85.9	72	157.9	**160**	150
	2005–2007	Average	81.0	72	153.0	150	150
	2006–2008	Average	83.8	72	155.8	**160**	150
	2005–2008	Average	82.3	72	154.3	150	150
Alternative K1[*]	2005	24-hour H2H	33.8	72	105.8	110	150
	2006	24-hour H2H	42.4	72	114.4	110	150
	2007	24-hour H2H	41.2	72	113.2	110	150
	2008	24-hour H2H	37.2	72	109.2	110	150
	2005–2007	Average	39.1	72	111.1	110	150
	2006–2008	Average	40.3	72	112.3	110	150
	2005–2008	Average	38.7	72	110.7	110	150

[*] Additional receptors only.

Note: A number in bold is a modeled exceedance.

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The results for Alternative K1 (additional receptors) comply with the NAAQS at all modeled receptors. Results for the Proposed Action and Alternative C do not show modeled compliance with the NAAQS for the 2006–2008 averaging period. Results for the Proposed Action and Alternative C do show modeled compliance with the NAAQS for the 2005–2007 averaging period and over the four-year 2005-2008 meteorological dataset.

Compliance with the 24-hour PM_{10} standard can also be verified against the highest fifth-high (H5H) modeled concentrations over the four-year period. The H5H was originally recommended by UDAQ because only four years of meteorological data were available for modeling (rather than the H6H associated with five years of metrological data). The form of the standard is not to be exceeded more than once per year on average over three years; therefore, the form allows one exceedance per year on average. With four years of meteorological data, the fifth exceedance would violate the NAAQS. Because the model results show that there is one exceedance on average per meteorological year, the H5H value does not exceed the standard.

Modeled exceedances are at the northwest side of the tract boundary near the boundary line. The public would only be exposed to lower concentrations of PM_{10}, because concentrations drop off quickly further away from the tract boundary.

3.1.5.2. $PM_{2.5}$ AERMOD RESULTS

Modeled $PM_{2.5}$ concentrations associated with the maximum development year are summarized here and in Table 3.5. The Alternative B 200-foot overburden removal emissions were modeled for compliance under Alternative K1. The form of the annual NAAQS is the annual mean, averaged over three years. The H1H for each year of the four years in the meteorological period is presented in the table. For comparison to the NAAQS, the three-year average of the H1H annual values was calculated for the years 2005–2007 and 2006–2008. These values are compared to the standard of 12.0 µg/m^3. The form of the 24-hour NAAQS is the 98th percentile concentration averaged over three years. The highest eighth-high (H8H) modeled value represents the 98th percentile. The H8H 24-hour value for each of the four years in the meteorological period is presented in Table 3.5. For comparison to the NAAQS, the three-year average of the H8H annual values was calculated for the years 2005–2007 and for the years 2006–2008. These values are compared to the standard of 35 µg/m^3. The model results have been rounded to the form of the standard.

The background $PM_{2.5}$ concentrations have been updated from those presented in the Technical Report.

Table 3.5 $PM_{2.5}$ Modeling Results

Alternative	Model Year	Averaging Period	Modeled $PM_{2.5}$ (µg/m^3)	Background $PM_{2.5}$[†] (µg/m^3)	Total $PM_{2.5}$ (µg/m^3)	NAAQS (µg/m^3)
Proposed Action	2005	24-hour	11.8	9.5	21	35
		Annual	4.20	2.8	7.0	12.0
	2006	24-hour	14.2	9.5	24	35
		Annual	4.40	2.8	7.2	12.0
	2007	24-hour	13.4	9.5	23	35
		Annual	4.7	2.8	8.0	12.0
	2008	24-hour	14.1	9.5	24	35

Table 3.5 $PM_{2.5}$ Modeling Results

Alternative	Model Year	Averaging Period	Modeled $PM_{2.5}$ ($\mu g/m^3$)	Background $PM_{2.5}$[†] ($\mu g/m^3$)	Total $PM_{2.5}$ ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)
		Annual	4.2	2.8	7.2	12.0
	2005–2007 Average	24-hour	13.1	9.5	23	35
		Annual	4.4	2.8	7.2	12.0
	2006–2008 Average	24-hour	13.9	9.5	23	35
		Annual	4.4	2.8	7.2	12.0
Alternative C	2005	24-hour	12.9	9.5	22	35
		Annual	4.5	2.8	7.3	12.0
	2006	24-hour	15.5	9.5	25	35
		Annual	4.8	2.8	7.6	12.0
	2007	24-hour	14.5	9.5	24	35
		Annual	5.1	2.8	7.9	12.0
	2008	24-hour	15.4	9.5	25	35
		Annual	4.6	2.8	7.4	12.0
	2005–2007 Average	24-hour	14.3	9.5	24	35
		Annual	4.8	2.8	7.6	12.0
	2006–2008 Average	24-hour	15.1	9.5	25	35
		Annual	4.8	2.8	7.6	12.0
Alternative K1[*]	2005	24-hour	4.8	9.5	14	35
		Annual	1.2	2.8	4.0	12.0
	2006	24-hour	5.7	9.5	15	35
		Annual	1.5	2.8	4.3	12.0
	2007	24-hour	4.8	9.5	14	35
		Annual	1.5	2.8	4.3	12.0
	2008	24-hour	5.2	9.5	15	35
		Annual	1.8	2.8	4.6	12.0
	2005–2007 Average	24-hour	5.1	9.5	15	35
		Annual	1.4	2.8	4.2	12.0
	2006–2008 Average	24-hour	5.2	9.5	15	35
		Annual	1.6	2.8	4.4	12.0

[*] Additional receptors only.

[†] 2.8 $\mu g/m^3$ is the three-year (2006–2008) annual average $PM_{2.5}$ concentration for Bryce Canyon National Park; 9.5 $\mu g/m^3$ is the three-year average 98th percentile 24-hour value for Bryce Canyon National Park.

The modeled concentrations indicate compliance with the annual NAAQS at all modeled receptors. The Alternative B concentrations reported here represent the maximum concentrations for Alternative K1.

3.1.5.3. NITROGEN DIOXIDE AERMOD RESULTS

The maximum-modeled NO_2 annual concentrations associated with the maximum development year are summarized in Table 3.6 for each year of the four-year meteorological period. These values are compared to the standard of 100 $\mu g/m^3$. The 200-foot overburden removal scenario was modeled for compliance with the annual NAAQS. The estimated NO_2 emissions for the Proposed Action and Alternative C are the same. A 75% ozone correction was applied to all annual NO_2 modeling results in accordance with EPA's Ambient Ratio Method as a way to estimate ambient annual NO_2 concentrations from modeled nitrogen oxides emission rates. The intent is to account for the interaction of ambient ozone with emissions of NO_x, which can chemically interact to form NO_2. The model results have been rounded to the form of the standard.

Table 3.6. Annual Maximum Nitrogen Dioxide Modeling Results (highest first-high)

Alternative	Model Year	Modeled NO_2 ($\mu g/m^3$)	Background NO_2 ($\mu g/m^3$)	Total NO_2 ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)
Proposed Action and Alternative C	2005	27.8	17	45	100
	2006	29.6	17	47	100
	2007	31.7	17	49	100
	2008	30.2	17	47	100
Alternative K1*	2005	9.1	17	26	100
	2006	11.3	17	28	100
	2007	11.8	17	29	100
	2008	13.5	17	31	100

* Additional receptors only.

Note: As a result of incorporating design features in lieu of modeling, this table does not include values for 1-hour NO_2.

The modeled concentrations indicate compliance with the annual NAAQS at all modeled receptors. The Alternative B concentration reported in the Technical Report represents the maximum concentration for Alternative K1.

3.1.5.4. CARBON MONOXIDE AERMOD RESULTS

The modeled CO concentrations associated with the maximum development year are summarized in Table 3.7 for each of the four years of the meteorological period. The 200-foot overburden removal scenario was modeled for compliance with the NAAQS. The 1-hour and 8-hour CO standards are not to be exceeded more than once per year. The results in Table 3.7 represent the H2H modeled concentration over the four-year meteorological period to meet the form of the standard. The estimated CO emissions for the Proposed Action and Alternative C are the same. Separate model runs were not necessary in the 200-foot overburden removal depth scenario. The model results have been rounded to the form of the standard.

Table 3.7. Carbon Monoxide Modeling Results (highest second-high)

Alternative	Model Year	Averaging Period	Modeled CO ($\mu g/m^3$)	Background CO ($\mu g/m^3$)	Total CO ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)
Proposed Action and Alternative C	2005	1-hour	2,283	1,150	3,433	40,000
		8-hour	582	1,150	1,732	10,000
	2006	1-hour	2,567	1,150	3,717	40,000
		8-hour	485	1,150	1,635	10,000
	2007	1-hour	2,639	1,150	3,789	40,000
		8-hour	519	1,150	1,669	10,000
	2008	1-hour	2,416	1,150	3,566	40,000
		8-hour	486	1,150	1,636	10,000
Alternative K1*	2005	1-hour	846	1,150	1,996	40,000
		8-hour	239	1,150	1,389	10,000
	2006	1-hour	1,009	1,150	2,159	40,000
		8-hour	224	1,150	1,374	10,000
	2007	1-hour	874	1,150	2,024	40,000
		8-hour	211	1,150	1,361	10,000
	2008	1-hour	934	1,150	2,084	40,000
		8-hour	245	1,150	1,395	10,000

* Additional receptors only.

The modeled concentrations indicate compliance with the 1-hour and 8-hour NAAQS at all modeled receptors. The Alternative B concentrations reported in the Technical Report represent the maximum concentrations for Alternative K1.

3.1.5.5. SULFUR DIOXIDE AERMOD RESULTS

The modeled SO_2 concentrations associated with the maximum development year are summarized in Table 3.8. The applicable averaging periods for comparison to the SO_2 NAAQS include the 3-hour, 24-hour, and annual averaging periods. The 3-hour and 24-hour SO_2 standards are not to be exceeded more than once per year. The results in Table 3.8 represent the H2H 3-hour and 24-hour modeled concentrations over each year of the four-year meteorological period. The annual modeled concentration is the H1H concentration over each year of the four-year meteorological period. The model results have been rounded to the form of the standard. Though potential SO_2 emissions associated with mining activities would be nominal, modeling was completed to quantify potential concentrations.

Table 3.8. Sulfur Dioxide Modeling Results

Alternative	Model Year	Averaging Period	Modeled SO_2 ($\mu g/m^3$)	Background SO_2 ($\mu g/m^3$)	Total SO_2 ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)
Proposed Action and Alternative C	2005	3-hour	1.49	20	21	1,300
		24-hour†	0.35	10	10	365
		Annual†	0.09	5	5	80
	2006	3-hour	1.51	20	22	1,300
		24-hour†	0.41	10	10	365
		Annual†	0.09	5	5	80
	2007	3-hour	1.64	20	22	1,300
		24-hour†	0.41	10	10	365
		Annual†	0.10	5	5	80
	2008	3-hour	1.47	20	21	1,300
		24-hour†	0.47	10	10	365
		Annual†	0.09	5	5	80
Alternative K1*	2005	3-hour	0.69	20	21	1,300
		24-hour†	0.17	10	10	365
		Annual†	0.03	5	5	80
	2006	3-hour	0.71	20	21	1,300
		24-hour†	0.17	10	10	365
		Annual†	0.03	5	5	80
	2007	3-hour	0.65	20	21	1,300
		24-hour†	0.16	10	10	365
		Annual†	0.03	5	5	80
	2008	3-hour	0.69	20	21	1,300
		24-hour†	0.17	10	10	365
		Annual†	0.04	5	5	80

* Additional receptors only.

† NAAQS revoked June 2, 2010.

Note: As a result of incorporating design features in lieu of modeling, this table does not include values for 1-hour SO_2.

The modeled concentrations indicate compliance with the respective 3-hour, 24-hour, and annual NAAQS at all modeled receptors. The Alternative B concentrations reported in the Technical Report represent the maximum concentrations for Alternative K1.

3.1.5.6. SUMMARY OF AERMOD MODELING

The results of AERMOD modeling for Alternative K1 demonstrate that modeled concentrations at the limited receptors modeled for this alternative indicate compliance with NAAQS standards. Alternative K1

concentrations are equal to or lower than the results for Alternative B. Therefore, Alternative B concentrations represent the maximum concentrations for all pollutants and averaging times for Alternative K1.

3.1.6. Coal Haul Road Impacts

The haul roads within the tract and the access road were included in the tract modeling in the Technical Report. Because $PM_{2.5}$ background concentrations have been updated for the Supplement, the updated $PM_{2.5}$ results are presented in Table 3.10.

Table 3.10. Haul Road Only (representative segment) Maximum Modeling Results

Pollutant	Modeled Years	Averaging Period	Modeled (µg/m3)	Background (µg/m3)	Total (µg/m3)	NAAQS (µg/m3)
PM2.5	2005–2008	24-hour	1.8	9.5	11	35
		Annual	0.7	2.8	3.5	12.0

* All max modeled values occur when source-receptors are at same elevation.

3.1.7. HAP AERMOD Results

Mobile sources, nonroad equipment, and diesel-powered generators would be sources of HAPs at the Alton Coal Tract. The only HAP sources in the emissions inventory that are quantifiable are the generators, because the mobile source emission factors obtained from the UDAQ do not include HAPs and the diesel-powered mining equipment emission factors, which were obtained from the *Federal Register*, do not include HAPs emission factors for these types of equipment or sources (EPA 2004). For the generators, AP-42 contains emission factors for six of the current 187 listed HAPs; these six HAPs were included in the emission inventory and in the HAP AERMOD analyses. These emission factors are not appropriate for mobile and nonroad sources.

Qualitatively, a comparison of diesel fuel usage for mobile and nonroad sources can be made to generator fuel usage to assess HAP impacts. Diesel fuel usage for the mobile and nonroad sources (i.e., area sources) is estimated to be 2,093,192 gallons; diesel fuel usage for the generators (i.e., point sources) is estimated to be 1,214,136 gallons. Total diesel fuel usage is approximately 1.7 times the generator fuel usage (see Attachment A). Modeled HAP impacts from the generators were more than two orders of magnitude below the risk thresholds and significance criterion (130 to 1,852,000). Because total diesel fuel usage is 1.7 times the usage for the generators, it is unlikely that HAPs impacts would exceed any risk threshold or significance criterion.

3.2. Near-field VISCREEN Analysis

The VISCREEN model was designed to determine whether a plume from a facility may be visible from a given vantage point. The primary variables that affect whether a plume is visible or not at a given location include the quantity of emissions, type of emissions, relative location of the emission source and the observer, and the background visibility range. Typically, VISCREEN is used for analyzing plume impacts from point sources. However, it can also be applied to virtual point sources such as mining operations. For this modeling, only the sources associated with surface mining operations were modeled because the underground and surface mining operations would occur sequentially, rather than concurrently. The off-site sources are too far from the mining operations for inclusion in this analysis.

Specifically, VISCREEN was used in the Technical Report to assess potential visibility impacts within the near-field modeling grid at Bryce Canyon National Park. These analyses have been updated for this Supplement. The primary pollutants of concern that impact visibility in the near-field are PM, NO_x, and soot (elemental carbon).

The PM_{10}, NO_x, and soot emission rates used for this analysis are 163 tons per year (tpy), 229 tpy, and 5.32 tpy, respectively, which correspond to the emissions for the 200-foot overburden scenario under Alternative C. A background visibility range of 272 kilometers (km) was used for the VISCREEN analysis based on annual average background visibility at Bryce Canyon National Park according to FLAG 2010 guidance. The default background ozone concentration of 40 parts per billion (ppb) was used.

3.2.1. Level-2 Analysis

Bryce Canyon National Park is approximately 18 km northeast of the proposed Alton Coal Tract and is also several hundred meters higher than the tract location. Because the Level-1 analysis in the Technical Report indicated potential visibility impacts inside of Bryce Canyon National Park, an additional Level-2 screening is warranted. The Level-2 screening allows the use of user-specified particle size, density, and the most conservative meteorological conditions specific to the proposed Alton Coal Tract area. Specifically for Level-2 screening, the VISCREEN model is used to find the maximum wind speed during the daytime (D stability) where delta-E and contrast in Bryce Canyon National Park could be exceeded.

Meteorological data for the Level-2 screening were based on the four years of hourly surface data from the Cedar City, Utah, airport for the 2005 to 2008 meteorological dataset used in the near-field modeling. The 1-percentile atmospheric stability and wind speed are determined to be Stability D with wind speed of 2 meters/sec (m/sec). However, because Bryce Canyon National Park has an elevation more than 500 meters above the Alton Coal Tract, when determining most conservative dispersion characteristics, the most conservative stability class should be shifted one class less stable (VISCREEN Users Manual, EPA 1992). Thus, for the Level-2 most conservative meteorology, a stability class of C with wind speed of 2 m/sec was used. The Level-2 VISCREEN visual impacts for Alternative C using this most conservative dispersion category inside of Bryce Canyon National Park are summarized in Table 3.11.

Table 3.11. Visual Impacts inside of Bryce Canyon National Park, 200-foot Overburden Results, Alternative C

Background	Theta	Azimuth	Distance from tract (km)	Alpha	Delta E		Contrast	
					Criteria	Plume	Criteria	Plume
Sky	10	157	35	11	5.35	0.420	0.13	0.009
Sky	140	157	35	11	3.70	0.108	0.13	-0.003
Terrain	10	84	18	84	5.44	1.205	0.28	0.005
Terrain	140	84	18	84	4.03	0.035	0.28	0.000

Note: Theta, azimuth, alpha, and delta E are VISCREEN modeling terms. Theta is the scattering angle or angle between direct solar radiation and the line of sight. Azimuth is an angular measurement in a spherical coordinate system, measured in degrees. Alpha is defined as the angle (in degrees) between a line of sight and the plume centerline. Delta E is the color difference parameter used to characterize the perceptibility of a plume on the basis of the color difference between the plume and a viewing background such as the sky or a cloud. Contrast is the relative difference in the intensity between the plume and its background (EPA 1992).

Results demonstrate that the maximum impacts inside of Bryce Canyon National Park from a potential tract plume under the Alternative C 200-foot overburden removal scenario will be less than the VISCREEN acceptance criteria for both color change (Delta E) and contrast. Because the emissions under

the Alternative B 200-foot overburden removal scenario are lower than Alternative C, impacts would be lower than those presented in the table.

3.3. Near-Field Class I and Class I Area Impacts

AERMOD was also used to model impacts at the Class I and sensitive Class II areas within the 50-km near-field domain. Bryce Canyon National Park is a Class I area approximately 18 km northeast of the Alton Coal Tract, whereas Grand Staircase-Escalante National Monument is a sensitive Class II area that is farther east. Because the 300-foot overburden removal alternatives are no longer analyzed in the EIS, the cumulative near-field run for Alternative C 200-foot overburden removal scenario has been included in this document. The modeling included the Alton sources and all regional background sources (Kanab, Richfield, Fishlake, Dixie, Navajo Generating Station, and St. George). The results indicate that the Class I and Class II increments are not exceeded (Tables 3.12a and 3.12b).

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Table 3.12a. Alton Tract Cumulative Near-Field Class I and Class II Impacts, 200-foot Overburden Results, Alternative C

Class I Increment, High First (Annual), Second-Highs for Other Averaging Periods									
Pollutant	**Averaging Period**	**Bryce Canyon National Park**				**Maximum Regional Impact (µg/m³)***	**Maximum Total (µg/m³)**	**Class I Increment**	**Exceed Increment?**
		2005 (µg/m³)	**2006 (µg/m³)**	**2007 (µg/m³)**	**2008 (µg/m³)**				
PM_{10}	Annual	0.01	0.01	0.01	0.01	0.00	0.01	4	N
	24-hour	0.16	0.20	0.23	0.25	0.05	0.30	8	N
SO_2	Annual	0.00	0.00	0.00	0.00	0.00	0.01	2	N
	24-hour	0.00	0.00	0.00	0.00	0.01	0.01	5	N
	3-hour	0.01	0.01	0.01	0.01	0.05	0.06	25	N
NO_x	Annual	0.04	0.03	0.03	0.04	0.00	0.04	2.5	N
$PM_{2.5}$	Annual	0.00	0.00	0.00	0.00	0.00	0.00	n/a	n/a
	24-hour	0.03	0.04	0.05	0.05	0.02	0.07	n/a	n/a
CO	8-hour	3.00	3.70	3.50	6.00	25.00	31.00	500[1]	n/a
	1-hour	19.00	26.00	27.00	48.00	43.00	91.00	2,000[1]	n/a

* The maximum regional impact is the H1H from the three CALPUFF model years, 2001–2003.

[1] Carbon monoxide modeling significance level.

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Table 3.12b. Alton Tract Cumulative Near-Field Class I and Class II Impacts, 200-foot Overburden Results, Alternative C

Class II Increment, High First (Annual), Second-Highs for Other Averaging Periods

Pollutant	Averaging Period	Grand Staircase-Escalante National Monument				Maximum Regional Impact (µg/m^3)*	Maximum Total (µg/m^3)	Class II Increment	Exceed Increment?
		2005 (µg/m^3)	2006 (µg/m^3)	2007 (µg/m^3)	2008 (µg/m^3)				
PM10	Annual	0.24	0.28	0.24	0.33	0.00	0.33	17	N
	24-hour	1.88	2.34	2.17	2.23	0.05	2.39	30	N
SO2	Annual	0.00	0.00	0.00	0.00	0.00	0.00	20	N
	24-hour	0.02	0.02	0.02	0.02	0.01	0.03	91	N
	3-hour	0.12	0.13	0.11	0.15	0.05	0.20	512	N
NOx	Annual	1.37	1.58	1.26	1.73	0.00	1.73	25	N
PM2.5	Annual	0.06	0.07	0.06	0.08	0.00	0.08	n/a	n/a
	24-hour	0.65	0.91	0.66	0.73	0.02	0.93	n/a	n/a
CO	8-hour	65.00	57.00	51.00	67.00	25.00	92.00	500[1]	n/a
	1-hour	387.00	441.00	367.00	497.00	44.00	541.00	2,000[1]	n/a

* The maximum regional impact is the H1H from the three CALPUFF model years, 2001–2003.

[1] Carbon monoxide modeling significance level.

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4. FAR-FIELD ANALYSIS

The purpose of the far-field analysis is to quantify potential air quality impacts to both ambient air concentrations and air quality-related values (AQRVs) from air pollutant emissions of NO_x, CO, SO_2, PM_{10}, and $PM_{2.5}$ that are expected to result from mining operations on the tract. Ambient air quality impacts beyond the tract and throughout the modeling domain were analyzed, as were AQRVs at Class I areas and selected Class II areas. Cumulative impacts also were quantified by including in the analyses other documented sources of air pollutant emissions within the modeling domain (Map 4). The analyses were performed using the EPA-recommended CALMET/CALPUFF/CALPOST modeling system (V5.8 Level 070623) to predict air quality direct and cumulative impacts at far-field Prevention of Significant Deterioration (PSD) Class I areas and selected Class II areas. The default model options were selected in the model. Impacts were predicted for calendar years 2001, 2002, and 2003.

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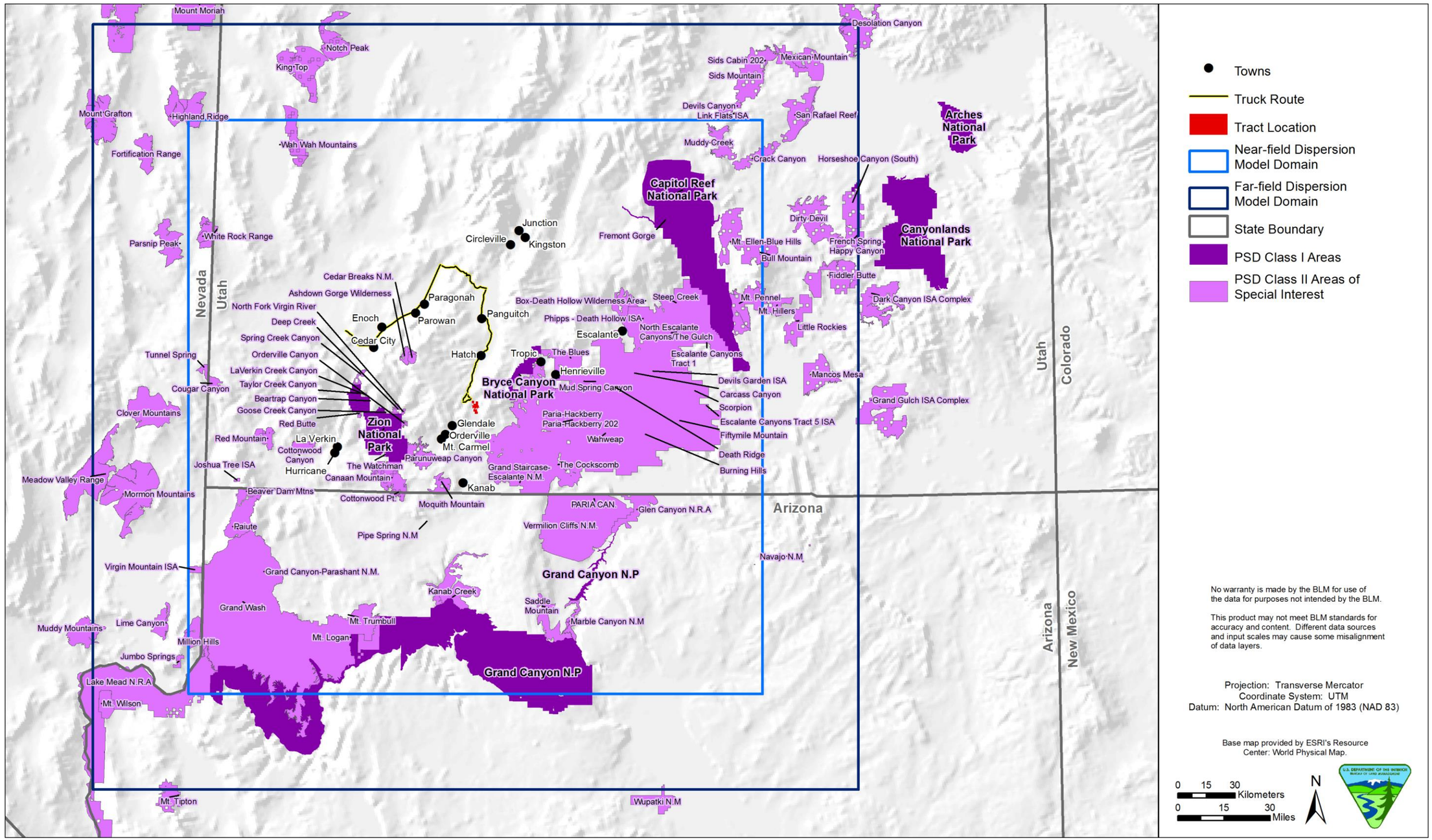

Map 4. Air resources analysis area (the near-field and far-field modeling domains).

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4.1. Concentration

CALPOST was used to process the CALPUFF concentration output files to compute appropriate concentration values for SO_2 (3-hour, 24-hour, and annual average), $PM_{2.5}$ (24-hour and annual average), NO_2 (annual average), PM_{10} (24-hour and annual average), and CO (1-hour and 8-hour averages). Because the 300-foot overburden removal scenario is no longer analyzed in the EIS, the cumulative far-field run for the Alternative C 200-foot overburden scenario has been included in this document.

Cumulative results were produced for the maximum emission rate case (200-foot overburden removal, Alternative C) and are presented in Table 4.1a and 4.1b. The impacts are significantly below both the Class I and Class II increments.

These demonstrations are for informational purposes only and are not regulatory PSD increment consumption analyses, which would be completed as necessary during the state permitting processes.

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Table 4.1a. Cumulative Far-Field Class I and Class II Impacts, 200-foot Overburden, Alternative C

Class I Increment, High First (Annual), Second-Highs for Other Averaging Periods

Pollutant	Averaging Period	Bryce Canyon National Park	Zion National Park			Grand Canyon National Park			Capitol Reef National Park			Class I Increment	Exceed Increment?
		*	2001 (µg/m^3)	2002 (µg/m^3)	2003 (µg/m^3)	2001 (µg/m^3)	2002 (µg/m^3)	2003 (µg/m^3)	2001 (µg/m^3)	2002 (µg/m^3)	2003 (µg/m^3)		
PM_{10}	Annual	*	0.09	0.14	0.11	0.01	0.01	0.01	0.01	0.01	0.01	4	N
	24-hour	*	0.85	1.06	0.82	0.12	0.12	0.14	0.12	0.13	0.09	8	N
SO_2	Annual	*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2	N
	24-hour	*	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.02	0.02	5	N
	3-hour	*	0.01	0.01	0.00	0.01	0.01	0.01	0.06	0.06	0.04	25	N
NO_x	Annual	*	0.00	0.00	0.00	0.00	0.00	0.00	-0.01	0.00	0.01	2.5	N
$PM_{2.5}$	Annual	*	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	n/a	n/a
	24-hour	*	0.03	0.04	0.04	0.01	0.01	0.01	0.01	0.01	0.01	n/a	n/a
CO	8-hour	*	11.00	13.47	20.18	25.05	23.89	20.33	15.55	16.36	16.26	500[1]	n/a
	1-hour	*	65.05	88.59	107.81	55.85	59.20	50.62	42.41	33.56	37.27	2,000[1]	n/a

* Class I and Class II increments were evaluated using AERMOD; see Section 3.3.

[1] Carbon monoxide modeling significance level.

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Table 4.1b. Cumulative Far-Field Class I and Class II Impacts, 200-foot Overburden, Alternative C

Class II Increment, High First (Annual), Second-Highs for Other Averaging Periods						
Pollutant	**Averaging Period**	**Grand Staircase-Escalante National Monument**			**Class II Increment**	**Exceed Increment?**
		2001 (µg/m^3)	**2002 (µg/m^3)**	**2003 (µg/m^3)**		
PM_{10}	Annual	0.03	0.03	0.03	17	N
	24-hour	0.12	0.24	0.23	30	N
SO_2	Annual	0.00	0.00	0.00	20	N
	24-hour	0.01	0.01	0.01	91	N
	3-hour	0.07	0.04	0.06	512	N
NO_x	Annual	-0.04	-0.01	-0.02	25	N
$PM_{2.5}$	Annual	0.00	0.00	0.00	n/a	n/a
	24-hour	0.01	0.02	0.02	n/a	n/a
CO	8-hour	52.04	38.29	38.83	500[1]	N
	1-hour	117.55	106.03	117.59	2,000[1]	N

[1] Carbon monoxide modeling significance level.

4.2. Deposition

The POSTUTIL utility provided with the CALPUFF modeling system was used to estimate total sulfur (S) and nitrogen (N) fluxes from CALPUFF-predicted wet and dry fluxes of SO_2, SO_4, nitrogen oxide, nitrate (NO_3), and nitric acid (HNO_3). CALPOST was used to summarize the annual S and N deposition values from the POSTUTIL program.

Because the 300-foot overburden removal scenario is no longer analyzed in the EIS, the cumulative far-field run for Alternative C 200-foot overburden has been included in this document. The N and S emissions are the same for Alternatives B and C, 200-foot overburden removal scenarios. Consequently, the results are identical for both alternatives.

Predicted direct project impacts were compared to the deposition analysis thresholds (DATs) for N and S in western Class I parks and refuges. The DATs were developed by the National Park Service (NPS) and the U.S. Fish and Wildlife Service to provide a quantitative method with which to evaluate deposition in Class I areas. These results are presented in Tables 4.2-4.12. Impacts for both S and N deposition are below the DAT in all cases, with the exception of Bryce Canyon National Park. The value for Bryce Canyon National Park exceeds the DAT.

Table 4.2. Soils and Vegetation Deposition Impacts at Bryce Canyon National Park, 200-foot Overburden, Alternative C

1. Annual Total Sulfur (S) Deposition estimated by CALPOST from dry and wet deposition of SO_2 and $(NH_4)_2SO_4$ modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Sulfur Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual S Deposition (g/m^2-yr)	Dry and Wet Annual S Deposition (kg/ha-yr)
2001	2.32E-13	3,600	8,760	7.32E-06	7.32E-05
2002	2.55E-13	3,600	8,760	8.05E-06	8.05E-05
2003	2.68E-13	3,600	8,760	8.45E-06	8.45E-05

2. Annual Total Nitrogen (N) Deposition estimated by CALPOST from dry and wet deposition of $(NH_4)_2SO_4$, NOx, and HNO_3 modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Nitrogen Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual N Deposition (g/m^2-yr)	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	3.11E-11	3,600	8,760	9.82E-04	9.82E-03
2002	3.94E-11	3,600	8,760	1.24E-03	1.24E-02
2003	3.71E-11	3,600	8,760	1.17E-03	1.17E-02

3. Comparison of Maximum Total Annual Sulfur (S) and Nitrogen (N) Deposition to the Deposition Analysis Thresholds (DATs) for each element

Model Year	Dry and Wet Annual S Deposition (kg/ha-yr)	Model Year	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	7.32E-05	2001	9.82E-03
2002	8.05E-05	2002	1.24E-02
2003	8.45E-05	2003	1.17E-02
Max. Annual Dep.	8.45E-05	Max. Annual Dep.	1.24E-02
DAT (kg/ha-yr)	0.005	DAT (kg/ha-yr)	0.005
Above DAT?	NO	Above DAT?	YES

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Table 4.3. Soils And Vegetation Deposition Impacts At Capitol Reef National Park, 200-foot Overburden, Alternative C

1. Annual Total Sulfur (S) Deposition estimated by CALPOST from dry and wet deposition of SO_2 and $(NH_4)_2SO_4$ modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Sulfur Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual S Deposition (g/m^2-yr)	Dry and Wet Annual S Deposition (kg/ha-yr)
2001	1.09E-14	3,600	8,760	3.44E-07	3.44E-06
2002	9.34E-15	3,600	8,760	2.94E-07	2.94E-06
2003	1.13E-14	3,600	8,760	3.57E-07	3.57E-06

2. Annual Total Nitrogen (N) Deposition estimated by CALPOST from dry and wet deposition of $(NH_4)_2SO_4$, NOx, and HNO_3 modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Nitrogen Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual N Deposition (g/m^2-yr)	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	1.33E-12	3,600	8,760	4.21E-05	4.21E-04
2002	1.13E-12	3,600	8,760	3.55E-05	3.55E-04
2003	1.37E-12	3,600	8,760	4.32E-05	4.32E-04

3. Comparison of Maximum Total Annual Sulfur (S) and Nitrogen (N) Deposition to the Deposition Analysis Thresholds (DATs) for each element

Model Year	Dry and Wet Annual S Deposition (kg/ha-yr)	Model Year	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	3.44E-06	2001	4.21E-04
2002	2.94E-06	2002	3.55E-04
2003	3.57E-06	2003	4.32E-04
Max. Annual Dep.	3.57E-06	Max. Annual Dep.	4.32E-04
DAT (kg/ha-yr)	0.005	DAT (kg/ha-yr)	0.005
Above DAT?	NO	Above DAT?	NO

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Table 4.4. Soils And Vegetation Deposition Impacts At Grand Staircase-Escalante National Monument, 200-foot Overburden, Alternative C

1. Annual Total Sulfur (S) Deposition estimated by CALPOST from dry and wet deposition of SO_2 and $(NH_4)_2SO_4$ modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Sulfur Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual S Deposition (g/m^2-yr)	Dry and Wet Annual S Deposition (kg/ha-yr)
2001	2.63E-14	3,600	8,760	8.30E-07	8.30E-06
2002	2.86E-14	3,600	8,760	9.02E-07	9.02E-06
2003	3.00E-14	3,600	8,760	9.46E-07	9.46E-06

2. Annual Total Nitrogen (N) Deposition estimated by CALPOST from dry and wet deposition of $(NH_4)_2SO_4$, NOx, and HNO_3 modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Nitrogen Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual N Deposition (g/m^2-yr)	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	3.832E-12	3,600	8,760	1.21E-04	1.21E-03
2002	4.038E-12	3,600	8,760	1.27E-04	1.27E-03
2003	4.115E-12	3,600	8,760	1.30E-04	1.30E-03

3. Comparison of Maximum Total Annual Sulfur (S) and Nitrogen (N) Deposition to the Deposition Analysis Thresholds (DATs) for each element

Model Year	Dry and Wet Annual S Deposition (kg/ha-yr)	Model Year	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	8.30E-06	2001	1.21E-03
2002	9.02E-06	2002	1.27E-03
2003	9.46E-06	2003	1.30E-03
Max. Annual Dep.	9.46E-06	Max. Annual Dep.	1.30E-03
DAT (kg/ha-yr)	0.005	DAT (kg/ha-yr)	0.005
Above DAT?	NO	Above DAT?	NO

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Table 4.5. Soils and Vegetation Deposition Impacts at Grand Canyon National Park, 200-foot Overburden, Alternative C

1. Annual Total Sulfur (S) Deposition estimated by CALPOST from dry and wet deposition of SO_2 and $(NH_4)_2SO_4$ modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Sulfur Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual S Deposition (g/m^2-yr)	Dry and Wet Annual S Deposition (kg/ha-yr)
2001	7.66E-15	3,600	8,760	2.42E-07	2.42E-06
2002	8.15E-15	3,600	8,760	2.57E-07	2.57E-06
2003	8.83E-15	3,600	8,760	2.79E-07	2.79E-06

2. Annual Total Nitrogen (N) Deposition estimated by CALPOST from dry and wet deposition of $(NH_4)_2SO_4$, NOx, and HNO_3 modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Nitrogen Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual N Deposition (g/m^2-yr)	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	8.86E-13	3,600	8,760	2.79E-05	2.79E-04
2002	8.79E-13	3,600	8,760	2.77E-05	2.77E-04
2003	9.15E-13	3,600	8,760	2.89E-05	2.89E-04

3. Comparison of Maximum Total Annual Sulfur (S) and Nitrogen (N) Deposition to the Deposition Analysis Thresholds (DATs) for each element

Model Year	Dry and Wet Annual S Deposition (kg/ha-yr)	Model Year	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	2.42E-06	2001	2.79E-04
2002	2.57E-06	2002	2.77E-04
2003	2.79E-06	2003	2.89E-04
Max. Annual Dep.	2.79E-06	Max. Annual Dep.	2.89E-04
DAT (kg/ha-yr)	0.005	DAT(kg/ha-yr)	0.005
Above DAT?	NO	Above DAT?	NO

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Table 4.6. Soils And Vegetation Deposition Impacts At Zion National Park, 200-foot Overburden, Alternative C

1. Annual Total Sulfur (S) Deposition estimated by CALPOST from dry and wet deposition of SO_2 and $(NH_4)_2SO_4$ modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Sulfur Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual S Deposition (g/m^2-yr)	Dry and Wet Annual S Deposition (kg/ha-yr)
2001	7.36E-14	3,600	8,760	2.32E-06	2.32E-05
2002	6.06E-14	3,600	8,760	1.91E-06	1.91E-05
2003	5.81E-14	3,600	8,760	1.83E-06	1.83E-05

2. Annual Total Nitrogen (N) Deposition estimated by CALPOST from dry and wet deposition of $(NH_4)_2SO_4$, NOx, and HNO_3 modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Nitrogen Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual N Deposition (g/m^2-yr)	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	1.21E-11	3,600	8,760	3.82E-04	3.82E-03
2002	9.51E-12	3,600	8,760	3.00E-04	3.00E-03
2003	9.10E-12	3,600	8,760	2.87E-04	2.87E-03

3. Comparison of Maximum Total Annual Sulfur (S) and Nitrogen (N) Deposition to the Deposition Analysis Thresholds (DATs) for each element

Model Year	Dry and Wet Annual S Deposition (kg/ha-yr)	Model Year	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	2.32E-05	2001	3.82E-03
2002	1.91E-05	2002	3.00E-03
2003	1.83E-05	2003	2.87E-03
Max. Annual Dep.	2.32E-05	Max. Annual Dep.	3.82E-03
DAT (kg/ha-yr)	0.005	DAT (kg/ha-yr)	0.005
Above DAT?	NO	Above DAT?	NO

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Table 4.7. Soils and Vegetation Deposition Impacts at Bryce Canyon National Park, 200-foot Overburden, Alternative C, Cumulative

1. Annual Total Sulfur (S) Deposition estimated by CALPOST from dry and wet deposition of SO_2 and $(NH_4)_2SO_4$ modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Sulfur Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual S Deposition (g/m^2-yr)	Dry and Wet Annual S Deposition (kg/ha-yr)
2001	6.06E-13	3,600	8,760	1.91E-05	1.91E-04
2002	9.22E-13	3,600	8,760	2.91E-05	2.91E-04
2003	8.19E-13	3,600	8,760	2.58E-05	2.58E-04

2. Annual Total Nitrogen (N) Deposition estimated by CALPOST from dry and wet deposition of $(NH_4)_2SO_4$, NOx, and HNO_3 modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Nitrogen Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual N Deposition (g/m^2-yr)	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	0.0E+00	3,600	8,760	0.0E+00	0.0E+00
2002	0.0E+00	3,600	8,760	0.0E+00	0.0E+00
2003	0.0E+00	3,600	8,760	0.0E+00	0.0E+00

3. Comparison of Maximum Total Annual Sulfur (S) and Nitrogen (N) Deposition to the Deposition Analysis Thresholds (DATs) for each element

Model Year	Dry and Wet Annual S Deposition (kg/ha-yr)	Model Year	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	1.91E-04	2001	0.0E+00
2002	2.91E-04	2002	0.0E+00
2003	2.58E-04	2003	0.0E+00
Max. Annual Dep.	2.91E-04	Max. Annual Dep.	0.0E+00
DAT (kg/ha-yr)	0.005	DAT (kg/ha-yr)	0.005
Above DAT?	NO	Above DAT?	NO

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Table 4.8. Soils and Vegetation Deposition Impacts at Capitol Reef National Park, 200-foot Overburden, Alternative C, Cumulative

1. Annual Total Sulfur (S) Deposition estimated by CALPOST from dry and wet deposition of SO_2 and $(NH_4)_2SO_4$ modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Sulfur Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual S Deposition (g/m^2-yr)	Dry and Wet Annual S Deposition (kg/ha-yr)
2001	1.84E-12	3,600	8,760	5.80E-05	5.80E-04
2002	2.03E-12	3,600	8,760	6.40E-05	6.40E-04
2003	2.12E-12	3,600	8,760	6.67E-05	6.67E-04

2. Annual Total Nitrogen (N) Deposition estimated by CALPOST from dry and wet deposition of $(NH_4)_2SO_4$, NOx, and HNO_3 modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Nitrogen Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual N Deposition (g/m^2-yr)	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	0.0E+00	3,600	8,760	0.0E+00	0.0E+00
2002	0.0E+00	3,600	8,760	0.0E+00	0.0E+00
2003	0.0E+00	3,600	8,760	0.0E+00	0.0E+00

3. Comparison of Maximum Total Annual Sulfur (S) and Nitrogen (N) Deposition to the Deposition Analysis Thresholds (DATs) for each element

Model Year	Dry and Wet Annual S Deposition (kg/ha-yr)	Model Year	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	5.80E-04	2001	0.0E+00
2002	6.40E-04	2002	0.0E+00
2003	6.67E-04	2003	0.0E+00
Max. Annual Dep.	6.67E-04	Max. Annual Dep.	0.0E+00
DAT (kg/ha-yr)	0.005	DAT (kg/ha-yr)	0.005
Above DAT?	NO	Above DAT?	NO

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Table 4.9. Soils and Vegetation Deposition Impacts at Grand Staircase-Escalante National Monument, 200-foot Overburden, Alternative C, Cumulative

1. Annual Total Sulfur (S) Deposition estimated by CALPOST from dry and wet deposition of SO_2 and $(NH_4)_2SO_4$ modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Sulfur Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual S Deposition (g/m^2-yr)	Dry and Wet Annual S Deposition (kg/ha-yr)
2001	2.60E-12	3,600	8,760	8.19E-05	8.19E-04
2002	2.81E-12	3,600	8,760	8.86E-05	8.86E-04
2003	3.04E-12	3,600	8,760	9.58E-05	9.58E-04

2. Annual Total Nitrogen (N) Deposition estimated by CALPOST from dry and wet deposition of $(NH_4)_2SO_4$, NOx, and HNO_3 modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Nitrogen Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual N Deposition (g/m^2-yr)	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	0.0E+00	3,600	8,760	0.0E+00	0.0E+00
2002	0.0E+00	3,600	8,760	0.0E+00	0.0E+00
2003	0.0E+00	3,600	8,760	0.0E+00	0.0E+00

3. Comparison of Maximum Total Annual Sulfur (S) and Nitrogen (N) Deposition to the Deposition Analysis Thresholds (DATs) for each element

Model Year	Dry and Wet Annual S Deposition (kg/ha-yr)	Model Year	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	8.19E-04	2001	0.0E+00
2002	8.86E-04	2002	0.0E+00
2003	9.58E-04	2003	0.0E+00
Max. Annual Dep.	9.58E-04	Max. Annual Dep.	0.0E+00
DAT (kg/ha-yr)	0.005	DAT (kg/ha-yr)	0.005
Above DAT?	NO	Above DAT?	NO

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Table 4.10. Soils and Vegetation Deposition Impacts at Grand Canyon National Park, 200-foot Overburden, Alternative C, Cumulative

1. Annual Total Sulfur (S) Deposition estimated by CALPOST from dry and wet deposition of SO_2 and $(NH_4)_2SO_4$ modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Sulfur Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual S Deposition (g/m^2-yr)	Dry and Wet Annual S Deposition (kg/ha-yr)
2001	1.96E-13	3,600	8,760	6.19E-06	6.19E-05
2002	2.94E-13	3,600	8,760	9.28E-06	9.28E-05
2003	2.76E-13	3,600	8,760	8.69E-06	8.69E-05

2. Annual Total Nitrogen (N) Deposition estimated by CALPOST from dry and wet deposition of $(NH_4)_2SO_4$, NOx, and HNO_3 modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Nitrogen Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual N Deposition (g/m^2-yr)	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	0.0E+00	3,600	8,760	0.0E+00	0.0E+00
2002	0.0E+00	3,600	8,760	0.0E+00	0.0E+00
2003	0.0E+00	3,600	8,760	0.0E+00	0.0E+00

3. Comparison of Maximum Total Annual Sulfur (S) and Nitrogen (N) Deposition to the Deposition Analysis Thresholds (DATs) for each element

Model Year	Dry and Wet Annual S Deposition (kg/ha-yr)	Model Year	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	6.19E-05	2001	0.0E+00
2002	9.28E-05	2002	0.0E+00
2003	8.69E-05	2003	0.0E+00
Max. Annual Dep.	9.28E-05	Max. Annual Dep.	0.0E+00
DAT (kg/ha-yr)	0.005	DAT (kg/ha-yr)	0.005
Above DAT?	NO	Above DAT?	NO

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Table 4.11. Soils and Vegetation Deposition Impacts at Zion National Park, 200-foot Overburden, Alternative C, Cumulative

1. Annual Total Sulfur (S) Deposition estimated by CALPOST from dry and wet deposition of SO_2 and $(NH_4)_2SO_4$ modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Sulfur Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual S Deposition (g/m^2-yr)	Dry and Wet Annual S Deposition (kg/ha-yr)
2001	2.91E-13	3,600	8,760	9.18E-06	9.18E-05
2002	2.87E-13	3,600	8,760	9.05E-06	9.05E-05
2003	2.79E-13	3,600	8,760	8.80E-06	8.80E-05

2. Annual Total Nitrogen (N) Deposition estimated by CALPOST from dry and wet deposition of $(NH_4)_2SO_4$, NOx, and HNO_3 modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Nitrogen Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual N Deposition (g/m^2-yr)	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	0.0E+00	3,600	8,760	0.0E+00	0.0E+00
2002	0.0E+00	3,600	8,760	0.0E+00	0.0E+00
2003	0.0E+00	3,600	8,760	0.0E+00	0.0E+00

3. Comparison of Maximum Total Annual Sulfur (S) and Nitrogen (N) Deposition to the Deposition Analysis Thresholds (DATs) for each element

Model Year	Dry and Wet Annual S Deposition (kg/ha-yr)	Model Year	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	9.18E-05	2001	0.0E+00
2002	9.05E-05	2002	0.0E+00
2003	8.80E-05	2003	0.0E+00
Max. Annual Dep.	9.18E-05	Max. Annual Dep.	0.0E+00
DAT (kg/ha-yr)	0.005	DAT (kg/ha-yr)	0.005
Above DAT?	NO	Above DAT?	NO

CALPUFF was used to predict annual deposition fluxes of S and N at Navajo Lake for one scenario: the 200-foot overburden Alternative C case. These results are shown in Table 4.12. However, because no data on lake chemistry at Navajo Lake are available, no estimates of changes in Navajo Lake were performed.

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Table 4.12. Deposition Impacts at Navajo Lake, 200-foot Overburden, Alternative C (tract only)

1. Annual Total Sulfur (S) Deposition estimated by CALPOST from dry and wet deposition of SO_2 and $(NH_4)_2SO_4$ modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Sulfur Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual S Deposition (g/m^2-yr)	Dry and Wet Annual S Deposition (kg/ha-yr)
2001	4.76E-14	3,600	8,760	1.50E-06	1.50E-05
2002	4.42E-14	3,600	8,760	1.39E-06	1.39E-05
2003	3.98E-14	3,600	8,760	1.25E-06	1.25E-05

2. Annual Total Nitrogen (N) Deposition estimated by CALPOST from dry and wet deposition of $(NH_4)_2SO_4$, NOx, and HNO_3 modeled by CALPUFF

Model Year	Maximum Average Annual Dry and Wet Nitrogen Deposition (g/m^2-s)	No. of Seconds in One Hour	No. of Hours in One Year	Dry and Wet Annual N Deposition (g/m^2-yr)	Dry and Wet Annual N Deposition (kg/ha-yr)
2001	6.56E-12	3,600	8,760	2.07E-04	2.07E-03
2002	5.64E-12	3,600	8,760	1.78E-04	1.78E-03
2003	4.89E-12	3,600	8,760	1.54E-04	1.54E-03

4.3. Visibility

The visibility analyses described in the Technical Report were performed using the EPA-recommended CALMET/CALPUFF/CALPOST modeling system to predict air quality direct and cumulative impacts at far-field PSD Class I areas and selected Class II areas. Three consecutive years (2001–2003) of MM5 model meteorological data were used as input to the CALMET model simulations. CALPUFF then used the meteorological fields generated by CALMET to assess the far-field impacts of the pollutants of concern on the Class I areas and selected Class II areas.

Since the modeling analyses were completed for the Technical Report, a revised FLAG guidance document was released (FLAG 2010). As indicated in the Table 4.13, there are some differences between FLAG 2000 and FLAG 2010.

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Table 4.13. Comparison of FLAG 2000 vs. FLAG 2010

Element	FLAG 2000	FLAG 2010	Implications for Alton Analysis
Annual Emissions/Distance (Q/D) Screening Criteria	None	≤10: sum of NO_x plus SO_2 emissions (TPY) divided by distance (km) from Class I area (page 18)	NO_x plus SO_2 emissions are less than 500 tons/year. No visibility analyses required beyond 50 km.
Background Visibility Conditions	Based on annual average natural, using National Acid Deposition Program (NAPAP) estimates	Based on annual average natural, or 20% best natural, using EPA data from Regional Haze Rule development (page xi)	New FLAG 2010 data are more refined than NAPAP data.
Relative Humidity Adjustment Factor f(RH)	Hour-by-hour (with RH capped at 98%)	Monthly average (with RH capped at 95%) (page x)	Using the FLAG 2010 monthly average with RH capped at 95% is less conservative.
First Level Screening Model	CALPUFF or CALPUFF-lite	< 50 km AERMOD, > 50 km CALPUFF (page xii)	AERMOD used < 50 km, CALPUFF used > 50
Visibility Assessment Criteria	Maximum modeled value	< 50 km calculate hourly estimates of changes in visibility, as characterized by the change in the color difference index (ΔE) and plume contrast (C) (page xiii), > 50 km calculate 98th percentile modeled value at any receptor (page 23)	VISCREEN was used < 50 km, using the 98th percentile eliminates the first seven highest concentrations at each receptor.
Deposition Analysis Thresholds/Concern Thresholds	None	Provided for nitrogen and sulfur deposition	Q/D screening criteria were not exceeded.
Adverse Impact Determination Criteria	"Likely to Object" if 10% threshold exceeded; regulatory factors implicitly considered	Adverse impact determination process more explicit; considers regulatory and other factors	No visibility or deposition analysis is required based on Q/D.

Under the FLAG 2010 guidance, no visibility analyses are required for receptors beyond 50 km from the tract because the sum of NO_x and SO_2 emissions for the tract is less than 500 tons/year (i.e., 230 tons/year). All of Bryce Canyon is within 50 km from the tract. The visibility analysis in the Technical Report for Bryce Canyon used the VISCREEN model to evaluate color difference index (ΔE) and plume contrast (C). This analysis is consistent with the FLAG 2010 guidance.

Zion National Park has a portion of its area within 50 km, and a portion outside 50 km. No visibility analyses are required for the portion outside 50 km (NO_x plus SO_2 emissions < 500 tons/year). A VISCREEN-type analysis would be appropriate for the portion within 50 km. For illustrative purposes, the visibility results obtained using the FLAG 2000 guidance for Zion National Park were compared to similar results calculated using the FLAG 2010 guidance.

EPA released a new version of CALPOST (V6.221 Level 080724) in 2008. The draft guidance that became FLAG 2010 is used in the Method 8 CALPOST algorithms to calculate visibility impacts. Model-predicted 2002 cumulative concentrations for Alternative B and the 200-foot overburden removal scenario were used with FLAG 2010 background visibility data for this analysis, along with CALPUFF-predicted concentrations. The highest visibility impact is selected for FLAG 2000, whereas the eighth highest impact is selected for FLAG 2010. The comparison between the two methodologies is presented in Table 4.14 for Zion National Park.

Table 4.14. Visibility Impact Comparison

Location, Method	Change (%)
Zion National Park, FLAG 2000, Maximum	5.38
Zion National Park, FLAG 2010, 98th percentile	3.94

Based on the comparison presented in Table 4.14, the visibility impacts predicted using the FLAG 2010 guidance (98th percentile change, using the same CALPUFF concentrations) are lower than the impacts predicted using the FLAG 2000 guidance (maximum change).

The far-field visibility analyses included in the Technical Report were updated for this Supplement. CALPOST was used to estimate change in light extinction from CALPUFF model concentration results. FLAG 2010 background visibility data were used for this analysis.

The far-field visibility results were updated to include

- EC effects from Alton Coal Tract emissions, and
- recomputation of the nitric acid/nitrate (HNO_3/NO_3) partition.

To estimate the EC of the fine particulate, exhaust emissions were calculated for each stationary, mobile, and nonroad combustion source. On average, 26% of the calculated $PM_{2.5}$ emissions were estimated to be from combustion (Attachment A). It was assumed that 80% of the exhaust emissions were EC (personal communication, Notar 2013).

The specific steps taken for the updated visibility analysis were as follows:

1. POSTUTIL was run to recompute the HNO_3/NO_3 partition using the MNITRATE = 1 setting, and a background NH_3 concentration of 1 ppb.
2. POSTUTIL was run a second time to partition the $PM_{2.5}$ into PM fine (PMF) and EC, with 26% of $PM_{2.5}$ being exhaust and 80% of exhaust being EC (20.8% of $PM_{2.5}$ was allocated to EC and 79.2% was assigned to PMF).
3. CALSUM was run to create the necessary concentration files for the regional impacts (Alton + Regional Positive NO_2 + Regional Negative NO_2).
4. CALPOST Version 6.221 was used to generate visibility impacts for Methods 2, 6, and 8.
5. MVISCHECK = 1 was used for Method 8 processing to ensure that the chosen options conformed with FLAG 2010 recommendations. NO_2 absorption was not considered in the cumulative visibility analyses, because of negative NO_x values in the regional runs.
6. For the Method 8 processing, the 98th-percentile was tabulated (the eighth-high).

Visibility results for the Alton Coal Tract alone are presented in Table 4.15 for the Alternative B 200-foot overburden removal scenario. The table summarizes results for Methods 2, 6, and 8. Under Alternative B, Zion National Park has three extinction changes that exceed 5% for Methods 2 and 6. There are no extinction changes exceeding 10% in any of the areas (maximum change of 5.93% at Zion National Park). The greatest percentage change for Method 8 is 4.0 % at Zion National Park.

Cumulative visibility results are presented in Table 4.16 for the Alternative B 200-foot overburden scenario. Impacts at Capitol Reef and Bryce Canyon national parks exceed the 10% change threshold on one day under Methods 2 and 6 (maximum of 17.09% for Method 2 and 10.86% for Method 6). These impacts are due to one of the regional sources (i.e., Dixie Oil Field Development), because the tract-alone

impacts at Capitol Reef National Park were small (maximum change of 1.29%). The greatest percentage change for Method 8 is 5.21% at Bryce Canyon National Park.

The tract-alone visibility modeling for Alternative B was performed with VISCREEN. It is likely that the cumulative impacts at Bryce Canyon National Park are attributable to Alton emissions. Based on the results presented in Table 4.15, the cumulative impacts at Zion National Park and Grand Canyon National Park are also attributable to Alton emissions. At Grand Staircase-Escalante National Monument, approximately 48% of the cumulative impact is attributable to Alton emissions. The remaining portion is attributable to other regional sources. Visibility results for the Alton Coal Tract alone are presented in Table 4.17 for the Alternative C 200-foot overburden removal scenario. The table summarizes results for Methods 2, 6, and 8. Under Alternative C, Zion National Park has three extinction changes that exceed 5% for Methods 2 and 6. There are no extinction changes exceeding 10% in any of the areas (maximum change of 5.93% at Zion National Park). The greatest percentage change for Method 8 is 4.0 % at Zion National Park.

Cumulative visibility results are presented in Table 4.18 for the Alternative C 200-foot overburden scenario. Capitol Reef National Park impacts exceed the 10% change threshold on one day under Methods 2 and 6 (maximum of 17.09% for Method 2 and 10.46% for Method 6). These impacts are due to one of the regional sources (i.e., Dixie Oil Field Development), because the tract-alone impacts at Capitol Reef National Park were small (maximum change of 1.3%). Bryce Canyon National Park impacts exceed the 10% threshold on two days for Method 2 and one day for Method 6 (maximum of 14.83% for Method 2 and 11.09% for Method 6). The greatest percentage change for Method 8 is 5.47% at Bryce Canyon National Park.

The tract-alone visibility modeling for Alternative C was performed with VISCREEN. It is likely that the cumulative impacts at Bryce Canyon National Park are attributable to Alton emissions. Based on the results presented in Table 4.17, the cumulative impacts at Zion National Park and Grand Canyon National Park are also attributable to Alton emissions. At Grand Staircase-Escalante National Monument, approximately 48% of the cumulative impact is attributable to Alton emissions. The remaining portion is attributable to other regional sources.

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Table 4.15. Tract-only Visibility Impacts, 200-foot Overburden, Alternative B, With EC and HNO_3/NO_3 Partitioning

Method 2 Class I/Class II Area	**2001 No. of Days > 5%**	**2001 No. of Days > 10%**	**2001 Max Change (%)**	**2002 No. of Days > 5%**	**2002 No. of Days > 10%**	**2002 Max Change (%)**	**2003 No. of Days > 5%**	**2003 No. of Days > 10%**	**2003 Max Change (%)**
Capitol Reef National Park	0	0	1.02	0	0	1.19	0	0	0.94
Grand Canyon National Park	0	0	2.64	0	0	1.81	0	0	1.82
Zion National Park	1	0	5.59	3	0	5.90	0	0	4.79
Grand Staircase-Escalante National Monument	0	0	1.66	0	0	2.94	0	0	2.29

Method 6 Class I/Class II Area	**2001 No. of Days > 5%**	**2001 No. of Days > 10%**	**2001 Max Change (%)**	**2002 No. of Days > 5%**	**2002 No. of Days > 10%**	**2002 Max Change (%)**	**2003 No. of Days > 5%**	**2003 No. of Days > 10%**	**2003 Max Change (%)**
Capitol Reef National Park	0	0	1.21	0	0	1.29	0	0	1.01
Grand Canyon National Park	0	0	3.04	0	0	1.43	0	0	1.49
Zion National Park	1	0	5.37	3	0	5.93	0	0	4.85
Grand Staircase-Escalante National Monument	0	0	1.6	0	0	2.33	0	0	2.75

Method 8 Class I/Class II Area	**2001 Change (%) 8th-high**	**2002 Change (%) 8th-high**	**2003 Change (%) 8th-high**
Capitol Reef National Park	0.67	0.73	0.64
Grand Canyon National Park	0.93	1.04	0.95
Zion National Park	3.13	4.00	3.19
Grand Staircase-Escalante National Monument	1.30	1.50	1.40

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Table 4.16. Cumulative Visibility Impacts, 200-foot Overburden, Alternative B - With EC and HNO_3/NO_3 Partitioning

Method 2 Class I/Class II Area	**2001 No. of Days > 5%**	**2001 No. of Days > 10%**	**2001 Max Change (%)**	**2002 No. of Days > 5%**	**2002 No. of Days > 10%**	**2002 Max Change (%)**	**2003 No. of Days > 5%**	**2003 No. of Days > 10%**	**2003 Max Change (%)**
Bryce Canyon National Park	1	0	6.32	7	1	14.61	2	0	7.09
Capitol Reef National Park	3	1	17.09	2	0	6.96	3	0	7.67
Grand Canyon National Park	0	0	2.66	0	0	1.60	0	0	2.22
Zion National Park	1	0	5.46	3	0	5.90	0	0	4.80
Grand Staircase-Escalante National Monument	1	0	5.27	2	0	5.31	0	0	4.83

Method 6 Class I/Class II Area	**2001 No. of Days > 5%**	**2001 No. of Days > 10%**	**2001 Max Change (%)**	**2002 No. of Days > 5%**	**2002 No. of Days > 10%**	**2002 Max Change (%)**	**2003 No. of Days > 5%**	**2003 No. of Days > 10%**	**2003 Max Change (%)**
Bryce Canyon National Park	1	0	6.31	7	1	10.86	2	0	7.25
Capitol Reef National Park	2	1	10.46	3	0	6.14	4	0	7.08
Grand Canyon National Park	0	0	3.06	0	0	1.84	0	0	1.89
Zion National Park	1	0	5.26	3	0	5.93	0	0	4.87
Grand Staircase-Escalante National Monument	0	0	4.84	2	0	5.78	2	0	5.79

Method 8 Class I/Class II Area	**2001 Change (%) 8th-high**	**2002 Change (%) 8th-high**	**2003 Change (%) 8th-high**
Bryce Canyon National Park	2.89	5.21	3.50
Capitol Reef National Park	2.80	4.18	4.44
Grand Canyon National Park	1.02	1.26	1.10
Zion National Park	3.18	3.94	3.02
Grand Staircase-Escalante National Monument	2.48	3.41	3.45

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Table 4.17. Tract-only Visibility Impacts, 200-foot Overburden, Alternative C - With EC and HNO_3/NO_3 Partitioning

Method 2 Class I/Class II Area	**2001 No. of Days > 5%**	**2001 No. of Days > 10%**	**2001 Max Change (%)**	**2002 No. of Days > 5%**	**2002 No. of Days > 10%**	**2002 Max Change (%)**	**2003 No. of Days > 5%**	**2003 No. of Days > 10%**	**2003 Max Change (%)**
Capitol Reef National Park	0	0	1.03	0	0	1.20	0	0	0.95
Grand Canyon National Park	0	0	2.67	0	0	1.82	0	0	1.83
Zion National Park	1	0	5.59	3	0	5.90	0	0	4.79
Grand Staircase-Escalante National Monument	0	0	1.68	0	0	2.99	0	0	2.33

Method 6 Class I/Class II Area	**2001 No. of Days > 5%**	**2001 No. of Days > 10%**	**2001 Max Change (%)**	**2002 No. of Days > 5%**	**2002 No. of Days > 10%**	**2002 Max Change (%)**	**2003 No. of Days > 5%**	**2003 No. of Days > 10%**	**2003 Max Change (%)**
Capitol Reef National Park	0	0	1.22	0	0	1.30	0	0	1.02
Grand Canyon National Park	0	0	3.07	0	0	1.45	0	0	1.51
Zion National Park	1	0	5.37	3	0	5.93	0	0	4.85
Grand Staircase-Escalante National Monument	0	0	1.62	0	0	2.38	0	0	2.79

Method 8 Class I/Class II Area	**2001 Change (%) 8th-high**	**2002 Change (%) 8th-high**	**2003 Change (%) 8th-high**
Capitol Reef National Park	0.68	0.74	0.65
Grand Canyon National Park	0.94	1.05	0.96
Zion National Park	3.13	4.00	3.19
Grand Staircase-Escalante National Monument	1.32	1.53	1.43

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Table 4.18. Cumulative Visibility Impacts, 200-foot Overburden, Alternative C - With EC and HNO_3/NO_3 Partitioning

Method 2 Class I/Class II Area	**2001 No. of Days > 5%**	**2001 No. of Days > 10%**	**2001 Max Change (%)**	**2002 No. of Days > 5%**	**2002 No. of Days > 10%**	**2002 Max Change (%)**	**2003 No. of Days > 5%**	**2003 No. of Days > 10%**	**2003 Max Change (%)**
Bryce Canyon National Park	1	0	6.70	8	2	14.83	3	0	7.56
Capitol Reef National Park	3	1	17.09	2	0	6.96	3	0	7.67
Grand Canyon National Park	0	0	2.70	0	0	1.61	0	0	2.23
Zion National Park	1	0	5.46	3	0	5.90	0	0	4.80
Grand Staircase-Escalante National Monument	1	0	5.27	2	0	5.31	0	0	4.83

Method 6 Class I/Class II Area	**2001 No. of Days > 5%**	**2001 No. of Days > 10%**	**2001 Max Change (%)**	**2002 No. of Days > 5%**	**2002 No. of Days > 10%**	**2002 Max Change (%)**	**2003 No. of Days > 5%**	**2003 No. of Days > 10%**	**2003 Max Change (%)**
Bryce Canyon National Park	1	0	6.70	8	1	11.09	3	0	7.72
Capitol Reef National Park	2	1	10.46	3	0	6.14	4	0	7.08
Grand Canyon National Park	0	0	3.10	0	0	1.85	0	0	1.89
Zion National Park	1	0	5.26	3	0	5.93	0	0	4.87
Grand Staircase-Escalante National Monument	0	0	4.84	2	0	5.78	2	0	5.80

Method 8 Class I/Class II Area	**2001 Change (%) 8th-high**	**2002 Change (%) 8th-high**	**2003 Change (%) 8th-high**
Bryce Canyon National Park	3.00	5.47	3.64
Capitol Reef National Park	2.80	4.20	4.44
Grand Canyon National Park	1.02	1.28	1.11
Zion National Park	3.18	3.94	3.02
Grand Staircase-Escalante National Monument	2.48	3.41	3.46

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5. Design Features and Mitigation Measures

Design features are applicant-committed environmental protection measures, actions, or practices that are part of Alternative B and all action alternatives and would be implemented by the lessee. The emission calculations and associated modeling results include control measures that are design features of the mine. In the event that ambient monitoring shows concentrations above the applicable NAAQS, potential mitigation measures will be implemented to lower emissions. Potential mitigation measures are additional means, measures, or practices not incorporated into Alternative B or alternatives as design features that would further reduce or eliminate impacts. These mitigation measures will be considered as possible terms and conditions of the record of decision (ROD), if and when an action alternative is selected.

5.1. Design Features

The emission calculations used for this Supplement assume the following design features:

- Tier 4 emission standards for generators and nonroad diesel engines
- Use of ultra-low sulfur diesel fuel for generators and nonroad vehicles
- Post-combustion controls on nonroad vehicles
- Application of water and/or chemical dust suppressants to roads and disturbed areas
- Enclosure of most coal transfer points and processing activities during coal production to reduce fugitive dust emissions
- Watering for predicted high-wind events to reduce windblown dust

Other assumptions used in emission calculations can be found in Attachment A.

The following design features will be included as lease stipulations to address impacts to air quality and AQRVs (each design feature is also identified with the applicable pollutant it would address):

1. Limit surface mining to no more than approximately 200 feet of overburden removal (NO_2, PM, SO_2, visibility)
2. Install fencing to restrict public access to active mining areas (1-hour NO_2)
3. Require blasting provisions for wind speed, direction, and variability, plus provisions for public notifications/alerts during blasting events (1-hour NO_2, PM)
4. Require diesel oxidation catalysts on heavy equipment (PM, HAPs, visibility, VOCs, CO)
5. Implement a dust control plan (PM)
6. Conduct continuous ambient air monitoring for PM_{10}, $PM_{2.5}$, NO_2, and visibility according to the adaptive management strategy
7. Ensure that all controls used in the 200-foot overburden removal scenario demonstrate compliance with the NAAQS, including Tier 4 engines, dust control, etc. (PM, NO_2, SO_2)

The dust control plan described in design feature 5 would include at a minimum the following provisions:

- Appropriate watering and/or surfactant application
- Appropriate wind-fencing and/or other wind barriers to prevent windblown dust as needed
- Speed limits for vehicle traffic on-site
- Stabilization of stockpiles (overburden, coal, and/or topsoil) to prevent wind erosion

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- Track-out provisions, including street-sweeping, grizzlies, and/or washing trucks before entering the roadway
- Covering and/or securing truck beds and other conveying devices to prevent fugitive dust emissions

Ambient air monitoring as required by design feature 6 would be used to demonstrate the effectiveness of these design features and validate the air modeling done for the DEIS and SDEIS analyses. Monitoring would be conducted according to the adaptive management strategy described below. If monitoring shows concentrations above the applicable NAAQS or indicates AQRV degradation, it would trigger the implementation of additional measures as defined in the adaptive management strategy to further decrease emissions.

Based on agreement with the EPA, design features are established in lieu of modeling for 1-hour NO_2 and 1-hour SO_2. The particular design features that apply to NO_2 and SO_2 are noted above. The use of ultra-low sulfur diesel fuel for nonroad vehicles and generators and the use of nonroad diesel engines and generators that meet Tier 4 emissions standards are also SO_2 design features.

5.1.1. Adaptive Management Strategy

The lease holder commits to developing a project-specific adaptive management strategy for air resources. This adaptive management strategy, as outlined here, has been designed to detect and address monitored air quality and AQRV degradation that can reasonably be attributed to emissions originating from mine activities on the tract. The adaptive management strategy would consist of the following elements to be implemented in the order listed:

1. Conduct targeted air monitoring to address potential impacts to air quality or AQRVs in Bryce Canyon National Park and the town of Alton.
2. Based on monitoring, refine air quality analyses and and/or modeling assessments as needed to determine whether any monitored air quality or AQRV deterioration is reasonably attributable to mine operations.
3. Implement additional environmental protection measures as needed based on monitoring and source attribution.

The first element of this strategy, targeted project-specific air monitoring, would be funded and implemented by the lease-holder with oversight by the BLM (and in consultation with NPS) upon issuance of the lease, with monitoring operations beginning at least one year before mining activities start on the tract based on the timing of the permitting process. Air monitoring would consist of the following:

- The installation of equipment at a location near the south end of Bryce Canyon National Park and at an intermediate site between the tract and the park. The location of the in-park site would be designed to better address potential Bryce Canyon National Park impacts than the current, existing monitoring site. The intermediate site would address decreasing gradients in observed impacts between the tract and Bryce Canyon National Park, identifying potential issues and the need for additional evaluation.
- Use of a meter capable of continuous visibility measurements (coarse and fine particle scattering) (e.g., Optec nephelometer), an instrument capable of continuous absorption and scattering measurements from fine particulate mass (e.g., DTM PAX), and an instrument to record meteorological measurements such as wind direction, wind speed, and relative humidity at the in-park site.
- Use of a continuous visibility meter, as well as meteorological monitoring equipment, at the intermediate site.

- Solar power sources or other supplemental power options.
- The incorporation of existing equipment into the air monitoring, including the filter-based PM_{10} samplers at the Coal Hollow Mine. In addition, the existing Coal Hollow monitoring site located between the Coal Hollow Mine and the town of Alton would be used to monitor and characterize possible NO_2 (and other) impacts to the residents of Alton.
- A four-year sampling period (to be extended if monitoring sites have recorded an exceedance of the NAAQS [not due to a natural event] or if impacts to Bryce Canyon National Park or the town of Alton have been clearly identified from mine operations)[1,2].
- The storage of data on-site with periodic offloading for transfer to a central facility for processing and database entry.
- Optical measurements related to visibility (dust, PM) collected on a shorter period than the 24-hour filter samples taken by the IMPROVE monitoring site.

Monitors would be operated to UDAQ specifications, and the monitoring data would be made publicly available. Existing NPS monitoring equipment, consisting of a night sky visibility camera and a daytime visibility camera, could be incorporated into the adaptive management strategy as well. The process by which data are examined, processed, and transmitted to the appropriate parties (data tracking) would be fully defined in an interagency memorandum of understanding (MOU) to be developed after the ROD. The actual data tracking procedures may need to be adjusted or revised as monitoring information becomes available, but at a minimum should incorporate either annual or biannual periodic in-depth data assessments to evaluate overall trends and conditions, as well as data flagging. The adaptive management strategy would include a commitment to funding a third-party contractor to be responsible for the data analysis and tracking procedures, as defined by the BLM and NPS in consultation with ARTAG. The lessee would be responsible for funding the tracking component, in addition to the remaining elements of the adaptive management strategy.

If monitoring shows impacts to air quality and/or AQRVs at Bryce Canyon National Park or the town of Alton that can reasonably be attributed to emissions from mining operations, the BLM and NPS would review the data and develop an analysis plan to definitively determine the source(s) of the monitored impacts. The plan may include additional monitoring and/or modeling, emission inventory analysis, and/or other investigative techniques to be decided by the BLM and NPS in consultation with the BLM Utah Air Resource Technical Advisory Group (ARTAG). This is the second element of the strategy.

To implement the second element of the strategy, quantifiable trigger points would be identified that define the potential for unacceptable impacts. This would include the identification of routine data analyses that indicate potential impacts from tract activities, such as wind roses and spatial gradients. Thresholds that account for the potential magnitudes, frequency, and duration of these impacts would also be defined. For monitoring sites in Bryce Canyon National Park, FLAG 2010 guidance would be used to determine appropriate thresholds. Although desirable to define the analyses and trigger points ahead of time, it is likely that modifications to the protocols would be needed after data have been collected and analyzed. Refinements would be mutually agreed upon by all parties. The second element of the strategy would also identify the acceptable level of source attribution analysis if the defined thresholds are

[1] The primary concern for Bryce Canyon National Park is AQRV (visibility), impacts and the primary concern for the town of Alton is NAAQS exceedances.

[2] DOGM coal rules (R645-301-420 through R645-301-425) state that all surface coal mining and reclamation activities with projected production rates exceeding 1,000,000 tons of coal per year must have an air pollution control plan with "an air quality monitoring program to provide sufficient data to evaluate the effectiveness of the fugitive dust control practices" to comply with federal and Utah air quality standards. Therefore, monitoring will be required by DOGM for the tract anytime the production exceeds 1,000,000 tons per year (projected to be annually for the life of the mine). The four years of monitoring specified in the adaptive management strategy include elements not required by DOGM (e.g., NO_2) and would be timed to capture the maximum impact. The timing would be determined during the permitting process when the specifics of the mining activities are known.

exceeded, while maintaining the ability to implement additional measures quickly if necessary. This could include (but would not be limited to) analyses using air dispersion, back trajectory, and Eulerian chemical transport models integrated in a weight of evidence analysis. Additional monitoring might also be required to quantify source impacts.

If the refined air quality analysis conducted in response to the monitored air quality impacts shows the tract contributing to degraded air quality and/or AQRVs at Bryce Canyon National Park or the town of Alton (including any exceedances of the NAAQS), the mine operator would be required to adopt additional measures as soon as possible but within no more than one year of the determination depending on the required measure (the third element of the strategy). Additional measures may include, but are not limited to, the following actions:

- Provisions to reduce NO_2 from blasting related to the sizing of shots, quality of explosive materials, minimum elapsed time between blasts, and measures that could be employed to reduce the need for blasting altogether (1-hour NO_2)
- Heavy-duty vehicle controls including, but not limited to, NOx combustion controls, limitation on the total number of vehicles in operation simultaneously, use of electrically driven equipment if available, and reduction of on-road emissions by obtaining lower-emitting engines than the county average (PM_{10}, $PM_{2.5}$, NO_x, HAPs)
- Dump height provisions, road paving (depending on the type of road in service), and/or fogging systems (PM_{10}, $PM_{2.5}$)
- Construction of buildings and/or silos to store coal, topsoil, and/or overburden (PM_{10}, $PM_{2.5}$)
- Restriction on simultaneously open pits as applicable (PM_{10}, $PM_{2.5}$)

Additional measures would be selected based on the nature of the monitored impacts, the effectiveness of the proposed measures to address monitored impacts, the feasibility of implementing the proposed measures, and final approval by the BLM in consultation with the NPS and ARTAG. The cost for these measures would be the sole responsibility of the successful bidder, and would be imposed as a lease stipulation.

Because the exact mining sequence and particulars of the mining operation are unknown at this point in time (the leasing process), some of the fine points of the adaptive management plan are not delineated here. However, the successful lessee would submit detailed mining plans as part of the permitting process (which includes air quality permitting), and additional details of the adaptive management strategy would be cooperatively determined during this time.

5.2. Potential Mitigation Measures

The following mitigation measures could be applied to reduce GHG emissions, as appropriate and economically feasible:

- Reduce engine idling or implement a “no idling” policy during construction and mining operations.
- Use biodiesel fuel in construction equipment and vehicles (typically blends of biodiesel and petroleum fuels can be used in diesel engines without any need for engine modifications).
- Use biodiesel fuel in operations equipment and vehicles.

6. Greenhouse Gases

Naturally occurring GHGs include water vapor, CO_2, CH_4, nitrous oxide (N_2O), and ozone (O_3). Other human-made GHGs include hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride (SF_6). Water vapor accounts for the largest percentage of greenhouse effect. Next to water vapor, CO_2 is the most abundant GHG. Because CO_2 is relatively stable in the atmosphere and uniformly mixed throughout the troposphere and stratosphere, the climatic impact of CO_2 emissions does not depend on the CO_2 source location on earth. The action alternatives would produce GHG emissions from the combustion of fuel by vehicles, mining equipment, and generators; coal combustion; and the release of CH_4 contained in the coal.

Globally, approximately 31,780 million (MM) metric tons of CO_2 were added to the atmosphere through the combustion of fossil fuels in 2010 (EPA 2013). The CO_2 emissions from Alternatives B or C are 58,984 tons (53,510 metric tons). This total includes all on-site emissions, as well as off-site emissions from employee travel, haul truck traffic, cars and light duty trucks, and heavy duty diesel vehicles. This value represents approximately 0.00017% of the 2010 global emissions.

The annual coal production from the tract is estimated to be approximately 2 million tons. The annual worldwide primary coal production based on 2011 data is approximately 8.46 billion tons (U.S. Energy Information Administration 2013). The coal produced from the tract could therefore be expected to be approximately 0.024% of the total worldwide production.

Because site-specific data are not available, EPA's default emission factor of 4,810 pounds per ton of coal for subbituminous coal (EPA 2008) was used to approximate the annual emissions from combusting the 2 million tons of coal produced at the tract.

2 MMtons/yr Coal * 4,810 lb CO_2/ton of Coal / 2,000 lb/ton = 4.8 MM TPY CO_2

The resulting emissions of 4.8 million tons of CO_2 per year (4.4 MM metric tons) would be emitted by the end user of the coal produced at the Alton Coal Tract. This total represents 0.014% of the total CO_2 emissions from global fossil fuel combustion.

Globally, approximately 588.6 million metric tons of CO_2 equivalent (CO_2e) are emitted annually from coal mining (EPA 2012). Based on an estimate of 0.1 cubic centimeter per gram (cm^3/g) of CH_4 in the Smirl Coal Zone in the Alton Coal Field (Duel and Kim 1988), estimated annual CO_2e emissions from the tract are 5,653,546 tons (5,128,870 metric tons). This value represents approximately 0.87% of global emissions from coal mining.

A summary of these comparisons is presented in Table 6.1.

Table 6.1. Greenhouse Gas Comparisons

Comparison	Global, MMTY	Alton Coal Tract (mining operations), MMTY	Alton Coal Combustion, MMTY	Alton % of Global
CO_2 Emissions from Fossil Fuel Combustion	31,780	0.05	4.4	0.014
CO_2e Emissions from Coal Mining	588.6	5.13	n/a	0.87

MMTY = million metric tons/year

n/a = not applicable

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Attachment A

Alton Coal Tract Emission Inventory

ANNUAL EMISSIONS, TONS/YEAR; 200 Feet Thick Overburden

Source Category		TSP	PM10	PM2.5	Calc. Exhaust	Final Exhaust	Ratio	NOx	VOC	CO	SO2	CO2	Benzene	Toluene	Xylenes	Formaldehyde	Acetaldehyde	Acrolein
Construction Emissions	Construction	43	13	1.3														
Topsoil load/unload Alt B	On-site	7.2	2.2	0.22														
Topsoil - Scraper Alt B	On-site	25	8.1	0.81	0.09	0.09		1.8	0.84	15	0.01	1361						
Topsoil load/unload Alt C	On-site	7.2	2.2	0.22														
Topsoil - Scraper Alt C	On-site	25	8.1	0.81	0.09	0.09		1.8	0.84	15	0.01	1361						
Truck load/unload Alt B	On-site	3.6	1.1	0.11	0.03	0.03		0.60	0.29	5.3	0.01	733						
Topsoil - FEL/Truck Alt B	On-site	5.2	1.3	0.13	0.23	0.13		7.9	0.90	7.9	0.01	2144						
Truck load/unload Alt C	On-site	3.6	1.1	0.11	0.03	0.03		0.60	0.29	5.3	0.01	733						
Topsoil - FEL/Truck Alt C	On-site	5.2	1.3	0.13	0.23	0.13		7.9	0.90	7.9	0.01	2144						
Overburden load/unload Alt B	On-site	8	4.0	0.61														
Overburden load/unload Alt C	On-site	8	4.0	0.61														
Haul Truck OVB Travel Alt B	On-site	117	30	3.0	4.9	3.0		170	19	170	0.05	10501						
Haul Truck OVB Travel Alt C	On-site	117	30	3.0	4.9	3.0		170	19	170	0.05	10501						
Wind Erosion Alt B	On-site	20	9.9	1.5														
Wind Erosion Alt C	On-site	40	20	3.0														
Coal Loading	On-site	0.44	0.21	0.03	0.09	0.03		1.8	0.86	16	0.02	2198						
Coal Haul Truck Travel	On-site	50	13	1.3	0.68	0.68		24	2.7	24	0.01	2144						
Coal Dumping at mine	On-site	0.44	0.21	0.03														
Coal Processing at mine	On-site	25	8.5	0.85														
Coal Pile at Mine	On-site	8.6	2.9	0.29														
Coal Loading OTR Trucks	On-site	0.02	0.01	0.00														
Coal Dumping at Loadout	Off-site	0.44	0.21	0.03														
Coal Storage at Loadout	Off-site	8.6	2.9	0.29														
Train Loading	Off-site	0.02	0.01	0.00														
Access Road Traffic	On-site	194	50	5.0														
Bulldozers	On-site	88	17	9.2	0.17	0.17		3.5	1.6	30	0.04	4521						
Service Vehicles	On-Site	19	4.9	0.49		0.49		1.2	0.07	0.53	0.00	123						
Graders	On-site	3.1	1.4	0.10	0.06	0.06		1.1	0.54	10	0.00	482						
Generators	On-site	1.9	1.9	1.93		1.93		13	7.7	68	0.13	13477	0.07	0.03	0.02	0.01	0.00	0.00
Blasting	On-site	0.48	0.25	0.01		0.01		2.6		10	0.30							
Paved Road Employees	Off-site	17	2.6	0.00								1333						
Paved Road Haul Trucks	Off-site	548	1067	38							0.16	17090						
Mobile 6 Access Road	On-site	0.13	0.13	0.13		0.13		4.3	0.89	11	0.01	499						
Mobile 6 Paved Road cars/LT	Off-site	0.11	0.11	0.11		0.11		6.6	8.0	113	0.03							
Mobile 6 Paved Road HDDV	Off-site	5.4	5.4	5.4		5.36		164	10	73								
Underground Mining	On-site																	
Generators	On-site	2.9	2.9	2.9		2.90		19	12	101	0.17	18008	0.18	0.07	0.05	0.02	0.01	0.00
Coal Dumping at Portal	On-site	0.44	0.21	0.03														
Coal Loading at Portal	On-site	0.44	0.21	0.03		0.09		1.8	0.86	16	0.02	2198						
Coal Haul Truck Travel	On-site	41	11	1.1		0.68		24	2.7	24	0.02	2144						

Emission Totals
NOTE: THE FOLLOWING EMISSION TOTALS ARE NOT ALL ADDITIVE

Alt B Construction		43	13	1.3														

Alt B On-Site - Scraper	569	154	25	6.58	0.259	223	35	354	0.58	35307	0.07	0.03	0.02	0.01	0.00	0.00
Alt B On-Site - FEL/Truck	545	146	25	6.65	0.270	229	35	352	0.58	36822	0.07	0.03	0.02	0.01	0.00	0.00
	551															
Alt B Off-Site	2	1079	43	5.46	0.13	171	18	186	0.19	18423						
Alt B Underground Mining	341	99	16	6.47	0.40	73	26	249	0.38	40561	0.26	0.09	0.06	0.03	0.01	0.00
Alt C Construction	43	13	1.3													
Alt C On-Site - Scraper	589	163	27	6.58	0.244	223	35	354	0.58	35307	0.07	0.03	0.02	0.01	0.00	0.00
Alt C On-Site - FEL/Truck	565	156	26	6.65	0.255	229	35	352	0.58	36822	0.07	0.03	0.02	0.01	0.00	0.00
	551															
Alt C Off-Site	2	1079	43	5.46	0.13	171	18	186	0.19	18423						
Alt C Underground Mining	361	108	18	6.47	0.37	73	26	248	0.38	40561	0.26	0.09	0.06	0.03	0.01	0.00

Rounding Conventions
Values 10 or greater, round to whole tons
Values less than 10 and greater than or equal to 1, round to 2 significant figures
Values less than 1 and greater than or equal to 0.1, round to 2 significant figures
Values less than 0.1, round to 2 decimal places.

0.23 Exhaust emissions are greater than PM2.5. Assume PM2.5 = exhaust
Mobile 6 PM emissions include brake wear, tire wear, and exhaust. Assume PM = exhaust.

Coal Mining Operational Parameter Assumptions 200 Feet Thick Overburden

1. Reasonable Maximum Year of Mining Activities

Revised 02/11/2010

	Parameter	Units	
Construction Duration	6	months	
Construction Acreage Disturbed	6	acre/mo	
Topsoil Thickness	12	in	
Topsoil Density	3,000	lb/yd^3	
One-way Topsoil Haul Distance	0.85	mi	original value was 1.5
Topsoil Haul Road Control Efficiency	70	%	Assume roads will be watered (UDEQ Memo, March 10, 2008)
Scraper Capacity	22	yd^3	
Scraper Empty weight	36	ton	
Topsoil Haul Road Silt Content - Scrapers	16.4	%	Geometric mean for scrapers AP-42 Table 11.9-3
Topsoil/Overburden/Coal Haul Road Silt Content	4.8	%	Based on UDEQ proposed default (UDEQ Memo, March 10, 2008)
Topsoil Front-End Loader Capacity	12	yd^3	
Topsoil Haul Truck Capacity	100	ton	
Topsoil Haul Truck Empty Weight	80.4	ton	
Overburden Thickness	200	ft	original value was 300
Overburden Hauled	13,117,440	ton	Based on projected volume of overburden, depth = 200 ft., 20 % moved by bulldozers; JBR Calculations 12/26/09
Overburden Density	2,562	lb/yd^3	Original value was 3,500. This value is based on regionally sampled overburden density data; JBR Calculations 12/26/09
Overburden Moisture	7.9	%	Geometric mean for overburden AP-42 Table 11.9-3
Overburden Silt Content	7	%	Geometric mean for overburden AP-42 Table 11.9-3
Average Annual Wind Speed	7	mi/hr	4-year average wind speed from Cedar City
Average Annual Daytime Wind Speed	8.1	mi/hr	4-year average wind speed from Cedar City; 6 a.m. to 6 p.m.
One-way Overburden Haul Distance	0.75	mi	original value was 1.5, shorter distance because of 200 ft overburden thickness
Overburden Haul Road Control Efficiency	85	%	Assume chemical suppressant and water (UDEQ Memo, March 10, 2008)
Overburden Haul Truck Capacity	420	ton	
Overburden Haul Truck Empty Weight	307	ton	
Number of Overburden Haul Trucks	2		
Annual Acres Disturbed - Alternative B	61	ac/yr	original value was 94 acres
Annual Acres Disturbed - Alternative C	61	ac/yr	original value was 98 acres
Effective Control Efficiency on New Disturbance	90	%	WRAP Fugitive Dust Handbook, Chapter 9. Assume 90 % for the area that can be reached. See the Overburden_Wind tab for specifics
Coal Thickness	16	ft	
Coal Density	2,300	lb/yd^3	
Coal Moisture	10.4	%	Geometric mean for coal AP-42 Table 11.9-3
Coal Silt Content	8.6	%	Geometric mean for coal AP-42 Table 11.9-3
Coal Haul Truck Capacity (at mining operation)	100	ton	
Coal Haul Truck Empty Weight	80.4	ton	
One-way Coal Haul Distance (on-site)	1	mi	Original value was 2, used a shorter distance for the 200 ft overburden thickness
Coal Haul Road Control Efficiency	85	%	Assume chemical suppressant and water (UDEQ Memo, March 10, 2008)
Coal Loading Into Mine Trucks	2	MMtpy	
Coal Dumping (at crusher)	2	MMtpy	
Coal Crushing/Screening/Conveying	2	MMtpy	
Coal Processing Control Efficiency	95	%	Conservative estimate for control (JBR Memo 3/3/10)
Coal Storage	150,000	tons	
Coal Storage Surface Area	170,000	ft^2	
Coal Storage Control Efficiency (mine)	90	%	WRAP Fugitive Dust Handbook, Chapter 9.
One-way Coal Haul Distance (off-site)	110	mi	

On-road Haul Truck Capacity	43.3	tons	Based on Manufacturer Specifications
On-road Haul Truck Empty Weight	20.95	tons	Based on Manufacturer Specifications
Coal Loading Into OTR Trucks	2	MMtpy	
Coal Loading Into OTR Trucks Control Efficiency	95	%	Assume this activity will be enclosed (Conservative estimate - Alton Coal - JBR Memo 3/3/10); at mine and loadout
Coal Dumping (at railhead)	2	MMtpy	
Coal Storage Control Efficiency (loadout)	90	%	WRAP Fugitive Dust Handbook, Chapter 9.
Coal Loading -Trains	2	MMtpy	
Coal Loading into Trains Control Efficiency	95	%	Assume this activity will be enclosed (Conservative estimate - Alton Coal - JBR Memo 3/3/10); at mine and loadout
Total Disturbed Area (mine area) - Alternative B	199.3	ac	Based on 200 ft overburden thickness
Total Disturbed Area (mine area) - Alternative C	398.6	ac	Based on 200 ft overburden thickness
Access Road Length	2.5	mi	
Access Road Silt Content	4.8	%	Based on UDEQ proposed default (UDEQ Memo, March 10, 2008)
Access Road Control Efficiency	85	%	Assume chemical suppressant and water (UDEQ Memo, March 10, 2008)
Average Vehicle Weight - Employees	2.5	ton	
Number of Employees	160		
Employee RT Distance	60	mi	
Number of Graders	2		
Grader speed	3	mi/hr	original value was 7.1
Grader Operating Hours	10	hr/day	
Grader Control Efficiency	55	%	WRAP Fugitive Dust Handbook Section 6. Unpaved Roads
Number of Water Trucks	2		
Water Truck Capacity	10,000	gals	
Number of Blasts Per Year	62		
Area/blast	1,000	m^2	
Number of bulldozers	5		Fewer bulldozers required for the 200ft overburden thickness
Number of Front-end Loaders	1		
Number of Service Vehicles	10		
Service Vehicles Travel	20	mi/day	
Service Vehicles Weight	4	tons	
Service Vehicles Control Efficiency	85	%	Assume chemical suppressant and water (UDEQ Memo, March 10, 2008)
Electric Power Shovel	36	yd^3	
Generating Capacity - Facility	2,000	kW	
Generating Capacity - Underground Mining	3,000	kW	
Hydraulic backhoe	1		
Paved Road Silt Loading	0.2	g/m^2	
Employee vehicle weight	2	tons	
Ammonium nitrate/fuel oil (ANFO) use	0.6	lb/yd^3	
Cubic Yards of Overburden Blasted	1,000,000	yd^3	
Diesel Fuel density	7.05	lb/gal	
Diesel Fuel sulfur content	15	ppm	
2. Construction Phase			
Duration	6	mo	
Acreage	36	ac	
Acres per month	6		
Emission Factor	1.2	ton/ac-mo	

ac - acre (43,560 ft2, 4840 yd2)
ft - feet
gals - gallons

in - inch
lb - pound
mi - mile
MMtpy - million tons per year
mo - month
% - percent
yd^3 - cubic yard
grams/ton - 907,185
hours/year - 8,760
pounds/ton - 2,000

Construction Emissions
AP-42 section 13.2.3

TSP	1.2	T/ac-mo
PM10 Multiplier	0.30	From AP-42 Table 13.2.2-2
PM2.5/PM10 Ratio	0.1	MRI, 2006 (Background document for Revisions to Fine Fraction Ratios Used in AP-42, Table 1)

6 ac/month for 6 months

TSP	PM10	PM2.5	
43	13	1.3	Tons

Topsoil Scraper
Scraper Haul Road Travel
AP-42 13.2.2.2 Equation 1a and Table 13.2.2-2
E = k (s/12)^a (W/3)^b lb/VMT
Topsoil is 12 in-thick, scraper capacity is 22 cubic yards, scraper MT weight is 36 tons, full weight is 69 tons
One-way travel distance is 0.85 miles

Alt B Acres Disturbed/yr	61	Cubic Yards/yr	98413	Tons/yr	147620	Trips/yr	4473
Alt C Acres Disturbed/yr	61	Cubic Yards/yr	98413	Tons/yr	147620	Trips/yr	4473

Use PM10 particle size multipliers for unpaved roads AP-42 13.2.2, Table 13.2.2-2
Use PM2.5 particle size multiplier from MRI, 2006 (Background document for Revisions to Fine Fraction Ratios Used in AP-42, Table 1)

TSP MT EF	18.63	TSP Full EF	24.98	lb/VMT
PM10 MT EF	6.07	PM10 Full EF	8.14	
PM2.5 MT EF	0.61	PM2.5 Full EF	0.81	

(EF*MT Trips + EF*Full Trips)*One way Distance/2000

Uncontrolled Tons/year	TSP	PM10	PM2.5
Alt B Tons/yr	82.9	27.0	2.70
Alt C Tons/yr	82.9	27.0	2.70

Topsoil Haul Road Control Efficiency		70%		Assume roads will be watered (UDEQ Memo, March 10, 2008)
Alt B Tons/yr	24.9	8.1	0.8	
Alt C Tons/yr	24.9	8.1	0.8	

Topsoil Removal by Scraper/Scraper Unload - AP-42 Table 11.9-4 (TSP = 0.058 removal lb/ton, 0.04 unload lb/ton)
lb/ton*tons/yer/2000 lb/ton

	TSP	PM10	PM2.5
Alt B Tons/yr	7.23	2.17	0.22
Alt C Tons/yr	7.23	2.17	0.22

Gaseous (Combustion) Emissions

Emission factors in g/kW-hr from
FR Vol. 69 No. 124 6/29/2004 Table 6
g/kW-hr*kW*8,760 hours/year/907185 grams/ton
CAT 21G/627G Scraper
272+ 186 kW (two engines) 458 kw
14 gal/hr fuel consumption (Caterpillar email)

	g/kW-hr	Emissions, Tons
NOx	0.4	1.8
VOC	0.19	0.8
CO	3.5	15.5
PM	0.02	0.1

Emission factors in g/kW-hr from FR Vol. 69 No. 124 6/29/2004 Table 6 907,185 grams/ton

Assume one scraper operates 8,760 hours/year

fuel consumption 122640 gal

CO2	22.2lb/gal	1361.304	tons	EPA Emission Facts EPA420-F-05-003 (February 2005)
SO2	Assume	15	ppm S	
	Mol. Wt of SO2 = 2 *S			
Diesel fuel	7.05	lb/gal		AP-42 Appendix A, page A-7

gal*lb/gal/1000000*15ppm/2000lb/ton
SO2 Emissions 0.013 Tons

Note: MT is shorthand for empty

Topsoil FEL/Truck

Topsoil is 12 in-thick, haul truck capacity is 100 tons, Truck MT weight is 80.4 tons, full weight is 180.4 tons
One-way travel distance is 0.85 miles

Alt B Acres Disturbed	61	Cubic Yards/yr	98413	Tons/yr	147620	Trips/yr	1476
Alt C Acres Disturbed	61	Cubic Yards/yr	98413	Tons/yr	147620	Trips/yr	1476

Haul Truck Travel
AP-42 13.2.2.2 Equation 1a and Table 13.2.2-2

E = k (s/12)^a (W/3)^b lb/VMT

Use PM10 particle size multipliers for unpaved roads AP-42 13.2.2
Use PM2.5 particle size multiplier from MRI, 2006 (Background document for Revisions to Fine Fraction Ratios Used in AP-42 - Table 1)

TSP MT EF	11.33	TSP Full EF	16.30	lb/VMT
PM10 MT EF	2.89	PM10 Full EF	4.15	
PM2.5 MT EF	0.29	PM2.5 Full EF	0.42	

Uncontrolled Tons/yr (EF*MT Trips + EF*Full Trips)*One way Distance/2000

	TSP	PM10	PM2.5
Alt B Tons/yr	17.3	4.4	0.44
Alt C Tons/yr	17.3	4.4	0.44

Topsoil Haul Road Control Efficiency 70% Assume roads will be watered (UDEQ Memo, March 10, 2008)

	TSP	PM10	PM2.5
Alt B Tons/yr	5.2	1.3	0.1
Alt C Tons/yr	5.2	1.3	0.1

Topsoil Truck Load/ Truck Unload - AP-42 11.9-4, Tons/yr (load 0.037 lb/ton, unload 0.012 lb/ton)
lb/ton*tons/year/2000 lb/ton

	TSP	PM10	PM2.5
Alt B Tons/yr	3.62	1.09	0.11
Alt C Tons/yr	3.62	1.09	0.11

Gaseous (Combustion) Emissions
Emission factors in g/kW-hr from
FR Vol. 69 No. 124 6/29/2004 Table 7
CAT 777F Off-highway Truck (nonroad vehicle)
700 kW
22.05 gal/hr fuel consumption (Caterpillar email)
Assume 1/3 of available hours for trucks (8760/3)
g/kW-hr*kW*8,760/3 hours/year/907185 grams/ton

	g/kW-hr	Emissions, Tons	
NOx	3.5	7.9	Emission factors in g/kW-hr from

VOC	0.4	0.9		FR Vol. 69 No. 124 6/29/2004 Table 7
CO	3.5	7.9		907,185 grams/ton
PM	0.10	0.23		
fuel consumption		193158	gal	
CO2	22.2lb/gal	2144.0538	tons	EPA Emission Facts EPA420-F-05-003 (February 2005)
SO2	Assume 15 ppm S			
	Mol. Wt of SO2 = 2 *S			
Diesel fuel 7.05 lb/gal		AP-42 Appendix A, page A-7		
gal*lb/gal/1000000*15ppm/2000lb/ton				
SO2 Emissions		0.010	Tons	
Emission factors in g/kW-hr from				
FR Vol. 69 No. 124 6/29/2004 Table 6				
Cat 990H Loader, 468 kw, 22.6 gal/hr				
468	kW			
22.6	gal/hr			
Assume 1/3 of available hours for the loader (8760/3)				
g/kW-hr*kW*8,760 hours/year/3/907185 grams/ton				
	g/kW-hr	Emissions, Tons		
NOx	0.4	0.6		Emission factors in g/kW-hr from
VOC	0.19	0.3		FR Vol. 69 No. 124 6/29/2004 Table 6
CO	3.5	5.3		907,185 grams/ton
PM	0.02	0.03		
Assume loader operates 2920 hours per year				
fuel consumption		65992	gal	
CO2	22.2lb/gal	732.5112	tons	EPA Emission Facts EPA420-F-05-001
SO2	Assume 15 ppm S			
	Mol. Wt of SO2 = 2 *S			
Diesel fuel 7.05 lb/gal				
gal*lb/gal/1000000*15ppm/2000lb/ton				
SO2 Emissions		0.0070	Tons	

Overburden Loading/Unloading

13,117,440 tons of overburden moved by truck

Haul truck capacity is 420 tons, Truck MT weight is 307 tons, full weight is 727 tons

One-way travel distance is 0.85 miles

Alt B Acres Disturbed/yr	61	Cubic Yards/yr	10,240,000	Tons/yr	13,117,440	Trips/yr	31,232	Trips/hr	3.6	Assume 2 trucks will each
Alt C Acres Disturbed/yr	61	Cubic Yards/yr	10,240,000	Tons/yr	13,117,440	Trips/yr	31,232	Trips/hr	3.6	make 2 trips each hour

Haul Truck Travel

AP-42 13.2.2.2 Equation 1a and Table 13.2.2-2

E = k (s/12)^a (W/3)^b

Use PM10 particle size multipliers for unpaved roads AP-42 13.2.2

Use PM2.5 particle size multiplier from MRI, 2006 (Background document for Revisions to Fine Fraction Ratios Used in AP-42 - Table 1)

TSP MT EF	20.71	TSP Full EF	30.52	lb/VMT
PM10 MT EF	5.28	PM10 Full EF	7.78	
PM2.5 MT EF	0.53	PM2.5 Full EF	0.78	

Uncontrolled Tons/yr — (EF*MT Trips + EF*Full Trips)*One way Distance/2000

	TSP	PM10	PM2.5
Alt B Tons/yr	600.0	152.92	15.29
Alt C Tons/yr	600.0	152.9	15.29

Overburden Haul Road Control Efficiency — 85 / 70 — Assume 70% of roads will be treated with chemical suppressants and watered (85% control), and 30% of roads will be watered (70% control) (UDEQ Memo, March 10, 2008)

	TSP	PM10	PM2.5		TSP	PM10	PM2.5		TSP	PM10	PM2.5
Alt B Tons/yr	117.0	29.8	3.0	70%	63.0	16.1	1.6	30%	54.0	13.8	1.4
Alt C Tons/yr	117.0	29.8	3.0	Portion	63.0	16.1	1.6	Portion	54.0	13.8	1.4
				Percent of total		53.8	53.8			46.2	46.2

Gaseous (Combustion) Emissions (Haul Truck)

The values 53.8 and 46.2 percent are used in the Apportioning spreadsheet.

Emission factors in g/kW-hr from FR Vol. 69 No. 124 6/29/2004 Table 7

CAT 797B Off-highway Truck (nonroad vehicle)

2513 kW

54 gal/hr fuel consumption (Caterpillar email)

2*g/kW-hr*kW*8,760 hours/year/907185 grams/ton

assume 2 trucks are required

	g/kW-hr	Emissions, Tons		
				Emission factors in g/kW-hr
NOx	3.5	169.9		from
VOC	0.4	19.4		FR Vol. 69 No. 124 6/29/2004 Table 7
CO	3.5	169.9		907,185 grams/ton
PM	0.1	4.9		
fuel consumption		946080	gal	
CO2	22.2lb/gal	10501.488	tons	EPA Emission Facts EPA420-F-05-003 (February 2005)
SO2	Assume 15 ppm S Mol. Wt of SO2 = 2 *S			
Diesel fuel 7.05 lb/gal gal*lb/gal/1000000*15ppm/2000lb/ton			AP-42 Appendix A, page A-7	
SO2 Emissions		0.050	Tons	

Overburden Load/Unload

Use aggregate loading emission factor (AP-42 13.2.4-4) for loading the overburden haul trucks

Overburden Loading and Unloading - AP-42 13.2.4-4, Tons/yr

E = k(0.0032)(U/5)^1.3/(M/2)^1.4, pounds/ton
lb/ton*tons/year/2000 lb/ton

Particle Size Multiplier (k)

	TSP	PM10	PM2.5
	0.74	0.35	0.053
Emissions			
Alt B Tons/yr	4.2	2.0	0.3
Alt C Tons/yr	4.2	2.0	0.3

Total Overburden Load/Unload

	TSP	PM10	PM2.5
Alt B Tons/yr	8	4	1
Alt C Tons/yr	8	4	1

Assume an Electric 36 cubic yard power shovel, so no gaseous emissions

Wind Erosion

	TSP	PM10	PM2.5
Particle size factors from AP-42 13.2.5	1	0.5	0.075
Wind Erosion emission factor from AP-42 11.9 0.38 t/ac-year*ac*particle size			

factor

Calculate emissions for entire disturbed area

Uncontrolled Emissions	TSP	PM10	PM2.5		
Alt B	76	38	5.7	tons	
Alt C	151	76	11		

Uncontrolled Emissions Total development 50 % of area				Percent of area that can be watered prior to a high wind event	
Alt B	38	19	2.8	64	(JBR Memo 3/3/10)
Main Coal Pit 30 % of area Alt B	23	11	1.7	100	(JBR Memo 3/3/10)
Reclamation 20 % of area Alt B	15	7.6	1.1	100	(JBR Memo 3/3/10)

Percent control for areas that are watered		WRAP Fugitive Dust Handbook, Chapter 9.
	90	

Controlled Emissions Total development 50 % of area			
Alt B	16	8.0	1.2
Main Coal Pit 30 % of area Alt B	2.3	1.1	0.17
Reclamation 20 % of area Alt B	1.5	0.76	0.11
Total Alt B	20	10	1.5

Uncontrolled Emissions Total development 50 % of area				Percent of area that can be watered prior to a high wind event	
Alt C	76	38	5.7	64	(JBR Memo 3/3/10)
Main Coal Pit 30 % of area Alt C	45	23	3.4	100	(JBR Memo 3/3/10)
Reclamation 20 % of area Alt C	30	15	2.3	100	(JBR Memo 3/3/10)

Percent control for areas that are watered	
	90

Controlled Emissions Total development 50 % of area			
Alt C	32	16	2.4
Main Coal Pit 30 % of area Alt C	4.5	2.3	0.34
Reclamation 20 % of area Alt C	3.0	1.5	0.23
Total Alt C	40	20	3.0

Coal Haul Trucks

Haul truck capacity is 100 tons, Truck MT weight is 80.4 tons, full weight is 180.4 tons
One-way travel distance is 1 mile

	Tons/yr	2000000	Trips/yr	20000	Trips/hour 2.3

Haul Truck Travel
AP-42 13.2.2-4 Equation 1a and Table 13.2.2-2
E = k (s/12)^a (W/3)^b

Assume one truck can make 2-3 trips/hour
Assume the equivalent of
1 truck working 8,760 hours/year

Use PM10 particle size multipliers for unpaved roads AP-42 13.2.2
Use PM2.5 particle size multiplier from MRI, 2006 (Background document for Revisions to Fine Fraction Ratios Used in AP-42 - Table 1)

TSP MT EF	11.33	TSP Full EF	16.30	lb/VMT
PM10 MT EF	2.89	PM10 Full EF	4.15	
PM2.5 MT EF	0.29	PM2.5 Full EF	0.42	

(EF*MT Trips + EF*Full Trips)*One way Distance/2000

	TSP	PM10	PM2.5
Uncontrolled Tons/yr	276.3	70.43	7.04

Assume 80% of roads will be treated with chemical suppressants and watered (85% control), and 20% of roads will be watered (70% control) (UDEQ Memo, March 10, 2008)

	TSP	PM10	PM2.5
Coal Haul Road Control Efficiency		85	70
Controlled Tons/yr	49.7	12.68	1.3

	TSP	PM10	PM2.5
80% Portion	33.2	8.45	0.8
20% Portion	16.6	4.23	0.4
Percent of total		66.7	66.7
			33.3	33.3

For Apportioning Spreadsheet

33.3 percent represents the emissions in the Main Coal Pit
Of the remaining 66.7 percent, the percentage is apportioned based on the original distribution (10% to Total Development and 70% to Coal Truck Haul Road.
So, 1/8 of 66.7 percent (8.3%) is assigned to Total Development
and 7/8 of 66.7 percent (58.4%) is assigned to To Coal Truck Haul Road.

Coal Loading in Pit

AP-42 13.2.4-4
E = k(0.0032)(U/5)^1.3/(M/2)^1.4, pounds/ton
lb/ton*tons/year/2000 lb/ton

	TSP	PM10	PM2.5
Particle Size Multiplier (k)	0.74	0.35	0.053
Uncontrolled Emissions (ton/yr)	0.44	0.21	0.03

Gaseous (Combustion) Emissions
Emission factors in g/kW-hr from
FR Vol. 69 No. 124 6/29/2004 Table 6
Cat 990H Loader, 468 kw, 22.6 gal/hr

468	kW
22.6	gal/hr

g/kW-hr*kW*8,760 hours/year/907185 grams/ton

	g/kW-hr	Emissions, Tons	
NOx	0.4	1.8	Emission factors in g/kW-hr from
VOC	0.19	0.9	FR Vol. 69 No. 124 6/29/2004 Table 6
CO	3.5	15.8	
PM	0.02	0.1	PM emissions are captured in the fugitive dust emission factors

Assume loader operates 8760 hours per year

fuel consumption		197976	gal	
CO2	22.2lb/gal	2197.53	tons	EPA Emission Facts EPA420-F-05-003 (February 2005)
SO2	Assume 15 ppm S Mol. Wt of SO2 = 2 *S			
Diesel fuel 7.05 lb/gal	AP-42 Appendix A, page A-7			
SO2 Emissions		0.021	Tons	

Coal Haul Truck
Emission factors in g/kW-hr from
FR Vol. 69 No. 124 6/29/2004 Table 7

CAT 777F Off-highway Truck
700 kW
22.05 gal/hr fuel consumption (Caterpillar email)

700	kW	
22.05	gal/hr	

g/kW-hr*kW*8,760 hours/year/907185 grams/ton

	g/kW-hr	Emissions, Tons	
NOx	3.5	23.7	Emission factors in g/kW-hr from
VOC	0.4	2.7	FR Vol. 69 No. 124 6/29/2004 Table 7
CO	3.5	23.7	
PM	0.1	0.7	

fuel consumption		193158	gal	
CO2	22.2lb/gal	2144.0538	tons	EPA Emission Facts EPA420-F-05-001
SO2	Assume 15 ppm S Mol. Wt of SO2 = 2 *S			
Diesel fuel 7.05 lb/gal gal*lb/gal/1000000*15ppm/2000lb/ton				
SO2 Emissions		0.010	Tons	

Coal Dumping at Processing Facility

AP-42 13.2.4-4
E = k(0.0032)(U/5)^1.3/(M/2)^1.4, pounds/ton
lb/ton*tons/year/2000 lb/ton

	TSP	PM10	PM2.5
Particle Size Multiplier (k)	0.74	0.35	0.053
Uncontrolled Emissions (ton/yr)	0.44	0.21	0.03

Coal Processing

EF from WRAP Fugitive Dust Handbook Chapter 11. Mineral Products Industry
Coal Processing Control Efficiency 95% Conservative estimate for control - JBR Memo 3/3/10

	TSP	PM10	PM2.5
lb/ton	0.50	0.17	0.017
Tons/year	2,000,000	2,000,000	2,000,000
Uncontrolled Emissions TPY	500	170	17
Controlled Emissions TPY	25	8.5	0.85

Coal Pile Wind Erosion at Mine

AP-42 Table 11.9-1 Active storage pile (wind erosion and maintenance)

TSP = 0.72 u	lb/acre-hr	u = wind speed, mph	7.0	4-year average wind speed from Cedar City

For PM10 use fraction from coal processing (0.17/0.50 = 0.34)
For PM2.5 use 0.1 * PM10

	TSP	PM10	PM2.5
Uncontrolled Emissions (ton/yr)	86	29	2.9

Coal Storage Control Efficiency (mine)	90	%	WRAP Fugitive Dust Handbook, Chapter 9.

	TSP	PM10	PM2.5
Controlled Emissions (ton/yr)	8.6	2.9	0.29

Coal Loading Into OTR Trucks

AP-42 13.2.4-4
E = k(0.0032)(U/5)^1.3/(M/2)^1.4, pounds/ton
lb/ton*tons/year/2000 lb/ton

Coal Loading Into OTR Trucks Control Efficiency	95	%	Assume this activity will be enclosed (Conservative estimate - Alton Coal - JRB Memo 3/3/10); at mine and loadout

	TSP	PM10	PM2.5
Particle Size Multiplier (k)	0.74	0.35	0.053
Uncontrolled Emissions (ton/yr)	0.44	0.21	0.03
Controlled Emissions (ton/yr)	0.02	0.01	0.00

Coal Dumping at Loadout

E = k(0.0032)(U/5)^1.3/(M/2)^1.4, pounds/ton
lb/ton*tons/year/2000 lb/ton

	TSP	PM10	PM2.5
Particle Size Multiplier (k)	0.74	0.35	0.053
Uncontrolled Emissions (ton/yr)	0.44	0.21	0.03

Coal Pile Wind Erosion at Loadout

AP-42 Table 11.9-1 Active storage pile (wind erosion and maintenance)

TSP = 0.72 u	lb/acre-hr	u = wind speed, mph	7	4-year average wind speed from Cedar City

For PM10 use fraction from coal processing (0.17/0.50 = 0.34)
For PM2.5 use 0.1 * PM10

Uncontrolled Emissions (ton/yr)	TSP	PM10	PM2.5
	86	29	2.9

Coal Storage Control Efficiency (loadout)	90	%	WRAP Fugitive Dust Handbook, Chapter 9.

	TSP	PM10	PM2.5
Controlled Emissions (ton/yr)	8.6	2.9	0.29

Train Loading

E = k(0.0032)(U/5)^1.3/(M/2)^1.4, pounds/ton
lb/ton*tons/year/2000 lb/ton

Coal Loading into Trains Control Efficiency	95	%	Assume this activity will be enclosed (Conservative estimate - Alton Coal - JRB Memo 3/3/10); at mine and loadout

	TSP	PM10	PM2.5
Particle Size Multiplier (k)	0.74	0.35	0.053
Uncontrolled Emissions (ton/yr)	0.44	0.21	0.03

Controlled Emissions (ton/yr)	0.02	0.01	0.00

Access Road
Traffic

160	employees	5	RT distance (miles)
VMT Employees	292000		

Coal OTR Trucks	2,000,000	Tons	
Truck capacity	43.3	Tons	Based on Manufacturer Specifications
Truck MT Weight	20.95	Tons	Based on Manufacturer Specifications
Average Weight	42.6	Tons	
One-Way Dist.	2.5	Miles	
Trips	46189		
VMT MT or Full	115473		

AP-42 13.2.2.2 Equation 1a and Table 13.2.2-2
E = k (s/12)^a (W/3)^b

Use PM10 particle size multipliers for unpaved roads AP-42 13.2.2
Use PM2.5 particle size multiplier from MRI, 2006 (Background document for Revisions to Fine Fraction Ratios Used in AP-42 - Table 1)

	Employees		OTR Coal Trucks Full	OTR Coal Trucks MT
TSP EF	2.38	lb/VMT	10.24	6.19
PM10 EF	0.61		2.61	1.58
PM2.5 EF	0.06		0.26	0.16

	TSP	PM10	PM2.5	
Uncontrolled Tons/yr	347.0	88.4	8.84	Employees
	591.5	150.7	15.07	OTR Coal Trucks Full
	357.2	91.0	9.10	OTR Coal Trucks MT

Access Road Control Efficiency	85%		Assume chemical suppressant and water (UDEQ Memo, March 10, 2008)
Controlled Tons/yr	52	13	1.3 Employees
	89	23	2.3 OTR Coal Trucks Full
	54	14	1.4 OTR Coal Trucks MT
	194	50	5.0 Total

Bulldozers

AP-42 Table 11.9-1 E = 5.7(s)^1.2 /(M)^1.3 lb/hr*8,760 hr/yr * # of bulldozers / 2000 lb/ton

	5	bulldozers					
		TSP	PM10	PM2.5		PM15	
EF		4.0	0.8	0.4		1.0	lb/hr
Emissions		87.8	16.8	9.2		22.5	tons

Gaseous (Combustion) Emissions

Emission factors in g/kW-hr from
FR Vol. 69 No. 124 6/29/2004 Table 6
CAT D7R

	179	kW		
	9.3	gal/hr fuel consumption (Caterpillar email)		
		g/kW-hr	Emissions, Tons	
NOx		0.4	3.5	Emission factors in g/kW-hr from
VOC		0.19	1.6	FR Vol. 69 No. 124 6/29/2004 Table 6
CO		3.5	30.2	
PM		0.02	0.2	

fuel consumption		407340	gal
CO2	22.2lb/gal	4521.474	EPA Emission Facts EPA420-F-05-003 (February 2005)
SO2	Assume 15 ppm S Mol. Wt of SO2 = 2 *S		
Diesel fuel 7.05 lb/gal			AP-42 Appendix A, page A-7
SO2 Emissions		0.043	Tons

Generators

2,000	kW of power needed	1	kW =	1.341022	HP
3 1000 kW generators (one is a backup)		2000	kW =	2682.044	

Gaseous (Combustion) Emissions

69.3 gal/hr fuel consumption at 75% load (Caterpillar 1230 ekW gen set)

	g/kW-hr	Emissions, Tons	
PM	0.1	1.9	Generators are subject to 40 CFR Part 60 Subpart IIII
NOx	0.67	12.9	Section 60.4201(a) makes the generators in 2011-2014 subject to
VOC	0.4	7.7	the Tier 4 standards
CO	3.5	67.6	FR Vol. 69 No.124 June 29, 2004
			Section 1039.102 Table 7

fuel consumption		1214136	gal
CO2	22.2lb/gal	13476.91	EPA Emission Facts EPA420-F-05-003 (February 2005)
SO2	Assume 15 ppm S		
	Mol. Wt of SO2 = 2 *S		
Diesel fuel 7.05 lb/gal			AP-42 Appendix A, page A-7
SO2 Emissions		0.128	Tons

HAPS

AP-42 Table 3.4-1 (10/96)

TOC	0.090	lb/MMBtu
NMHC	0.0819	
Benzene	7.76E-04	
Toluene	2.81E-04	
Xylenes	1.93E-04	
Formaldehyde	7.89E-05	
Acetaldehyde	2.52E-05	
Acrolein	7.88E-06	

To calculate HAPS, use the EF ratio HAP/NMHC * VOC emissions

Benzene	Toluene	Xylenes	Formaldehyde	Acetaldehyde	Acrolein
7.32E-02	2.65E-02	1.82E-02	7.44E-03	2.38E-03	7.43E-04

Service Vehicles

Assume 10 vehicles, 20 miles/day each

VMT 73000

Unpaved Road Travel
AP-42 13.2.2.2 Equation 1a and Table 13.2.2-2
E = k (s/12)^a (W/3)^b

Use PM10 particle size multipliers for unpaved roads AP-42 13.2.2
Use PM2.5 particle size multiplier from MRI, 2006 (Background document for Revisions to Fine Fraction Ratios Used in AP-42 - Table 1)

TSP EF	2.94	lb/VMT
PM10 EF	0.75	
PM2.5 EF	0.07	

Uncontrolled Tons/yr (EF*VMT)/2000

TSP	PM10	PM2.5
107.2	27.3	2.73

Haul Road Control Efficiency				85		70	Assume 80% of roads will be treated with chemical suppressants and watered (85% control), and 20% of roads will be watered (70% control) (UDEQ Memo, March 10, 2008)				
Controlled Tons/yr				TSP	PM10	PM2.5		TSP	PM10	PM2.5	
	19.3	4.9	0.5	80%	12.9	3.3	0.3	20%	6.4	1.6	0.2
				Portion				Portion			
Graders				Percent of total		66.7	66.7			33.3	33.3

AP-42 Table 11.9-1 (0.040 (S)^2.5 TSP lb/hr)*3 mph * 10 hr/day * 365 days/yr * 2 graders

For Apportioning Spreadsheet

33.3 percent represents the emissions in the Main Coal Pit
Of the remaining 66.7 percent, the percentage is apportioned based on the original distribution (50%
to Total Development and 30% to Coal Truck Haul Road.
So, 5/8 of 66.7 percent (41.7%) is assigned to Total Development
and 3/8 of 66.7 percent (25%) is assigned to To Coal Truck Haul Road.

Assume 2 graders, 3 miles/hour, 10 hours/day

VMT 21900

TSP EF	0.62	lb/VMT
PM10 EF	0.28	
PM2.5 EF	0.02	
PM15 EF	0.46	

Uncontrolled Tons

TSP	PM10	PM2.5
6.8	3.0	0.2

Grader Control Efficiency 55% WRAP Fugitive Dust Handbook Section 6. Unpaved Roads
Grader is not just traveling on the roads, but is grading them, so a lower control efficiency is appropriate

3.1	1.4	0.10

Gaseous (Combustion) Emissions

Emission factors in g/kW-hr from
FR Vol. 69 No. 124 6/29/2004 Table 6
CAT 140M Motor Grader

148	kW
5.95	gal/hr fuel consumption (Caterpillar email)
2	graders

	g/kW-hr	Emissions, Tons	
NOx	0.4	1.1	Emission factors in g/kW-hr from
VOC	0.19	0.5	FR Vol. 69 No. 124 6/29/2004 Table 6
CO	3.5	10.0	
PM	0.02	0.06	

fuel consumption	43435	gal	gal/hr * 10 hours/grader-day * 365 days/year * 2 graders
CO2	22.2lb/gal	482.1285	tons EPA Emission Facts EPA420-F-05-003 (February 2005)
SO2	Assume 15 ppm S		
	Mol. Wt of SO2 = 2 *S		
Diesel fuel 7.05 lb/gal			AP-42 Appendix A, page A-7
SO2 Emissions	0.0046	Tons	

Blasting

AP-42 Table 11.9-1 E = 0.000014(A)^1.5 TSP lb/blast * # of blasts / 2000 lb/ton
Area per blast 1000 m2 10764 ft2
62 blasts per year

	TSP	PM10	PM2.5
lb/blast	15.63	8.13	0.47
ton/year	0.48	0.25	0.01

Ammonium nitrate and fuel oil (ANFO)
ANFO - Use AP-42 Table 13.3-1 EFs

0.6	lb ANFO/yd3	Email from Chris Court ACD
1,000,000	yd3 blasted/yr	
300	Tons ANFO	

		lb/ton ANFO		
CO	67		10.05	ton
NOx	17		2.55	
SO2	2		0.3	

Paved Road Emissions

AP-42 13.2.1.3 eqn 1 E = k(sL/2)^0.65 (W/3)^1.5 - C lb/VMT
160 employees, 60 mile RT

Cars/Light Trucks (LT) Travel

VMT	3504000				
	TSP	PM10	PM2.5	PM2.5 set to zero per AP-42	
lb/VMT	0.00952	0.00148	-0.00007	0	
ton/year	16.68	2.59	-0.12	0	

Haul Trucks

Coal	2,000,000	Tons	
Truck capacity	43.3	Tons	
Truck MT Weight	20.95	Tons	Based on Topsoil haul truck - empty weight is 80 percent of capacity
One-way Dist.	110	Miles	
Trips	46189		
VMT MT or Full	5080831		

	TSP	PM10	PM2.5
lb/VMT MT	0.3383	0.0656	0.0094
lb/VMT Full	1.8190	0.3545	0.0053
lb/VMT Avg			
Ton/year	5480	1067	38

Gaseous (Combustion) Emissions

Cars/LT
Assume 1/2 cars, 1/2 LT

Fuel Economy	27.5	mpg-cars	23.5	mpg-LT trucks	CAFE Proposed Rule for 2010
Avg. Fuel Economy	25.5	mpg			
Gallons of fuel	137411.8				
Gasoline density	6.17 lb/gal	AP-42 Appendix A, page A-7			
CO2 lb/gallon - gasoline	19.4	EPA Emission Facts EPA420-F-05-003 (February 2005)			
CO2 Emissions	1332.894				

Gaseous (Combustion) Emissions

Heavy Duty Diesel Vehicles - OTR Trucks (NOx, CO, and VOC emissions in the Mobile 6 UDAQ tab)

	6.6	mpg	Atmospheric Environment 40 (2006)		
fuel consumption			1539646	gal	
CO2		22.2lb/gal	17090.07	tons	EPA Emission Facts EPA420-F-05-003 (February 2005)

SO2	Assume 15 ppm S		
	Mol. Wt of SO2 = 2 *S		
Diesel fuel 7.05 lb/gal			
SO2 Emissions	0.163	Tons	

Mobile 6 UDAQ
Gaseous (Combustion) Emissions
Use Kane County Emission Factors
Rural Other Principal Arterial

	Emission Factors, g/mi			
	LDGV	LDGT	HDDV	
PM	0.0267	0.029	0.4782	
NOx	1.509	1.902	14.635	
VOC	1.849	2.308	0.869	
CO	25.6	32.91	6.538	The Sulfur content of gasoline in the Mobile 6 runs was 160 ppm vs a standard of 30 ppm
Rev SO2	0.006825	0.009394		The SO2 emission factors were adjusted accordingly
Base SO2	0.0364	0.0501		For HDDVs assume SO2 emissions are captured in the Paved Road tab

Access Road VMT		
Employees	292000	
Access Road VMT OTR Coal Trucks	230947	
Paved Road VMT - cars/LT	3504000	assume 1/2 cars, 1/2 LT
Paved Road VMT - haul trucks	10161663	
Service Vehicle VMT	73000	

Emissions, tons

Access Road - Employees

	LDGV	LDGT	Total
PM	0.00	0.00	0.01
NOx	0.24	0.31	0.55
VOC	0.30	0.37	0.67
CO	4.12	5.30	9.42
Rev SO2	0.00	0.00	0.003

Access Road OTR Coal Trucks

	HDDV
PM	0.12
NOx	3.73
VOC	0.22
CO	1.66

Cars/LT
Assume 1/2 cars, 1/2 LT

Fuel Economy	27.5	mpg-cars	23.5	mpg-LT trucks	CAFE Proposed Rule for 2010
Avg. Fuel Economy	25.5	mpg			
Gallons of fuel	11450.9804				

Gasoline density	6.17 lb/gal	AP-42 Appendix A, page A-7
CO2 lb/gallon - gasoline	19.4	EPA Emission Facts EPA420-F-05-003 (February 2005)
CO2 Emissions, tons	111.07451	

Access Road
OTR Coal Haul Trucks

6.6	mpg		Atmospheric Environment 40 (2006)
fuel consumption		34991.95	gal
CO2	22.2lb/gal	388	tons
SO2	Assume 15 ppm S Mol. Wt of SO2 = 2 *S		

Diesel fuel 7.05 lb/gal

SO2 Emissions	0.004	Tons

Paved Road - cars/LT - tons/year

	LDGV	LDGT	Total
PM	0.05	0.06	0.11
NOx	2.91	3.67	6.59
VOC	3.57	4.46	8.03
CO	49.44	63.56	113.00
Rev SO2	0.01	0.02	0.03

Haul Trucks - tons/year

	HDDV
PM	5.36
NOx	163.93
VOC	9.73
CO	73.23

Service Vehicles - tons/year

	HDDV
PM	0.04
NOx	1.18
VOC	0.07
CO	0.53

Heavy Duty Diesel Vehicles - Service Vehicles

6.6	mpg		Atmospheric Environment 40 (2006)
fuel consumption		11060.61	gal
CO2	22.2lb/gal	122.7727	tons
SO2	Assume 15 ppm S		

Mol. Wt of SO2 = 2 *S

Diesel fuel 7.05 lb/gal

SO2 Emissions	0.001	Tons

Mobile 6 UDAQ
Gaseous (Combustion) Emissions
Use Kane County Emission Factors
Rural Other Principal Arterial

	Emission Factors, g/mi			
	LDGV	LDGT	HDDV	
PM	0.0267	0.029	0.4782	
NOx	1.509	1.902	14.635	
VOC	1.849	2.308	0.869	
CO	25.6	32.91	6.538	The Sulfur content of gasoline in the Mobile 6 runs was 160 ppm vs a standard of 30 ppm
Rev SO2	0.006825	0.009394		The SO2 emission factors were adjusted accordingly
Base SO2	0.0364	0.0501		For HDDVs assume SO2 emissions are captured in the Paved Road tab

Access Road VMT		
Employees	292000	
Access Road VMT OTR Coal Trucks	230947	
Paved Road VMT - cars/LT	3504000	assume 1/2 cars, 1/2 LT
Paved Road VMT - haul trucks	10161663	
Service Vehicle VMT	73000	

Emissions, tons

Access Road - Employees

	LDGV	LDGT	Total
PM	0.00	0.00	0.01
NOx	0.24	0.31	0.55
VOC	0.30	0.37	0.67
CO	4.12	5.30	9.42
Rev SO2	0.00	0.00	0.003

Access Road OTR Coal Trucks

	HDDV
PM	0.12
NOx	3.73
VOC	0.22
CO	1.66

Cars/LT
Assume 1/2 cars, 1/2 LT

Fuel Economy	27.5	mpg-cars	23.5	mpg-LT trucks	CAFE Proposed Rule for 2010
Avg. Fuel Economy	25.5	mpg			
Gallons of fuel	11450.9804				
Gasoline density	6.17 lb/gal	AP-42 Appendix A, page A-7			
CO2 lb/gallon - gasoline	19.4	EPA Emission Facts EPA420-F-05-003 (February 2005)			
CO2 Emissions, tons	111.07451				

Access Road
OTR Coal Haul Trucks

6.6	mpg	Atmospheric Environment 40 (2006)	
fuel consumption		34991.95	gal
CO2	22.2lb/gal	388	tons
SO2	Assume 15 ppm S Mol. Wt of SO2 = 2 *S		
Diesel fuel 7.05 lb/gal			
SO2 Emissions		0.004	Tons

Paved Road - cars/LT - tons/year

	LDGV	LDGT	Total
PM	0.05	0.06	0.11
NOx	2.91	3.67	6.59
VOC	3.57	4.46	8.03
CO	49.44	63.56	113.00
Rev SO2	0.01	0.02	0.03

Haul Trucks - tons/year

	HDDV
PM	5.36
NOx	163.93
VOC	9.73
CO	73.23

Service Vehicles - tons/year

	HDDV
PM	0.04
NOx	1.18
VOC	0.07
CO	0.53

Heavy Duty Diesel Vehicles - Service Vehicles

6.6	mpg	Atmospheric Environment 40 (2006)	
fuel consumption		11060.61	gal
CO2	22.2lb/gal	122.7727	tons
SO2	Assume 15 ppm S Mol. Wt of SO2 = 2 *S		
Diesel fuel 7.05 lb/gal			
SO2 Emissions		0.001	Tons

Underground Mining
Coal Haul Trucks
Same as for surface mining
Haul truck capacity is 100 tons, Truck MT weight is 80.4 tons, full weight is180.4 tons
One-way travel distance is 1 mile

Tons 2000000 Trips 20000

AP-42 13.2.2.2 Equation 1a and Table 13.2.2-2
E = k (s/12)^a (W/3)^b

Use PM10 particle size multipliers for unpaved roads AP-42 13.2.2
Use PM2.5 particle size multiplier from MRI, 2006 (Background document for Revisions to Fine Fraction Ratios Used in AP-42 - Table 1)

TSP MT EF	11.33	TSP Full EF	16.30	lb/VMT
PM10 MT EF	2.89	PM10 Full EF	4.15	
PM2.5 MT EF	0.29	PM2.5 Full EF	0.42	

Uncontrolled Tons/yr (EF*MT Trips + EF*Full Trips)*One way Distance/2000

TSP	PM10	PM2.5
276.3	70.4	7.04

Coal Haul Road Control Efficiency 85% Assume chemical suppressant and water (UDEQ Memo, March 10, 2008)

41.5	10.6	1.1

Coal Loading
Same as for surface mining coal loading

AP-42 13.2.4-4
E = k(0.0032)(U/5)^1.3/(M/2)^1.4, pounds/ton
lb/ton*tons/year/2000 lb/ton

	TSP	PM10	PM2.5
Particle Size Multiplier (k)	0.74	0.35	0.053
Uncontrolled Emissions (ton/yr)	0.44	0.21	0.03

Emission factors in g/kW-hr from
FR Vol. 69 No. 124 6/29/2004 Table 6
Cat 990H Loader, 468 kw, 22.6 gal/hr

Cat 990H Loader

468	kW
22.6	gal/hr

		g/kW-hr	Emissions, Tons	
NOx		0.4	1.8	Emission factors in g/kW-hr from
VOC		0.19	0.9	FR Vol. 69 No. 124 6/29/2004 Table 6
CO		3.5	15.8	
PM		0.02	0.09	PM emissions are captured in the fugitive dust emission factors

Assume loader operates 8760 hours per year

fuel consumption	197976	gal	
CO2	22.2lb/gal	2197.5336	EPA Emission Facts EPA420-F-005-001
SO2	Assume 15 ppm S Mol. Wt of SO2 = 2 *S		

Diesel fuel 7.05 lb/gal

SO2 Emissions	0.0209	Tons	

Coal Haul Truck
Emission factors in g/kW-hr from
FR Vol. 69 No. 124 6/29/2004 Table 7
Same as for surface mining
CAT 777F Off-highway Truck

700 kW
22.05 gal/hr fuel consumption (Caterpillar email)

	g/kW-hr	Emissions, Tons	
NOx	3.5	23.7	Emission factors in g/kW-hr from
VOC	0.4	2.7	FR Vol. 69 No. 124 6/29/2004 Table 7
CO	3.5	23.7	
PM	0.1	0.7	

fuel consumption		193158	gal	
CO2	22.2lb/gal	2144.0538	tons	EPA Emission Facts EPA420-F-05-003 (February 2005)
SO2	Assume 15 ppm S Mol. Wt of SO2 = 2 *S			

Diesel fuel 7.05 lb/gal

SO2 Emissions	0.0204	Tons

2 highwall miners, 2 MMtpy mined

Generators
3,000 kW of power needed
2 1500 kW generators

Gaseous

	3000	kW of power needed		1	kW =	1.341022	HP
				3000	kW =	4023.066	
		kW					
	92.6	gal/hr fuel consumption at 75% load (Caterpillar 1650 ekW gen set) - each					

	g/kW-hr	Emissions, Tons		
PM	0.1	2.9		Generators are subject to 40 CFR Part 60 Subpart IIII
NOx	0.67	19.4		Section 60.4201(a) makes the generators in 2011-2014 subject to
VOC	0.4	11.6		the Tier 4 standards
CO	3.5	101.4		FR Vol. 69 No.124 June 29, 2004
				Section 1039.102 Table 7
fuel consumption		1622352	gal	
CO2	22.2lb/gal	18008.1072	tons	EPA Emission Facts EPA420-F-05-003 (February 2005)
SO2	Assume 15 ppm S			
	Mol. Wt of SO2 = 2 *S			
Diesel fuel 7.05 lb/gal				
SO2 Emissions		0.172	Tons	

HAPS

AP-42 Table 3.4-1

TOC	0.090	lb/MMBtu
NMHC	0.0819	
Benzene	7.76E-04	
Toluene	2.81E-04	
Xylenes	1.93E-04	
Formaldehyde	7.89E-05	
Acetaldehyde	2.52E-05	
Acrolein	7.88E-06	

To calculate HAPS, use the EF ratio HAP/NMHC * VOC emissions

Benzene	Toluene	Xylenes	Formaldehyde	Acetaldehyde	Acrolein
1.84E-01	6.66E-02	4.57E-02	1.87E-02	5.97E-03	1.87E-03

Coal Dumping from Highwall Miner

AP-42 13.2.4-4
E = k(0.0032)(U/5)^1.3/(M/2)^1.4, pounds/ton
lb/ton*tons/year/2000 lb/ton

	TSP	PM10	PM2.5
Particle Size Multiplier (k)	0.74	0.35	0.053
Uncontrolled Emissions (ton/yr)	0.44	0.21	0.03

Duel and Kim Reference

Gas Content of Coal in Alton Coal Field
Assume gas is 100 % methane
(CH4)
Assume 100 % of methane in coal is released

	cm3/g	ft3/ton	ft3/yr	ton CH4/yr	ton CO2e/yr
Smirl Coal Bed	0.1	3.204	6407352	269216	5,653,546

Constants

907185	g/ton	
28317	cm3/ft3	
2000000	ton/yr	
23.8	ft3/lb	AP-42 Appendix A
21	Global warming potential	

Alton Tract - Alternative B

Area Source PM10 Apportioning Calculations

Max Development Year	Area	Access Road Traffic	Coal Haul Truck Traffic -PM	Coal Haul Truck Traffic -Gases	Graders	Service_veh-PM	Service_veh-Gases	Bulldozers	Overburden Loading	Overburden Haul Truck - PM	Overburden Haul Truck - Gases	Topsoil Scraping	Coal Loading	Blasting	Wind Erosion	Coal Processing	Generators	Total		
Worst-Case	Total Development		8%	10%	50%	42%	50%	50%	70%	54%	70%			70%	50%					
	Main Coal Pit		33%	20%	20%	33%	20%	30%	30%	46%	30%		100%	30%	30%					
	Reclamation							20%				100%			20%					
	Coal Haul Truck Road		58%	70%	30%	25%	30%													
	Access Road	100%																		
	Facilities																		Check	
	PM-10 Emissions (tons)	**49.7**	**12.68**		**1.36**	**4.92**		**16.85**	**4.02**	**29.82**		**10.28**	**0.21**	**0.25**	**9.92**	**11.65**	**1.93**	**153.5**		153.5
	PM-2.5 Emissions (tons)	**5.1**	**1.27**		**0.10**	**0.49**		**9.22**	**0.61**	**2.98**		**1.03**	**0.03**	**0.01**	**1.49**	**1.18**	**1.93**	**25.4**		25.4
	NOx Emissions (tons)	**4.27**		**23.66**	**1.14**		**1.18**	**3.46**	**0.00**		**169.86**	**1.77**	**1.81**	**2.55**	**0.00**	**0.00**	**12.94**	**222.6**		222.6
	CO Emissions (tons)	**11.08**		**23.66**	**10.00**		**0.53**	**30.25**	**0.00**		**169.86**	**15.48**	**15.82**	**10.05**	**0.00**	**0.00**	**67.59**	**354.32**		354.32
	SO2 Emissions (tons)	**0.01**		**0.01**	**0.00**		**0.00**	**0.04**	**0.00**		**0.05**	**0.01**	**0.02**	**0.30**	**0.00**	**0.00**	**0.13**	**0.58**		0.58

Yellow indicates changed emissions

Alton Tract - Alternative B

AERMOD Area Source PM-10 Modeling Emissions

Emissions by Area (g/s)

Emission Activities	Total Annual PM-10 Q (g/s)	Total Development Area	Main Coal Pit	Reclamation	Facilities	Coal Haul Truck Road	Access Road	Check
Graders	0.0390	0.0195	0.0078			0.0117		0.0390
Bulldozers	0.4846	0.2423	0.1454	0.0969				0.4846
Overburden Loading	0.1156	0.0809	0.0347					0.1156
Overburden Haul Truck	0.8578	0.4615	0.3963					0.8578
Topsoil Scraping	0.2956			0.2956				0.2956
Coal Loading	0.0060		0.0060					0.0060
Blasting (within pit)	0.0073	0.0051	0.0022					0.0073
Wind Erosion	0.2854	0.1427	0.0856	0.0571				0.2854
Coal Processing (increase to 25' release height)	0.3351				0.3351			0.3351
Access Road Traffic	1.4287						1.4287	1.4287
Coal Haul Truck	0.3647	0.0303	0.1218			0.2126		0.3647
Service Vehicles (separated from graders line item)	0.1415	0.0590	0.0471			0.0354		0.1415
Total Emissions by Area	**4.3613**	**1.04**	**0.85**	**0.45**	**0.34**	**0.26**	**1.43**	4.3613

Source Description	Total Development Area	Main Coal Pit	Reclamation	Facilities	Coal Haul Truck	Alton to Facilities area
Area (m^2)	806,600	274,081	274,713	152,856		
Emissions (g/s)	1.0413	0.8469	0.4496	0.3351	0.2597	1.4287
Initial Lateral Width (m)						
Road Segment Length (m)						
Model Emission Rate (g/s-m2)	1.29098E-06	3.08996E-06	1.63661E-06	2.19215E-06		
Road Segments					44	140
Volume Source Emission Rate (g/s)					0.0059	0.01021

Open Pits Source Calculations

have to model volume sources as independent adjacent sources with emissions input as g/s (BEEST figures out g/sec-m2 by area and volume inputs)

Coal Pit Volumes(Assumes 180ft Depth)	**Leg 1**	**Leg 2**	**Leg 3**	
Xinit(m)	100.58	100.58	100.58	
Yinit(m)	1325	800	600	
Depth(m)**	54.9	54.9	54.9	**Total Volume of Open pits**
Volume (m3)	7,311,643	4,414,577	3,310,933	15037152.55
Equivalent Surface Area (m2)	133268.5	80464	60348	274080.5

Emissions (g/s)	0.411794851	0.248630854	0.18647314	0.8469	(Matches main coal pit emissions above)
Model Emission Rate (g/s-m2)				3.0900E-06	
Main Pit (Overburden removal, etc.) Assumes 120 foot average depth	**Leg 1**	**Leg 2**	**Leg 3**		
Xinit(m)	296	296	296		
Yinit(m)	1325	800	600		
Depth(m) **	36.58	36.58	36.58	**Total Volume of Open pits**	
Volume (m3)	14,345,107	8,661,197	6,495,898	29502201.60	
Equivalent Surface Area (m2)	392200	236800	177600	806600	
Total (g/s)	0.506323242	0.305704599	0.22927844 9	1.0413	(Matches total development area emissions above)
Model Emission Rate (g/s-m2)				1.2910E-06	

** The BEEST AERMOD processor figures out the pit depth by using the input volume and surface area for the source

Alton Tract - Alternative B
AERMOD Area Source PM-2.5 Modeling Emissions

		Emissions by Area (g/s)						
Emission Activities	**Total Annual PM-2.5 Q (g/s)**	**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck Road**	**Access Road**	
Graders	0.0027	0.0014	0.0005			0.0008		0.0027
Bulldozers	0.2652	0.1326	0.0796	0.0530				0.2652
Overburden Loading	0.0175	0.0123	0.0053					0.0175
Overburden Haul Truck	0.0858	0.0462	0.0396					0.0858
Topsoil Scraping	0.0296			0.0296				0.0296
Coal Loading	0.0009		0.0009					0.0009
Blasting	0.0004	0.0003	0.0001					0.0004
Wind Erosion	0.0428	0.0214	0.0128	0.0086				0.0428
Coal Processing	0.0338				0.0338			0.0338
Access Road Traffic	0.1463						0.1463	0.1463
Coal Haul Truck	0.0365	0.0030	0.0122			0.0213		0.0365
Service Vehicles (separated from graders line item)	0.0141	0.0071	0.0028			0.0042		0.0141
Total, g/sec	**0.676**	**0.22**	**0.15**	**0.09**	**0.03**	**0.03**	**0.15**	0.6757
Total, ton/yr	23.49							

Source Description		**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck**	**Alton to Facilities area**
Area (m^2)		806,600	274,081	274,713	152,856		
Emissions (g/s)		0.2242	0.1539	0.0912	0.0338	0.0263	0.1463
Initial Lateral Width (m)							
Road Segment Length (m)							
Model Emission Rate (g/s-m2)		2.77941E-07	5.61463E-07	3.3186E-07	2.21334E-07		
Road Segments						44	144
Volume Source Emission Rate (g/s)						0.00060	0.00102
	0.001614	Haul road and access road overlap					

Open_Pits

Coal Pit Volumes (210' below grade)	**Leg 1**	**Leg 2**	**Leg 3**		
Xinit(m)	110	110	110		
Yinit(m)	1000	1000	750		
Depth(m)	62.5	62.5	62.5		
Volume (m3)	6873240	6873240	5154930	18901410	
Equivalent Surface Area (m2)	110000	110000	82500	302500	
Emissions at Pit Bottom (g/s)				0.0009	
Emissions assumed at 1/2 depth of pit g/s)				0.1380	
Emissions (g/s)	0.013772862	0.050500493	0.03787537	0.1389	0.1021487 25
Model Emission Rate (g/s-m2)				4.5910E-07	

Main Pit (Overburden removal, etc.)	**Leg 1**	**Leg 2**	**Leg 3**	
assume 100' below grade				
Xinit(m)	350	350	350	
Yinit(m)	800	1400	700	
Depth(m)	30	30	30	
Volume (m3)	8,400,000	14,700,000	7,350,000	
Equivalent Surface Area (m2)	280000	490000	245000	1015000
emissions in main pit overburden removal area (g/s)				0.0584
other emissions assumed at 1/2 depth of main pit area				0.1557
Total (g/s)	0.05905856	0.10335248	0.051676 24	0.2141
Model Emission Rate (g/s-m2)				2.1092E-07

Alton Tract - Alternative B

AERMOD Area Source NOx Modeling Emissions

		Emissions by Area (g/s)						
Emission Activities	**Total Annual NOx Q (g/s)**	**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck Road**	**Access Road**	
Graders	0.0329	0.0164	0.0066			0.0099		0.0329
Bulldozers	0.0994	0.0497	0.0298	0.0199				0.0994
Overburden Loading	0.0000	0.0000	0.0000					0.0000
Overburden Haul Truck	4.8865	3.4205	1.4659					4.8865
Topsoil Scraping	0.0509			0.0509				0.0509
Coal Loading	0.0520		0.0520					0.0520
Blasting	0.0734	0.0513	0.0220					0.0734
Wind Erosion	0.0000	0.0000	0.0000	0.0000				0.0000
Coal Processing	0.0000				0.0000			0.0000
Access Road Traffic	0.1230						0.1230	0.1230
Coal Haul Truck	0.6806	0.0681	0.1361			0.4764		0.6806
Service Vehicles (separated from graders line item)	0.0339	0.0169	0.01			0.0102		0.0339
Total	**6.03**	**3.62**	**1.72**	**0.07**	**0.00**	**0.50**	**0.12**	6.03
	209.69							

Source Description	**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck**	**Alton to Facilities area**	
Area (m^2)	1,255,880	303,991	264,387	152,856			
Emissions (g/s)	3.6230	1.7192	0.0708	0.0000	0.4964	0.1230	
Initial Lateral Width (m)					45.77	45.77	
Road Segment Length (m)							
Model Emission Rate (g/s-m2)	2.88486E-06	5.6556E-06	2.6771E-07	0			
Road Segments					66	143	
Volume Source Emission Rate (g/s)					0.0075	0.00086	
					0.00838	Haul road and access road overlap	

Alton Tract - Alternative B

AERMOD Area Source CO Modeling Emissions

		Emissions by Area (g/s)						
Emission Activities	**Total Annual CO Q(g/s)**	**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck Road**	**Access Road**	
Graders	0.2878	0.1439	0.0576			0.0863		0.2878
Bulldozers	0.8702	0.4351	0.2610	0.1740				0.8702
Overburden Loading	0.0000	0.0000	0.0000					0.0000
Overburden Haul Truck	4.8865	3.4205	1.4659					4.8865
Topsoil Scraping	0.4453			0.4453				0.4453
Coal Loading	0.4550		0.4550					0.4550
Blasting	0.2891	0.2024	0.0867					0.2891
Wind Erosion	0.0000	0.0000	0.0000	0.0000				0.0000
Coal Processing	0.0000				0.0000			0.0000
Access Road Traffic	0.3188						0.3188	0.3188
Coal Haul Truck	0.6806	0.0681	0.1361			0.4764		0.6806
Service Vehicles (separated from graders line item)	0.0151	0.0076	0.0030			0.0045		0.0151
Total	**8.23**	**4.27**	**2.46**	**0.62**	**0.00**	**0.56**	**0.32**	8.2331
	286.18							

Source Description	**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck**	**Alton to Facilities area**
Area (m^2)	1,255,880	303,991	264,387	152,856		
Emissions (g/s)	4.2699	2.4624	0.6193	0.0000	0.5627	0.3188
Initial Lateral Width (m)					45.77	45.77
Road Segment Length (m)						
Model Emission Rate (g/s-m2)	3.39995E-06	8.10024E-06	2.34246E-06	0		
Road Segments					66	143
Volume Source Emission Rate (g/s)					0.00853	0.00223
					0.01076	Haul road and access road overlap

Alton Tract - Alternative B

AERMOD Area Source SO2 Modeling Emissions

		Emissions by Area (g/s)						
Emission Activities	**Total Annual SO2 Q(g/s)**	**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck Road**	**Access Road**	
Graders	0.0001	0.0001	0.0000			0.0000		0.0001
Bulldozers	0.0012	0.0006	0.0004	0.0002				0.0012
Overburden Loading	0.0000	0.0000	0.0000					0.0000
Overburden Haul Truck	0.0014	0.0010	0.0004					0.0014
Topsoil Scraping	0.0004			0.0004				0.0004
Coal Loading	0.0006		0.0006					0.0006
Blasting	0.0086	0.0060	0.0026					0.0086
Wind Erosion	0.0000	0.0000	0.0000	0.0000				0.0000
Coal Processing	0.0000				0.0000			0.0000
Access Road Traffic	0.0002						0.0002	0.0002
Coal Haul Truck	0.0003	0.0000	0.0001			0.0002		0.0003
Service Vehicles (separated from graders line item)	0.0000	0.0000	0.0000			0.0000		0.0000
Total	**0.0129**	**0.0078**	**0.0041**	**0.0006**	**0.0000**	**0.0002**	**0.0002**	0.0129
	0.45							

Source Description	**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck**	**Alton to Facilities area**
Area (m^2)	1,255,880	303,991	264,387	152,856		
Emissions (g/s)	0.0078	0.0041	0.0006	0.0000	0.0002	0.0002
Initial Lateral Width (m)					45.77	45.77
Road Segment Length (m)						
Model Emission Rate (g/s-m2)	6.1817E-09	1.34214E-08	2.34853E-09	0		
Road Segments					66	143
Volume Source Emission Rate (g/s)					0.000004	0.000001
					0.000005	Haul road and access road overlap

ANNUAL EMISSIONS, TONS/YEAR; 200 Feet Thick Overburden

Source Category		TSP	PM10	PM2.5	Calc. Exhaust	Final Exhaust	Ratio	NOx	VOC	CO	SO2	CO2	Benzene	Toluene	Xylenes	Formaldehyde	Acetaldehyde	Acrolein
Construction Emissions	Construction	43	13	1.3														
Topsoil load/unload Alt B	On-site	7.2	2.2	0.22														
Topsoil - Scraper Alt B	On-site	25	8.1	0.81	0.09	0.09		1.8	0.84	15	0.01	1361						
Topsoil load/unload Alt C	On-site	7.2	2.2	0.22														
Topsoil - Scraper Alt C	On-site	25	8.1	0.81	0.09	0.09		1.8	0.84	15	0.01	1361						
Truck load/unload Alt B	On-site	3.6	1.1	0.11	0.03	0.03		0.60	0.29	5.3	0.01	733						
Topsoil - FEL/Truck Alt B	On-site	5.2	1.3	0.13	0.23	0.13		7.9	0.90	7.9	0.01	2144						
Truck load/unload Alt C	On-site	3.6	1.1	0.11	0.03	0.03		0.60	0.29	5.3	0.01	733						
Topsoil - FEL/Truck Alt C	On-site	5.2	1.3	0.13	0.23	0.13		7.9	0.90	7.9	0.01	2144						
Overburden load/unload Alt B	On-site	8	4.0	0.61														
Overburden load/unload Alt C	On-site	8	4.0	0.61														
Haul Truck OVB Travel Alt B	On-site	117	30	3.0	4.9	3.0		170	19	170	0.05	10501						
Haul Truck OVB Travel Alt C	On-site	117	30	3.0	4.9	3.0		170	19	170	0.05	10501						
Wind Erosion Alt B	On-site	20	9.9	1.5														
Wind Erosion Alt C	On-site	40	20	3.0														
Coal Loading	On-site	0.44	0.21	0.03	0.09	0.03		1.8	0.86	16	0.02	2198						
Coal Haul Truck Travel	On-site	50	13	1.3	0.68	0.68		24	2.7	24	0.01	2144						
Coal Dumping at mine	On-site	0.44	0.21	0.03														
Coal Processing at mine	On-site	25	8.5	0.85														
Coal Pile at Mine	On-site	8.6	2.9	0.29														
Coal Loading OTR Trucks	On-site	0.02	0.01	0.00														
Coal Dumping at Loadout	Off-site	0.44	0.21	0.03														
Coal Storage at Loadout	Off-site	8.6	2.9	0.29														
Train Loading	Off-site	0.02	0.01	0.00														
Access Road Traffic	On-site	194	50	5.0														
Bulldozers	On-site	88	17	9.2	0.17	0.17		3.5	1.6	30	0.04	4521						
Service Vehicles	On-Site	19	4.9	0.49		0.49		1.2	0.07	0.53	0.00	123						
Graders	On-site	3.1	1.4	0.10	0.06	0.06		1.1	0.54	10	0.00	482						
Generators	On-site	1.9	1.9	1.93		1.93		13	7.7	68	0.13	13477	0.07	0.03	0.02	0.01	0.00	0.00
Blasting	On-site	0.48	0.25	0.01		0.01		2.6		10	0.30							
Paved Road Employees	Off-site	17	2.6	0.00								1333						
Paved Road Haul Trucks	Off-site	548	1067	38							0.16	17090						
Mobile 6 Access Road	On-site	0.13	0.13	0.13		0.13		4.3	0.89	11	0.01	499						
Mobile 6 Paved Road cars/LT	Off-site	0.11	0.11	0.11		0.11		6.6	8.0	113	0.03							
Mobile 6 Paved Road HDDV	Off-site	5.4	5.4	5.4		5.36		164	10	73								
Underground Mining	On-site																	
Generators	On-site	2.9	2.9	2.9		2.9		19	12	101	0.17	18008	0.18	0.07	0.05	0.02	0.01	0.00
Coal Dumping at Portal	On-site	0.44	0.21	0.03														
Coal Loading at Portal	On-site	0.44	0.21	0.03		0.09		1.8	0.86	16	0.02	2198						
Coal Haul Truck Travel	On-site	41	11	1.1		0.68		24	2.7	24	0.02	2144						

Emission Totals
NOTE: THE FOLLOWING EMISSION TOTALS ARE NOT ALL ADDITIVE

Alt B Construction		43	13	1.3														

Alt B On-Site - Scraper	569	154	25	6.58	0.26	223	35	354	0.58	35307	0.07	0.03	0.02	0.01	0.00	0.00
Alt B On-Site - FEL/Truck	545	146	25	6.65	0.27	229	35	352	0.58	36822	0.07	0.03	0.02	0.01	0.00	0.00
	551															
Alt B Off-Site	2	1079	43	5.46	0.13	171	18	186	0.19	18423						
Alt B Underground Mining	341	99	16	6.47	0.40	73	26	248	0.38	40561	0.26	0.09	0.06	0.03	0.01	0.00
Alt C Construction	43	13	1.3													
Alt C On-Site - Scraper	589	163	27	6.58	0.24	223	35	354	0.58	35307	0.07	0.03	0.02	0.01	0.00	0.00
Alt C On-Site - FEL/Truck	565	156	26	6.65	0.25	229	35	352	0.58	36822	0.07	0.03	0.02	0.01	0.00	0.00
	551															
Alt C Off-Site	2	1079	43	5.46	0.13	171	18	186	0.19	18423						
Alt C Underground Mining	361	108	18	6.47	0.37	73	26	249	0.38	40561	0.26	0.09	0.06	0.03	0.01	0.00

Rounding Conventions
Values 10 or greater, round to whole tons
Values less than 10 and greater than or equal to 1, round to 2 significant figures
Values less than 1 and greater than or equal to 0.1, round to 2 significant figures
Values less than 0.1, round to 2 decimal places.

0.23 Exhaust emissions are greater than PM2.5. Assume PM2.5 = exhaust
Mobile 6 PM emissions include brake wear, tire wear, and exhaust. Assume PM = exhaust.

Coal Mining Operational Parameter Assumptions 200 Feet Thick Overburden

1. Reasonable Maximum Year of Mining Activities

Revised 06/01/2010

	Parameter	Units	
Construction Duration	6	months	
Construction Acreage Disturbed	6	acre/mo	
Topsoil Thickness	12	in	
Topsoil Density	3,000	lb/yd^3	
One-way Topsoil Haul Distance	0.85	mi	original value was 1.5
Topsoil Haul Road Control Efficiency	70	%	Assume roads will be watered (UDEQ Memo, March 10, 2008)
Scraper Capacity	22	yd^3	
Scraper Empty weight	36	ton	
Topsoil Haul Road Silt Content - Scrapers	16.4	%	Geometric mean for scrapers AP-42 Table 11.9-3
Topsoil/Overburden/Coal Haul Road Silt Content	4.8	%	Based on UDEQ proposed default (UDEQ Memo, March 10, 2008)
Topsoil Front-End Loader Capacity	12	yd^3	
Topsoil Haul Truck Capacity	100	ton	
Topsoil Haul Truck Empty Weight	80.4	ton	
Overburden Thickness	200	ft	original value was 300
Overburden Hauled	13,117,440	ton	Based on projected volume of overburden, depth = 200 ft., 20 % moved by bulldozers; JBR Calculations 12/26/09
Overburden Density	2,562	lb/yd^3	Original value was 3,500. This value is based on regionally sampled overburden density data; JBR Calculations 12/26/09
Overburden Moisture	7.9	%	Geometric mean for overburden AP-42 Table 11.9-3
Overburden Silt Content	7	%	Geometric mean for overburden AP-42 Table 11.9-3
Average Annual Wind Speed	7	mi/hr	4-year average wind speed from Cedar City
Average Annual Daytime Wind Speed	8.1	mi/hr	4-year average wind speed from Cedar City; 6 a.m. to 6 p.m.
One-way Overburden Haul Distance	0.75	mi	original value was 1.5, shorter distance because of 200 ft overburden thickness
Overburden Haul Road Control Efficiency	85	%	Assume chemical suppressant and water (UDEQ Memo, March 10, 2008)
Overburden Haul Truck Capacity	420	ton	
Overburden Haul Truck Empty Weight	307	ton	
Number of Overburden Haul Trucks	2		
Annual Acres Disturbed - Alternative B	61	ac/yr	original value was 94 acres
Annual Acres Disturbed - Alternative C	61	ac/yr	original value was 98 acres
Effective Control Efficiency on New Disturbance	90	%	WRAP Fugitive Dust Handbook, Chapter 9. Assume 90 % for the area that can be reached. See the Overburden_Wind tab for specifics
Coal Thickness	16	ft	
Coal Density	2,300	lb/yd^3	
Coal Moisture	10.4	%	Geometric mean for coal AP-42 Table 11.9-3
Coal Silt Content	8.6	%	Geometric mean for coal AP-42 Table 11.9-3
Coal Haul Truck Capacity (at mining operation)	100	ton	
Coal Haul Truck Empty Weight	80.4	ton	
One-way Coal Haul Distance (on-site)	1	mi	Original value was 2, used a shorter distance for the 200 ft overburden thickness
Coal Haul Road Control Efficiency	85	%	Assume chemical suppressant and water (UDEQ Memo, March 10, 2008)
Coal Loading Into Mine Trucks	2	MMtpy	
Coal Dumping (at crusher)	2	MMtpy	
Coal Crushing/Screening/Conveying	2	MMtpy	
Coal Processing Control Efficiency	95	%	Conservative estimate for control (JBR Memo 3/3/10)
Coal Storage	150,000	tons	
Coal Storage Surface Area	170,000	ft^2	
Coal Storage Control Efficiency (mine)	90	%	WRAP Fugitive Dust Handbook, Chapter 9.
One-way Coal Haul Distance (off-site)	110	mi	

On-road Haul Truck Capacity	43.3	tons	Based on Manufacturer Specifications
On-road Haul Truck Empty Weight	20.95	tons	Based on Manufacturer Specifications
Coal Loading Into OTR Trucks	2	MMtpy	
Coal Loading Into OTR Trucks Control Efficiency	95	%	Assume this activity will be enclosed (Conservative estimate - Alton Coal - JBR Memo 3/3/10); at mine and loadout
Coal Dumping (at railhead)	2	MMtpy	
Coal Storage Control Efficiency (loadout)	90	%	WRAP Fugitive Dust Handbook, Chapter 9.
Coal Loading -Trains	2	MMtpy	
Coal Loading into Trains Control Efficiency	95	%	Assume this activity will be enclosed (Conservative estimate - Alton Coal - JBR Memo 3/3/10); at mine and loadout
Total Disturbed Area (mine area) - Alternative B	199.3	ac	Based on 200 ft overburden thickness
Total Disturbed Area (mine area) - Alternative C	398.6	ac	Based on 200 ft overburden thickness
Access Road Length	2.5	mi	
Access Road Silt Content	4.8	%	Based on UDEQ proposed default (UDEQ Memo, March 10, 2008)
Access Road Control Efficiency	85	%	Assume chemical suppressant and water (UDEQ Memo, March 10, 2008)
Average Vehicle Weight - Employees	2.5	ton	
Number of Employees	160		
Employee RT Distance	60	mi	
Number of Graders	2		
Grader speed	3	mi/hr	original value was 7.1
Grader Operating Hours	10	hr/day	
Grader Control Efficiency	55	%	WRAP Fugitive Dust Handbook Section 6. Unpaved Roads
Number of Water Trucks	2		
Water Truck Capacity	10,000	gals	
Number of Blasts Per Year	62		
Area/blast	1,000	m^2	
Number of bulldozers	5		Fewer bulldozers required for the 200ft overburden thickness
Number of Front-end Loaders	1		
Number of Service Vehicles	10		
Service Vehicles Travel	20	mi/day	
Service Vehicles Weight	4	tons	
Service Vehicles Control Efficiency	85	%	Assume chemical suppressant and water (UDEQ Memo, March 10, 2008)
Electric Power Shovel	36	yd^3	
Generating Capacity - Facility	2,000	kW	
Generating Capacity - Underground Mining	3,000	kW	
Hydraulic backhoe	1		
Paved Road Silt Loading	0.2	g/m^2	
Employee vehicle weight	2	tons	
Ammonium nitrate/fuel oil (ANFO) use	0.6	lb/yd^3	
Cubic Yards of Overburden Blasted	1,000,000	yd^3	
Diesel Fuel density	7.05	lb/gal	
Diesel Fuel sulfur content	15	ppm	
2. Construction Phase			
Duration	6	mo	
Acreage	36	ac	
Acres per month	6		
Emission Factor	1.2	ton/ac-mo	

ac - acre (43,560 ft2, 4840 yd2)
ft - feet
gals - gallons

in - inch
lb - pound
mi - mile
MMtpy - million tons per year
mo - month
% - percent
yd^3 - cubic yard
grams/ton - 907,185
hours/year - 8,760
pounds/ton - 2,000

Construction Emissions
AP-42 section 13.2.3

TSP	1.2	T/ac-mo
PM10 Multiplier	0.30	From AP-42 Table 13.2.2-2
PM2.5/PM10 Ratio	0.1	MRI, 2006 (Background document for Revisions to Fine Fraction Ratios Used in AP-42, Table 1)

6 ac/month for 6 months

TSP	PM10	PM2.5	
43	13	1.3	Tons

Topsoil Scraper
Scraper Haul Road Travel
AP-42 13.2.2.2 Equation 1a and Table 13.2.2-2
E = k (s/12)^a (W/3)^b lb/VMT
Topsoil is 12 in-thick, scraper capacity is 22 cubic yards, scraper MT weight is 36 tons, full weight is 69 tons
One-way travel distance is 0.85 miles

Alt B Acres Disturbed/yr	61	Cubic Yards/yr	98413	Tons/yr	147620	Trips/yr	4473
Alt C Acres Disturbed/yr	61	Cubic Yards/yr	98413	Tons/yr	147620	Trips/yr	4473

Use PM10 particle size multipliers for unpaved roads AP-42 13.2.2, Table 13.2.2-2
Use PM2.5 particle size multiplier from MRI, 2006 (Background document for Revisions to Fine Fraction Ratios Used in AP-42, Table 1)

TSP MT EF	18.63	TSP Full EF	24.98	lb/VMT
PM10 MT EF	6.07	PM10 Full EF	8.14	
PM2.5 MT EF	0.61	PM2.5 Full EF	0.81	

(EF*MT Trips + EF*Full Trips)*One way Distance/2000

Uncontrolled Tons/year	TSP	PM10	PM2.5
Alt B Tons/yr	82.9	27.0	2.70
Alt C Tons/yr	82.9	27.0	2.70

Topsoil Haul Road Control Efficiency		70%		Assume roads will be watered (UDEQ Memo, March 10, 2008)
Alt B Tons/yr	24.9	8.1	0.8	
Alt C Tons/yr	24.9	8.1	0.8	

Topsoil Removal by Scraper/Scraper Unload - AP-42 Table 11.9-4 (TSP = 0.058 removal lb/ton, 0.04 unload lb/ton)
lb/ton*tons/yer/2000 lb/ton

	TSP	PM10	PM2.5
Alt B Tons/yr	7.23	2.17	0.22
Alt C Tons/yr	7.23	2.17	0.22

Gaseous (Combustion) Emissions

Emission factors in g/kW-hr from
FR Vol. 69 No. 124 6/29/2004 Table 6
g/kW-hr*kW*8,760 hours/year/907185 grams/ton
CAT 21G/627G Scraper
272+ 186 kW (two engines) 458 kw
14 gal/hr fuel consumption (Caterpillar email)

	g/kW-hr	Emissions, Tons
NOx	0.4	1.8
VOC	0.19	0.8
CO	3.5	15.5
PM	0.02	0.1

Emission factors in g/kW-hr from FR Vol. 69 No. 124 6/29/2004 Table 6 907,185 grams/ton

Assume one scraper operates 8,760 hours/year

fuel consumption 122640 gal

CO2	22.2lb/gal	1361.304	tons	EPA Emission Facts EPA420-F-05-003 (February 2005)

SO2 Assume 15 ppm S
Mol. Wt of SO2 = 2 *S
Diesel fuel 7.05 lb/gal AP-42 Appendix A, page A-7
gal*lb/gal/1000000*15ppm/2000lb/ton
SO2 Emissions 0.013 Tons

Note: MT is shorthand for empty

Topsoil FEL/Truck

Topsoil is 12 in-thick, haul truck capacity is 100 tons, Truck MT weight is 80.4 tons, full weight is 180.4 tons
One-way travel distance is 0.85 miles

Alt B Acres Disturbed	61	Cubic Yards/yr	98413	Tons/yr	147620	Trips/yr	1476
Alt C Acres Disturbed	61	Cubic Yards/yr	98413	Tons/yr	147620	Trips/yr	1476

Haul Truck Travel
AP-42 13.2.2.2 Equation 1a and Table 13.2.2-2

E = k (s/12)^a (W/3)^b lb/VMT

Use PM10 particle size multipliers for unpaved roads AP-42 13.2.2
Use PM2.5 particle size multiplier from MRI, 2006 (Background document for Revisions to Fine Fraction Ratios Used in AP-42 - Table 1)

TSP MT EF	11.33	TSP Full EF	16.30	lb/VMT
PM10 MT EF	2.89	PM10 Full EF	4.15	
PM2.5 MT EF	0.29	PM2.5 Full EF	0.42	

Uncontrolled Tons/yr (EF*MT Trips + EF*Full Trips)*One way Distance/2000

	TSP	PM10	PM2.5
Alt B Tons/yr	17.3	4.4	0.44
Alt C Tons/yr	17.3	4.4	0.44

Topsoil Haul Road Control Efficiency 70% Assume roads will be watered (UDEQ Memo, March 10, 2008)

	TSP	PM10	PM2.5
Alt B Tons/yr	5.2	1.3	0.1
Alt C Tons/yr	5.2	1.3	0.1

Topsoil Truck Load/ Truck Unload - AP-42 11.9-4, Tons/yr (load 0.037 lb/ton, unload 0.012 lb/ton)
lb/ton*tons/year/2000 lb/ton

	TSP	PM10	PM2.5
Alt B Tons/yr	3.62	1.09	0.11
Alt C Tons/yr	3.62	1.09	0.11

Gaseous (Combustion) Emissions
Emission factors in g/kW-hr from
FR Vol. 69 No. 124 6/29/2004 Table 7
CAT 777F Off-highway Truck (nonroad vehicle)
700 kW
22.05 gal/hr fuel consumption (Caterpillar email)
Assume 1/3 of available hours for trucks (8760/3)
g/kW-hr*kW*8,760/3 hours/year/907185 grams/ton

	g/kW-hr	Emissions, Tons	
NOx	3.5	7.9	Emission factors in g/kW-hr from

VOC	0.4	0.9		FR Vol. 69 No. 124 6/29/2004 Table 7
CO	3.5	7.9		907,185 grams/ton
PM	0.1	0.2		
fuel consumption		193158	gal	
CO2	22.2lb/gal	2144.0538	tons	EPA Emission Facts EPA420-F-05-003 (February 2005)
SO2	Assume 15 ppm S			
	Mol. Wt of SO2 = 2 *S			
Diesel fuel 7.05 lb/gal		AP-42 Appendix A, page A-7		
gal*lb/gal/1000000*15ppm/2000lb/ton				
SO2 Emissions		0.010	Tons	
Emission factors in g/kW-hr from				
FR Vol. 69 No. 124 6/29/2004 Table 6				
Cat 990H Loader, 468 kw, 22.6 gal/hr				
468	kW			
22.6	gal/hr			
Assume 1/3 of available hours for the loader (8760/3)				
g/kW-hr*kW*8,760 hours/year/3/907185 grams/ton				
	g/kW-hr	Emissions, Tons		
NOx	0.4	0.6		Emission factors in g/kW-hr from
VOC	0.19	0.3		FR Vol. 69 No. 124 6/29/2004 Table 6
CO	3.5	5.3		907,185 grams/ton
PM	0.02	0.03		
Assume loader operates 2920 hours per year				
fuel consumption		65992	gal	
CO2	22.2lb/gal	732.5112	tons	EPA Emission Facts EPA420-F-05-001
SO2	Assume 15 ppm S			
	Mol. Wt of SO2 = 2 *S			
Diesel fuel 7.05 lb/gal				
gal*lb/gal/1000000*15ppm/2000lb/ton				
SO2 Emissions		0.0070	Tons	

Overburden Loading/Unloading

13,117,440 tons of overburden moved by truck

Haul truck capacity is 420 tons, Truck MT weight is 307 tons, full weight is 727 tons

One-way travel distance is 0.85 miles

Alt B Acres Disturbed/yr	61	Cubic Yards/yr	10,240,000	Tons/yr	13,117,440	Trips/yr	31,232	Trips/hr	3.6	Assume 2 trucks will each
Alt C Acres Disturbed/yr	61	Cubic Yards/yr	10,240,000	Tons/yr	13,117,440	Trips/yr	31,232	Trips/hr	3.6	make 2 trips each hour

Haul Truck Travel

AP-42 13.2.2.2 Equation 1a and Table 13.2.2-2

E = k (s/12)^a (W/3)^b

Use PM10 particle size multipliers for unpaved roads AP-42 13.2.2

Use PM2.5 particle size multiplier from MRI, 2006 (Background document for Revisions to Fine Fraction Ratios Used in AP-42 - Table 1)

TSP MT EF	20.71	TSP Full EF	30.52	lb/VMT
PM10 MT EF	5.28	PM10 Full EF	7.78	
PM2.5 MT EF	0.53	PM2.5 Full EF	0.78	

Uncontrolled Tons/yr — (EF*MT Trips + EF*Full Trips)*One way Distance/2000

	TSP	PM10	PM2.5
Alt B Tons/yr	600.0	152.92	15.29
Alt C Tons/yr	600.0	152.9	15.29

Overburden Haul Road Control Efficiency — 85 — 70 — Assume 70% of roads will be treated with chemical suppressants and watered (85% control), and 30% of roads will be watered (70% control) (UDEQ Memo, March 10, 2008)

	TSP	PM10	PM2.5		TSP	PM10	PM2.5		TSP	PM10	PM2.5
Alt B Tons/yr	117.0	29.8	3.0	70%	63.0	16.1	1.6	30%	54.0	13.8	1.4
Alt C Tons/yr	117.0	29.8	3.0	Portion	63.0	16.1	1.6	Portion	54.0	13.8	1.4
				Percent of total		53.8	53.8			46.2	46.2

Gaseous (Combustion) Emissions (Haul Truck)

The values 53.8 and 46.2 percent are used in the Apportioning spreadsheet.

Emission factors in g/kW-hr from FR Vol. 69 No. 124 6/29/2004 Table 7

CAT 797B Off-highway Truck (nonroad vehicle)

2513 kW

54 gal/hr fuel consumption (Caterpillar email)

2*g/kW-hr*kW*8,760 hours/year/907185 grams/ton

assume 2 trucks are required

	g/kW-hr	Emissions, Tons		
NOx	3.5	169.9		Emission factors in g/kW-hr from
VOC	0.4	19.4		FR Vol. 69 No. 124 6/29/2004 Table 7
CO	3.5	169.9		907,185 grams/ton
PM	0.1	4.9		
fuel consumption		946080	gal	
CO2	22.2lb/gal	10501.488	tons	EPA Emission Facts EPA420-F-05-003 (February 2005)
SO2	Assume 15 ppm S Mol. Wt of SO2 = 2 *S			
Diesel fuel 7.05 lb/gal gal*lb/gal/1000000*15ppm/2000lb/ton				AP-42 Appendix A, page A-7
SO2 Emissions		0.050	Tons	

Overburden Load/Unload

Use aggregate loading emission factor (AP-42 13.2.4-4) for loading the overburden haul trucks

Overburden Loading and Unloading - AP-42 13.2.4-4, Tons/yr

E = k(0.0032)(U/5)^1.3/(M/2)^1.4, pounds/ton
lb/ton*tons/year/2000 lb/ton

Particle Size Multiplier (k)

	TSP	PM10	PM2.5
	0.74	0.35	0.053
Emissions			
Alt B Tons/yr	4.2	2.0	0.3
Alt C Tons/yr	4.2	2.0	0.3

Total Overburden Load/Unload

	TSP	PM10	PM2.5
Alt B Tons/yr	8	4	1
Alt C Tons/yr	8	4	1

Assume an Electric 36 cubic yard power shovel, so no gaseous emissions

Wind Erosion

	TSP	PM10	PM2.5
Particle size factors from AP-42 13.2.5	1	0.5	0.075

Wind Erosion emission factor from AP-42 11.9
0.38 t/ac-year*ac*particle size

factor

Calculate emissions for entire disturbed area

Uncontrolled Emissions	TSP	PM10	PM2.5		
Alt B	76	38	5.7	tons	
Alt C	151	76	11		

Uncontrolled Emissions Total development 50 % of area				Percent of area that can be watered prior to a high wind event	
Alt B	38	19	2.8	64	(JBR Memo 3/3/10)
Main Coal Pit 30 % of area Alt B	23	11	1.7	100	(JBR Memo 3/3/10)
Reclamation 20 % of area Alt B	15	7.6	1.1	100	(JBR Memo 3/3/10)

Percent control for areas that are watered		WRAP Fugitive Dust Handbook, Chapter 9.
	90	

Controlled Emissions Total development 50 % of area			
Alt B	16	8.0	1.2
Main Coal Pit 30 % of area Alt B	2.3	1.1	0.17
Reclamation 20 % of area Alt B	1.5	0.76	0.11
Total Alt B	20	10	1.5

Uncontrolled Emissions Total development 50 % of area				Percent of area that can be watered prior to a high wind event	
Alt C	76	38	5.7	64	(JBR Memo 3/3/10)
Main Coal Pit 30 % of area Alt C	45	23	3.4	100	(JBR Memo 3/3/10)
Reclamation 20 % of area Alt C	30	15	2.3	100	(JBR Memo 3/3/10)

Percent control for areas that are watered	
	90

Controlled Emissions Total development 50 % of area			
Alt C	32	16	2.4
Main Coal Pit 30 % of area Alt C	4.5	2.3	0.34
Reclamation 20 % of area Alt C	3.0	1.5	0.23
Total Alt C	40	20	3.0

Coal Haul Trucks

Haul truck capacity is 100 tons, Truck MT weight is 80.4 tons, full weight is 180.4 tons
One-way travel distance is 1 mile

	Tons/yr	2000000	Trips/yr	20000	Trips/hour	2.3

Haul Truck Travel
AP-42 13.2.2-4 Equation 1a and Table 13.2.2-2
E = k (s/12)^a (W/3)^b

Assume one truck can make 2-3 trips/hour
Assume the equivalent of
1 truck working 8,760 hours/year

Use PM10 particle size multipliers for unpaved roads AP-42 13.2.2
Use PM2.5 particle size multiplier from MRI, 2006 (Background document for Revisions to Fine Fraction Ratios Used in AP-42 - Table 1)

TSP MT EF	11.33	TSP Full EF	16.30	lb/VMT
PM10 MT EF	2.89	PM10 Full EF	4.15	
PM2.5 MT EF	0.29	PM2.5 Full EF	0.42	

(EF*MT Trips + EF*Full Trips)*One way Distance/2000

	TSP	PM10	PM2.5
Uncontrolled Tons/yr	276.3	70.43	7.04

Coal Haul Road Control Efficiency		85	70

Assume 80% of roads will be treated with chemical suppressants and watered (85% control), and 20% of roads will be watered (70% control) (UDEQ Memo, March 10, 2008)

	TSP	PM10	PM2.5
Controlled Tons/yr	49.7	12.68	1.3

	TSP	PM10	PM2.5
80% Portion	33.2	8.45	0.8
Percent of total		66.7	66.7

	TSP	PM10	PM2.5
20% Portion	16.6	4.23	0.4
		33.3	33.3

Coal Loading in Pit

For Apportioning Spreadsheet

33.3 percent represents the emissions in the Main Coal Pit
Of the remaining 66.7 percent, the percentage is apportioned based on the original distribution (10% to Total Development and 70% to Coal Truck Haul Road.
So, 1/8 of 66.7 percent (8.3%) is assigned to Total Development
and 7/8 of 66.7 percent (58.4%) is assigned to To Coal Truck Haul Road.

AP-42 13.2.4-4
E = k(0.0032)(U/5)^1.3/(M/2)^1.4, pounds/ton
lb/ton*tons/year/2000 lb/ton

	TSP	PM10	PM2.5
Particle Size Multiplier (k)	0.74	0.35	0.053
Uncontrolled Emissions (ton/yr)	0.44	0.21	0.03

Gaseous (Combustion) Emissions
Emission factors in g/kW-hr from
FR Vol. 69 No. 124 6/29/2004 Table 6
Cat 990H Loader, 468 kw, 22.6 gal/hr

468	kW
22.6	gal/hr

g/kW-hr*kW*8,760 hours/year/907185 grams/ton

	g/kW-hr	Emissions, Tons		
NOx	0.4	1.8		Emission factors in g/kW-hr from
VOC	0.19	0.9		FR Vol. 69 No. 124 6/29/2004 Table 6
CO	3.5	15.8		
PM	0.02	0.1		

Assume loader operates 8760 hours per year

fuel consumption		197976	gal	
CO2	22.2lb/gal	2197.53	tons	EPA Emission Facts EPA420-F-05-003 (February 2005)
SO2	Assume 15 ppm S Mol. Wt of SO2 = 2 *S			
Diesel fuel 7.05 lb/gal		AP-42 Appendix A, page A-7		
SO2 Emissions		0.021	Tons	

Coal Haul Truck
Emission factors in g/kW-hr from
FR Vol. 69 No. 124 6/29/2004 Table 7

CAT 777F Off-highway Truck
700 kW
22.05 gal/hr fuel consumption (Caterpillar email)

700	kW			
22.05	gal/hr			

g/kW-hr*kW*8,760 hours/year/907185 grams/ton

	g/kW-hr	Emissions, Tons		
NOx	3.5	23.7		Emission factors in g/kW-hr from
VOC	0.4	2.7		FR Vol. 69 No. 124 6/29/2004 Table 7
CO	3.5	23.7		
PM	0.1	0.7		

fuel consumption		193158	gal	
CO2	22.2lb/gal	2144.0538	tons	EPA Emission Facts EPA420-F-05-001
SO2	Assume 15 ppm S Mol. Wt of SO2 = 2 *S			
Diesel fuel 7.05 lb/gal				
gal*lb/gal/1000000*15ppm/2000lb/ton				
SO2 Emissions		0.010	Tons	

Coal Dumping at Processing Facility

AP-42 13.2.4-4
E = k(0.0032)(U/5)^1.3/(M/2)^1.4, pounds/ton
lb/ton*tons/year/2000 lb/ton

	TSP	PM10	PM2.5
Particle Size Multiplier (k)	0.74	0.35	0.053
Uncontrolled Emissions (ton/yr)	0.44	0.21	0.03

Coal Processing

EF from WRAP Fugitive Dust Handbook Chapter 11. Mineral Products Industry
Coal Processing Control Efficiency 95% Conservative estimate for control - JBR Memo 3/3/10

	TSP	PM10	PM2.5
lb/ton	0.50	0.17	0.017
Tons/year	2,000,000	2,000,000	2,000,000
Uncontrolled Emissions TPY	500	170	17
Controlled Emissions TPY	25	8.5	0.85

Coal Pile Wind Erosion at Mine

AP-42 Table 11.9-1 Active storage pile (wind erosion and maintenance)

TSP = 0.72 u	lb/acre-hr	u = wind speed, mph	7.0	4-year average wind speed from Cedar City

For PM10 use fraction from coal processing (0.17/0.50 = 0.34)
For PM2.5 use 0.1 * PM10

	TSP	PM10	PM2.5
Uncontrolled Emissions (ton/yr)	86	29	2.9

Coal Storage Control Efficiency (mine)	90	%	WRAP Fugitive Dust Handbook, Chapter 9.

	TSP	PM10	PM2.5
Controlled Emissions (ton/yr)	8.6	2.9	0.29

Coal Loading Into OTR Trucks

AP-42 13.2.4-4
E = k(0.0032)(U/5)^1.3/(M/2)^1.4, pounds/ton
lb/ton*tons/year/2000 lb/ton

Coal Loading Into OTR Trucks Control Efficiency	95	%	Assume this activity will be enclosed (Conservative estimate - Alton Coal - JRB Memo 3/3/10); at mine and loadout

	TSP	PM10	PM2.5
Particle Size Multiplier (k)	0.74	0.35	0.053
Uncontrolled Emissions (ton/yr)	0.44	0.21	0.03
Controlled Emissions (ton/yr)	0.02	0.01	0.00

Coal Dumping at Loadout

E = k(0.0032)(U/5)^1.3/(M/2)^1.4, pounds/ton
lb/ton*tons/year/2000 lb/ton

	TSP	PM10	PM2.5
Particle Size Multiplier (k)	0.74	0.35	0.053
Uncontrolled Emissions (ton/yr)	0.44	0.21	0.03

Coal Pile Wind Erosion at Loadout

AP-42 Table 11.9-1 Active storage pile (wind erosion and maintenance)

TSP = 0.72 u	lb/acre-hr	u = wind speed, mph	7	4-year average wind speed from Cedar City

For PM10 use fraction from coal processing (0.17/0.50 = 0.34)
For PM2.5 use 0.1 * PM10

Uncontrolled Emissions (ton/yr)	TSP	PM10	PM2.5
	86	29	2.9

Coal Storage Control Efficiency (loadout)	90	%

WRAP Fugitive Dust Handbook, Chapter 9.

	TSP	PM10	PM2.5
Controlled Emissions (ton/yr)	8.6	2.9	0.29

Train Loading

E = k(0.0032)(U/5)^1.3/(M/2)^1.4, pounds/ton
lb/ton*tons/year/2000 lb/ton

Coal Loading into Trains Control Efficiency	95	%

Assume this activity will be enclosed (Conservative estimate - Alton Coal - JRB Memo 3/3/10); at mine and loadout

	TSP	PM10	PM2.5
Particle Size Multiplier (k)	0.74	0.35	0.053
Uncontrolled Emissions (ton/yr)	0.44	0.21	0.03

Controlled Emissions (ton/yr)	0.02	0.01	0.00

Access Road
Traffic

	160	employees	5	RT distance (miles)
VMT Employees		292000		

Coal OTR Trucks	2,000,000	Tons	
Truck capacity	43.3	Tons	Based on Manufacturer Specifications
Truck MT Weight	20.95	Tons	Based on Manufacturer Specifications
Average Weight	42.6	Tons	
One-Way Dist.	2.5	Miles	
Trips	46189		
VMT MT or Full	115473		

AP-42 13.2.2.2 Equation 1a and Table 13.2.2-2
E = k (s/12)^a (W/3)^b

Use PM10 particle size multipliers for unpaved roads AP-42 13.2.2
Use PM2.5 particle size multiplier from MRI, 2006 (Background document for Revisions to Fine Fraction Ratios Used in AP-42 - Table 1)

	Employees		OTR Coal Trucks Full	OTR Coal Trucks MT
TSP EF	2.38	lb/VMT	10.24	6.19
PM10 EF	0.61		2.61	1.58
PM2.5 EF	0.06		0.26	0.16

	TSP	PM10	PM2.5		
Uncontrolled Tons/yr	347.0	88.4		8.84	Employees
	591.5	150.7		15.07	OTR Coal Trucks Full
	357.2	91.0		9.10	OTR Coal Trucks MT
Access Road Control Efficiency			85%		Assume chemical suppressant and water (UDEQ Memo, March 10, 2008)
Controlled Tons/yr	52	13		1.3	Employees
	89	23		2.3	OTR Coal Trucks Full
	54	14		1.4	OTR Coal Trucks MT
	194	50		5.0	Total

Bulldozers

AP-42 Table 11.9-1 E = 5.7(s)^1.2 /(M)^1.3 lb/hr*8,760 hr/yr * # of bulldozers / 2000 lb/ton

5	bulldozers				
	TSP	PM10	PM2.5		PM15

EF	4.0	0.8	0.4	1.0	lb/hr
Emissions	87.8	16.8	9.2	22.5	tons

Gaseous (Combustion) Emissions

Emission factors in g/kW-hr from
FR Vol. 69 No. 124 6/29/2004 Table 6
CAT D7R

179 kW
9.3 gal/hr fuel consumption (Caterpillar email)

	g/kW-hr	Emissions, Tons	
NOx	0.4	3.5	Emission factors in g/kW-hr from
VOC	0.19	1.6	FR Vol. 69 No. 124 6/29/2004 Table 6
CO	3.5	30.2	
PM	0.02	0.2	

fuel consumption		407340	gal
CO2	22.2lb/gal	4521.474	EPA Emission Facts EPA420-F-05-003 (February 2005)
SO2	Assume 15 ppm S Mol. Wt of SO2 = 2 *S Diesel fuel 7.05 lb/gal		AP-42 Appendix A, page A-7
SO2 Emissions		0.043	Tons

Generators

2,000	kW of power needed	1	kW =	1.341022	HP
3 1000 kW generators (one is a backup)		2000	kW =	2682.044	

Gaseous (Combustion) Emissions

69.3 gal/hr fuel consumption at 75% load (Caterpillar 1230 ekW gen set)

	g/kW-hr	Emissions, Tons	
PM	0.1	1.9	Generators are subject to 40 CFR Part 60 Subpart IIII
NOx	0.67	12.9	Section 60.4201(a) makes the generators in 2011-2014 subject to
VOC	0.4	7.7	the Tier 4 standards
CO	3.5	67.6	FR Vol. 69 No.124 June 29, 2004
			Section 1039.102 Table 7

fuel consumption		1214136	gal
CO2	22.2lb/gal	13476.91	EPA Emission Facts EPA420-F-05-003 (February 2005)
SO2	Assume 15 ppm S		
	Mol. Wt of SO2 = 2 *S		
Diesel fuel 7.05 lb/gal			AP-42 Appendix A, page A-7
SO2 Emissions		0.128	Tons

HAPS

AP-42 Table 3.4-1 (10/96)

TOC	0.090	lb/MMBtu
NMHC	0.0819	
Benzene	7.76E-04	
Toluene	2.81E-04	
Xylenes	1.93E-04	
Formaldehyde	7.89E-05	
Acetaldehyde	2.52E-05	
Acrolein	7.88E-06	

To calculate HAPS, use the EF ratio HAP/NMHC * VOC emissions

Benzene	Toluene	Xylenes	Formaldehyde	Acetaldehyde	Acrolein
7.32E-02	2.65E-02	1.82E-02	7.44E-03	2.38E-03	7.43E-04

Service Vehicles

Assume 10 vehicles, 20 miles/day each

VMT 73000

Unpaved Road Travel
AP-42 13.2.2.2 Equation 1a and Table 13.2.2-2
E = k (s/12)^a (W/3)^b

Use PM10 particle size multipliers for unpaved roads AP-42 13.2.2
Use PM2.5 particle size multiplier from MRI, 2006 (Background document for Revisions to Fine Fraction Ratios Used in AP-42 - Table 1)

TSP EF	2.94	lb/VMT
PM10 EF	0.75	
PM2.5 EF	0.07	

Uncontrolled Tons/yr (EF*VMT)/2000

TSP	PM10	PM2.5
107.2	27.3	2.73

Haul Road Control Efficiency				85		70	Assume 80% of roads will be treated with chemical suppressants and watered (85% control), and 20% of roads will be watered (70% control) (UDEQ Memo, March 10, 2008)				
Controlled Tons/yr				TSP	PM10	PM2.5		TSP	PM10	PM2.5	
	19.3	4.9	0.5	80%	12.9	3.3	0.3	20%	6.4	1.6	0.2
				Portion				Portion			
Graders				Percent of total		66.7	66.7			33.3	33.3

AP-42 Table 11.9-1 (0.040 (S)^2.5 TSP lb/hr)*3 mph * 10 hr/day * 365 days/yr * 2 graders

For Apportioning Spreadsheet

33.3 percent represents the emissions in the Main Coal Pit
Of the remaining 66.7 percent, the percentage is apportioned based on the original distribution (50%
to Total Development and 30% to Coal Truck Haul Road.
So, 5/8 of 66.7 percent (41.7%) is assigned to Total Development
and 3/8 of 66.7 percent (25%) is assigned to To Coal Truck Haul Road.

Assume 2 graders, 3 miles/hour, 10 hours/day

VMT 21900

TSP EF	0.62	lb/VMT
PM10 EF	0.28	
PM2.5 EF	0.02	
PM15 EF	0.46	

Uncontrolled Tons

TSP	PM10	PM2.5
6.8	3.0	0.2

Grader Control Efficiency 55% WRAP Fugitive Dust Handbook Section 6. Unpaved Roads
Grader is not just traveling on the roads, but is grading them, so a lower control efficiency is appropriate

3.1	1.4	0.10

Gaseous (Combustion) Emissions

Emission factors in g/kW-hr from
FR Vol. 69 No. 124 6/29/2004 Table 6
CAT 140M Motor Grader

148	kW
5.95	gal/hr fuel consumption (Caterpillar email)
2	graders

	g/kW-hr	Emissions, Tons	
NOx	0.4	1.1	Emission factors in g/kW-hr from
VOC	0.19	0.5	FR Vol. 69 No. 124 6/29/2004 Table 6
CO	3.5	10.0	
PM	0.02	0.06	

fuel consumption	43435	gal	gal/hr * 10 hours/grader-day * 365 days/year * 2 graders
CO2	22.2lb/gal	482.1285	tons EPA Emission Facts EPA420-F-05-003 (February 2005)
SO2	Assume 15 ppm S		
	Mol. Wt of SO2 = 2 *S		
Diesel fuel 7.05 lb/gal			AP-42 Appendix A, page A-7
SO2 Emissions	0.0046	Tons	

Blasting

AP-42 Table 11.9-1	E = 0.000014(A)^1.5 TSP lb/blast * # of blasts / 2000 lb/ton				
Area per blast		1000	m2	10764	ft2
62 blasts per year					

	TSP	PM10	PM2.5
lb/blast	15.63	8.13	0.47
ton/year	0.48	0.25	0.01

Ammonium nitrate and fuel oil (ANFO)
ANFO - Use AP-42 Table 13.3-1 EFs

0.6	lb ANFO/yd3	Email from Chris Court ACD
1,000,000	yd3 blasted/yr	
300	Tons ANFO	

		lb/ton ANFO		
CO	67		10.05	ton
NOx	17		2.55	
SO2	2		0.3	

Paved Road Emissions

AP-42 13.2.1.3 eqn 1 E = k(sL/2)^0.65 (W/3)^1.5 - C lb/VMT
160 employees, 60 mile RT

Cars/Light Trucks (LT) Travel

VMT	3504000				
	TSP	PM10	PM2.5	PM2.5 set to zero per AP-42	
lb/VMT	0.00952	0.00148	-0.00007	0	
ton/year	16.68	2.59	-0.12	0	
Haul Trucks					
Coal	2,000,000	Tons			
Truck capacity	43.3	Tons			
Truck MT Weight	20.95	Tons	Based on Topsoil haul truck - empty weight is 80 percent of capacity		
One-way Dist.	110	Miles			
Trips	46189				
VMT MT or Full	5080831				
	TSP	PM10	PM2.5		
lb/VMT MT	0.3383	0.0656	0.0094		
lb/VMT Full	1.8190	0.3545	0.0053		
lb/VMT Avg					
Ton/year	5480	1067	38		

Gaseous (Combustion) Emissions

Cars/LT					
Assume 1/2 cars, 1/2 LT					
Fuel Economy	27.5	mpg-cars	23.5	mpg-LT trucks	CAFE Proposed Rule for 2010
Avg. Fuel Economy	25.5	mpg			
Gallons of fuel	137411.8				
Gasoline density	6.17 lb/gal	AP-42 Appendix A, page A-7			
CO2 lb/gallon - gasoline	19.4	EPA Emission Facts EPA420-F-05-003 (February 2005)			
CO2 Emissions	1332.894				

Gaseous (Combustion) Emissions

Heavy Duty Diesel Vehicles - OTR Trucks (NOx, CO, and VOC emissions in the Mobile 6 UDAQ tab)

	6.6 mpg	Atmospheric Environment 40 (2006)			
fuel consumption		1539646	gal		
CO2	22.2lb/gal	17090.07	tons	EPA Emission Facts EPA420-F-05-003 (February 2005)	

SO2	Assume 15 ppm S Mol. Wt of SO2 = 2 *S		
Diesel fuel 7.05 lb/gal			
SO2 Emissions		0.163	Tons

Mobile 6 UDAQ
Gaseous (Combustion) Emissions
Use Kane County Emission Factors
Rural Other Principal Arterial

	Emission Factors, g/mi			
	LDGV	LDGT	HDDV	
PM	0.0267	0.029	0.4782	
NOx	1.509	1.902	14.635	
VOC	1.849	2.308	0.869	
CO	25.6	32.91	6.538	The Sulfur content of gasoline in the Mobile 6 runs was 160 ppm vs a standard of 30 ppm
Rev SO2	0.006825	0.009394		The SO2 emission factors were adjusted accordingly
Base SO2	0.0364	0.0501		For HDDVs assume SO2 emissions are captured in the Paved Road tab

Access Road VMT		
Employees	292000	
Access Road VMT OTR Coal Trucks	230947	
Paved Road VMT - cars/LT	3504000	assume 1/2 cars, 1/2 LT
Paved Road VMT - haul trucks	10161663	
Service Vehicle VMT	73000	

Emissions, tons

Access Road - Employees

	LDGV	LDGT	Total
PM	0.00	0.00	0.01
NOx	0.24	0.31	0.55
VOC	0.30	0.37	0.67
CO	4.12	5.30	9.42
Rev SO2	0.00	0.00	0.003

Access Road OTR Coal Trucks

	HDDV
PM	0.12
NOx	3.73
VOC	0.22
CO	1.66

Cars/LT
Assume 1/2 cars, 1/2 LT

Fuel Economy	27.5	mpg-cars	23.5	mpg-LT trucks	CAFE Proposed Rule for 2010
Avg. Fuel Economy	25.5	mpg			
Gallons of fuel	11450.9804				
Gasoline density	6.17 lb/gal	AP-42 Appendix A, page A-7			
CO2 lb/gallon - gasoline	19.4	EPA Emission Facts EPA420-F-05-003 (February 2005)			
CO2 Emissions, tons	111.07451				

Access Road
OTR Coal Haul Trucks

	6.6	mpg	Atmospheric Environment 40 (2006)	
fuel consumption			34991.95	gal
CO2		22.2lb/gal	388	tons
SO2		Assume 15 ppm S Mol. Wt of SO2 = 2 *S		
Diesel fuel 7.05 lb/gal				
SO2 Emissions			0.004	Tons

Paved Road - cars/LT - tons/year

	LDGV	LDGT	Total
PM	0.05	0.06	0.11
NOx	2.91	3.67	6.59
VOC	3.57	4.46	8.03
CO	49.44	63.56	113.00
Rev SO2	0.01	0.02	0.03

Haul Trucks - tons/year

	HDDV
PM	5.36
NOx	163.93
VOC	9.73
CO	73.23

Service Vehicles - tons/year

	HDDV
PM	0.04
NOx	1.18
VOC	0.07
CO	0.53

Heavy Duty Diesel Vehicles - Service Vehicles

	6.6	mpg	Atmospheric Environment 40 (2006)	
fuel consumption			11060.61	gal
CO2		22.2lb/gal	122.7727	tons
SO2		Assume 15 ppm S Mol. Wt of SO2 = 2 *S		
Diesel fuel 7.05 lb/gal				
SO2 Emissions			0.001	Tons

Underground Mining
Coal Haul Trucks
Same as for surface mining
Haul truck capacity is 100 tons, Truck MT weight is 80.4 tons, full weight is180.4 tons
One-way travel distance is 1 mile

Tons 2000000 Trips 20000

AP-42 13.2.2.2 Equation 1a and Table 13.2.2-2
E = k (s/12)^a (W/3)^b

Use PM10 particle size multipliers for unpaved roads AP-42 13.2.2
Use PM2.5 particle size multiplier from MRI, 2006 (Background document for Revisions to Fine Fraction Ratios Used in AP-42 - Table 1)

TSP MT EF	11.33	TSP Full EF	16.30	lb/VMT
PM10 MT EF	2.89	PM10 Full EF	4.15	
PM2.5 MT EF	0.29	PM2.5 Full EF	0.42	

Uncontrolled Tons/yr (EF*MT Trips + EF*Full Trips)*One way Distance/2000

TSP	PM10	PM2.5
276.3	70.4	7.04

Coal Haul Road Control Efficiency 85% Assume chemical suppressant and water (UDEQ Memo, March 10, 2008)

TSP	PM10	PM2.5
41.5	10.6	1.1

Coal Loading
Same as for surface mining coal loading

AP-42 13.2.4-4
E = k(0.0032)(U/5)^1.3/(M/2)^1.4, pounds/ton
lb/ton*tons/year/2000 lb/ton

	TSP	PM10	PM2.5
Particle Size Multiplier (k)	0.74	0.35	0.053
Uncontrolled Emissions (ton/yr)	0.44	0.21	0.03

Emission factors in g/kW-hr from
FR Vol. 69 No. 124 6/29/2004 Table 6
Cat 990H Loader, 468 kw, 22.6 gal/hr

Cat 990H Loader
468 kW
22.6 gal/hr

	g/kW-hr	Emissions, Tons	
NOx	0.4	1.8	Emission factors in g/kW-hr from
VOC	0.19	0.9	FR Vol. 69 No. 124 6/29/2004 Table 6
CO	3.5	15.8	
PM	0.02	0.1	

Assume loader operates 8760 hours per year

fuel consumption	197976	gal	
CO2	22.2lb/gal	2197.5336	EPA Emission Facts EPA420-F-005-001
SO2	Assume 15 ppm S Mol. Wt of SO2 = 2 *S		

Diesel fuel 7.05 lb/gal

SO2 Emissions	0.0209	Tons	

Coal Haul Truck
Emission factors in g/kW-hr from
FR Vol. 69 No. 124 6/29/2004 Table 7
Same as for surface mining
CAT 777F Off-highway Truck

700 kW
22.05 gal/hr fuel consumption (Caterpillar email)

	g/kW-hr	Emissions, Tons		
NOx	3.5	23.7		Emission factors in g/kW-hr from
VOC	0.4	2.7		FR Vol. 69 No. 124 6/29/2004 Table 7
CO	3.5	23.7		
PM	0.1	0.7		
fuel consumption		193158	gal	
CO2	22.2lb/gal	2144.0538	tons	EPA Emission Facts EPA420-F-05-003 (February 2005)
SO2	Assume 15 ppm S Mol. Wt of SO2 = 2 *S			

Diesel fuel 7.05 lb/gal

SO2 Emissions	0.0204	Tons	

2 highwall miners, 2 MMtpy mined

Generators
3,000 kW of power needed
2 1500 kW generators

Gaseous

	3000	kW of power needed		1	kW =	1.341022	HP
				3000	kW =	4023.066	
		kW					
	92.6	gal/hr fuel consumption at 75% load (Caterpillar 1650 ekW gen set) - each					

	g/kW-hr	Emissions, Tons		
PM	0.1	2.9		Generators are subject to 40 CFR Part 60 Subpart IIII
NOx	0.67	19.4		Section 60.4201(a) makes the generators in 2011-2014 subject to
VOC	0.4	11.6		the Tier 4 standards
CO	3.5	101.4		FR Vol. 69 No.124 June 29, 2004
				Section 1039.102 Table 7
fuel consumption		1622352	gal	
CO2	22.2lb/gal	18008.1072	tons	EPA Emission Facts EPA420-F-05-003 (February 2005)
SO2	Assume 15 ppm S			
	Mol. Wt of SO2 = 2 *S			
Diesel fuel 7.05 lb/gal				
SO2 Emissions		0.172	Tons	

HAPS

AP-42 Table 3.4-1

TOC	0.090 lb/MMBtu
NMHC	0.0819
Benzene	7.76E-04
Toluene	2.81E-04
Xylenes	1.93E-04
Formaldehyde	7.89E-05
Acetaldehyde	2.52E-05
Acrolein	7.88E-06

To calculate HAPS, use the EF ratio HAP/NMHC * VOC emissions

Benzene	Toluene	Xylenes	Formaldehyde	Acetaldehyde	Acrolein
1.84E-01	6.66E-02	4.57E-02	1.87E-02	5.97E-03	1.87E-03

Coal Dumping from Highwall Miner

AP-42 13.2.4-4
E = k(0.0032)(U/5)^1.3/(M/2)^1.4, pounds/ton
lb/ton*tons/year/2000 lb/ton

	TSP	PM10	PM2.5
Particle Size Multiplier (k)	0.74	0.35	0.053
Uncontrolled Emissions (ton/yr)	0.44	0.21	0.03

Duel and Kim Reference

Gas Content of Coal in Alton Coal Field
Assume gas is 100 % methane (CH^4)
Assume 100 % of methane in coal is released

	cm^3/g	ft^3/ton	ft^3/yr	ton CH4/yr	ton CO^2e/yr
Smirl Coal Bed	0.10	3.2036762	6407352.5	269216	5,653,546

Constants

907185	g/ton	
28317	cm^3/ft^3	
2000000	ton/yr	
23.8	ft^3/lb	AP-42 Appendix A
21	Global warming potential	

Alton Tract - Alternative B

Area Source PM10 Apportioning Calculations

Max Development Year	Area	Access Road Traffic	Coal Haul Truck Traffic -PM	Coal Haul Truck Traffic -Gases	Graders	Service_veh-PM	Service_veh-Gases	Bulldozers	Overburden Loading	Overburden Haul Truck - PM	Overburden Haul Truck - Gases	Topsoil Scraping	Coal Loading	Blasting	Wind Erosion	Coal Processing	Generators	Total		
Worst-Case	Total Development		8%	10%	50%	42%	50%	50%	70%	54%	70%			70%	50%					
	Main Coal Pit		33%	20%	20%	33%	20%	30%	30%	46%	30%		100%	30%	30%					
	Reclamation							20%				100%			20%					
	Coal Haul Truck Road		58%	70%	30%	25%	30%													
	Access Road	100%																		
	Facilities																		Check	
	PM-10 Emissions (tons)	**49.7**	**12.68**		**1.36**	**4.92**		**16.85**	**4.02**	**29.82**		**10.28**	**0.21**	**0.25**	**19.84**	**11.65**	**1.93**	**163.5**		163.5
	PM-2.5 Emissions (tons)	**5.1**	**1.27**		**0.10**	**0.49**		**9.22**	**0.61**	**2.98**		**1.03**	**0.03**	**0.01**	**2.98**	**1.18**	**1.93**	**26.9**		26.9
	NOx Emissions (tons)	**4.27**		**23.66**	**1.14**		**1.18**	**3.46**	**0.00**		**169.86**	**1.77**	**1.81**	**2.55**	**0.00**	**0.00**	**12.94**	**222.6**		222.6
	CO Emissions (tons)	**11.08**		**23.66**	**10.00**		**0.53**	**30.25**	**0.00**		**169.86**	**15.48**	**15.82**	**10.05**	**0.00**	**0.00**	**67.59**	**354.32**		354.32
	SO2 Emissions (tons)	**0.01**		**0.01**	**0.00**		**0.00**	**0.04**	**0.00**		**0.05**	**0.01**	**0.02**	**0.30**	**0.00**	**0.00**	**0.13**	**0.58**		0.58

Yellow indicates changed emissions

Alton Tract - Alternative C

AERMOD Area Source PM-10 Modeling Emissions

Emissions by Area (g/s)

Emission Activities	Total Annual PM-10 Q (g/s)	Total Development Area	Main Coal Pit	Reclamation	Facilities	Coal Haul Truck Road	Access Road	Check
Graders	0.0390	0.0195	0.0078			0.0117		0.0390
Bulldozers	0.4846	0.2423	0.1454	0.0969				0.4846
Overburden Loading	0.1156	0.0809	0.0347					0.1156
Overburden Haul Truck	0.8578	0.4615	0.3963					0.8578
Topsoil Scraping	0.2956			0.2956				0.2956
Coal Loading	0.0060		0.0060					0.0060
Blasting (within pit)	0.0073	0.0051	0.0022					0.0073
Wind Erosion	0.5708	0.2854	0.1712	0.1142				0.5708
Coal Processing (increase to 25' release height)	0.3351				0.3351			0.3351
Access Road Traffic	1.4287						1.4287	1.4287
Coal Haul Truck	0.3647	0.0303	0.1218			0.2126		0.3647
Service Vehicles (separated from graders line item)	0.1415	0.0590	0.0471			0.0354		0.1415
Total Emissions by Area	**4.6467**	**1.18**	**0.93**	**0.51**	**0.34**	**0.26**	**1.43**	4.6467

Source Description	Total Development Area	Main Coal Pit	Reclamation	Facilities	Coal Haul Truck	Alton to Facilities area
Area (m^2)	806,600	274,081	274,713	152,856		
Emissions (g/s)	1.1840	0.9325	0.5067	0.3351	0.2597	1.4287
Initial Lateral Width (m)						
Road Segment Length (m)						
Model Emission Rate (g/s-m2)	1.4679E-06	3.40236E-06	1.84439E-06	2.19215E-06		
Road Segments					44	140
Volume Source Emission Rate (g/s)					0.0059	0.01021

Open Pits Source Calculations

have to model volume sources as independent adjacent sources with emissions input as g/s (BEEST figures out g/sec-m2 by area and volume inputs)

Coal Pit Volumes(Assumes 180ft Depth)	**Leg 1**	**Leg 2**	**Leg 3**	
Xinit(m)	100.58	100.58	100.58	
Yinit(m)	1325	800	600	
Depth(m)**	54.9	54.9	54.9	**Total Volume of Open pits**
Volume (m3)	7,311,643	4,414,577	3,310,933	15037152.55
Equivalent Surface Area (m2)	133268.5	80464	60348	274080.5

Emissions (g/s)	0.453427041	0.27376727	0.205325452	0.9325	(Matches main coal pit emissions above)
Model Emission Rate (g/s-m2)				3.4024E-06	
Main Pit (Overburden removal, etc.) Assumes 120 foot average depth	**Leg 1**	**Leg 2**	**Leg 3**		
Xinit(m)	296	296	296		
Yinit(m)	1325	800	600		
Depth(m) **	36.58	36.58	36.58	**Total Volume of Open pits**	
Volume (m3)	14,345,107	8,661,197	6,495,898	29502201.60	
Equivalent Surface Area (m2)	392200	236800	177600	806600	
Total (g/s)	0.575710224	0.347598626	0.260698969	1.1840	(Matches total development area emissions above)
Model Emission Rate (g/s-m2)				1.4679E-06	

** The BEEST AERMOD processor figures out the pit depth by using the input volume and surface area for the source

Alton Tract - Alternative C
AERMOD Area Source PM-2.5 Modeling Emissions

Emissions by Area (g/s)

Emission Activities	Total Annual PM-2.5 Q (g/s)	Total Development Area	Main Coal Pit	Reclamation	Facilities	Coal Haul Truck Road	Access Road	
Graders	0.0027	0.0014	0.0005			0.0008		0.0027
Bulldozers	0.2652	0.1326	0.0796	0.0530				0.2652
Overburden Loading	0.0175	0.0123	0.0053					0.0175
Overburden Haul Truck	0.0858	0.0462	0.0396					0.0858
Topsoil Scraping	0.0296			0.0296				0.0296
Coal Loading	0.0009		0.0009					0.0009
Blasting	0.0004	0.0003	0.0001					0.0004
Wind Erosion	0.0856	0.0428	0.0257	0.0171				0.0856
Coal Processing	0.0338				0.0338			0.0338
Access Road Traffic	0.1463						0.1463	0.1463
Coal Haul Truck	0.0365	0.0030	0.0122			0.0213		0.0365
Service Vehicles (separated from graders line item)	0.0141	0.0071	0.0028			0.0042		0.0141
Total, g/sec	**0.718**	**0.25**	**0.17**	**0.10**	**0.03**	**0.03**	**0.15**	0.7185
Total, ton/yr	24.97							

Source Description	Total Development Area	Main Coal Pit	Reclamation	Facilities	Coal Haul Truck	Alton to Facilities area
Area (m^2)	806,600	274,081	274,713	152,856		
Emissions (g/s)	0.2456	0.1667	0.0997	0.0338	0.0263	0.1463
Initial Lateral Width (m)						
Road Segment Length (m)						
Model Emission Rate (g/s-m2)	3.04478E-07	6.08322E-07	3.63027E-07	2.21334E-07		
Road Segments					44	144
Volume Source Emission Rate (g/s)					0.00060	0.00102
					0.001614	Haul road and access road overlap

Open_Pits

Coal Pit Volumes (210' below grade)	**Leg 1**	**Leg 2**	**Leg 3**		
Xinit(m)	110	110	110		
Yinit(m)	1000	1000	750		
Depth(m)	62.5	62.5	62.5		
Volume (m3)	6873240	6873240	5154930	18901410	
Equivalent Surface Area (m2)	110000	110000	82500	302500	
Emissions at Pit Bottom (g/s)				0.0009	
Emissions assumed at 1/2 depth of pit g/s)				0.1508	
Emissions (g/s)	0.015046561	0.055170725	0.041378044	0.1517	0.1115953 31
Model Emission Rate (g/s-m2)				5.0155E-07	

Main Pit (Overburden removal, etc.)	**Leg 1**	**Leg 2**	**Leg 3**

assume 100' below grade				
Xinit(m)	350	350	350	
Yinit(m)	800	1400	700	
Depth(m)	30	30	30	
Volume (m3)	8,400,000	14,700,000	7,350,000	
Equivalent Surface Area (m2)	280000	490000	245000	1015000
emissions in main pit overburden removal area (g/s)				0.0584
other emissions assumed at 1/2 depth of main pit area				0.1771
Total (g/s)	0.064963451	0.113686039	0.0568430 2	0.2355
Model Emission Rate (g/s-m2)				2.3201E-07

Alton Tract - Alternative C

AERMOD Area Source NOx Modeling Emissions

		Emissions by Area (g/s)						
Emission Activities	**Total Annual NOx Q (g/s)**	**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck Road**	**Access Road**	
Graders	0.0329	0.0164	0.0066			0.0099		0.0329
Bulldozers	0.0994	0.0497	0.0298	0.0199				0.0994
Overburden Loading	0.0000	0.0000	0.0000					0.0000
Overburden Haul Truck	4.8865	3.4205	1.4659					4.8865
Topsoil Scraping	0.0509			0.0509				0.0509
Coal Loading	0.0520		0.0520					0.0520
Blasting	0.0734	0.0513	0.0220					0.0734
Wind Erosion	0.0000	0.0000	0.0000	0.0000				0.0000
Coal Processing	0.0000				0.0000			0.0000
Access Road Traffic	0.1230						0.1230	0.1230
Coal Haul Truck	0.6806	0.0681	0.1361			0.4764		0.6806
Service Vehicles (separated from graders line item)	0.0339	0.0169	0.01			0.0102		0.0339
Total	**6.03**	**3.62**	**1.72**	**0.07**	**0.00**	**0.50**	**0.12**	6.03
	209.69							

Source Description	Total Development Area	Main Coal Pit	Reclamation	Facilities	Coal Haul Truck	Alton to Facilities area
Area (m^2)	1,255,880	303,991	264,387	152,856		
Emissions (g/s)	3.6230	1.7192	0.0708	0.0000	0.4964	0.1230
Initial Lateral Width (m)					45.77	45.77
Road Segment Length (m)						
Model Emission Rate (g/s-m2)	2.88486E-06	5.6556E-06	2.6771E-07	0		
Road Segments					66	143
Volume Source Emission Rate (g/s)					0.0075	0.00086
					0.00838	Haul road and access road overlap

Alton Tract - Alternative C

AERMOD Area Source CO Modeling Emissions

		Emissions by Area (g/s)						
Emission Activities	**Total Annual CO Q(g/s)**	**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck Road**	**Access Road**	
Graders	0.2878	0.1439	0.0576			0.0863		0.2878
Bulldozers	0.8702	0.4351	0.2610	0.1740				0.8702
Overburden Loading	0.0000	0.0000	0.0000					0.0000
Overburden Haul Truck	4.8865	3.4205	1.4659					4.8865
Topsoil Scraping	0.4453			0.4453				0.4453
Coal Loading	0.4550		0.4550					0.4550
Blasting	0.2891	0.2024	0.0867					0.2891
Wind Erosion	0.0000	0.0000	0.0000	0.0000				0.0000
Coal Processing	0.0000				0.0000			0.0000
Access Road Traffic	0.3188						0.3188	0.3188
Coal Haul Truck	0.6806	0.0681	0.1361			0.4764		0.6806
Service Vehicles (separated from graders line item)	0.0151	0.0076	0.0030			0.0045		0.0151
Total	**8.23**	**4.27**	**2.46**	**0.62**	**0.00**	**0.56**	**0.32**	8.2331
	286.18							

Source Description	**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck**	**Alton to Facilities area**
Area (m^2)	1,255,880	303,991	264,387	152,856		
Emissions (g/s)	4.2699	2.4624	0.6193	0.0000	0.5627	0.3188
Initial Lateral Width (m)					45.77	45.77
Road Segment Length (m)						
Model Emission Rate (g/s-m2)	3.39995E-06	8.10024E-06	2.34246E-06	0		
Road Segments					66	143
Volume Source Emission Rate (g/s)					0.00853	0.00223
					0.01076	Haul road and access road overlap

Alton Tract - Alternative C

AERMOD Area Source SO2 Modeling Emissions

		Emissions by Area (g/s)						
Emission Activities	**Total Annual SO2 Q(g/s)**	**Total Development Area**	**Main Coal Pit**	**Reclamation**	**Facilities**	**Coal Haul Truck Road**	**Access Road**	
Graders	0.0001	0.0001	0.0000			0.0000		0.0001
Bulldozers	0.0012	0.0006	0.0004	0.0002				0.0012
Overburden Loading	0.0000	0.0000	0.0000					0.0000
Overburden Haul Truck	0.0014	0.0010	0.0004					0.0014
Topsoil Scraping	0.0004			0.0004				0.0004
Coal Loading	0.0006		0.0006					0.0006
Blasting	0.0086	0.0060	0.0026					0.0086
Wind Erosion	0.0000	0.0000	0.0000	0.0000				0.0000
Coal Processing	0.0000				0.0000			0.0000
Access Road Traffic	0.0002						0.0002	0.0002
Coal Haul Truck	0.0003	0.0000	0.0001			0.0002		0.0003
Service Vehicles (separated from graders line item)	0.0000	0.0000	0.0000			0.0000		0.0000
Total	**0.0129**	**0.0078**	**0.0041**	**0.0006**	**0.0000**	**0.0002**	**0.0002**	0.0129
	0.45							

Source Description	Total Development Area	Main Coal Pit	Reclamation	Facilities	Coal Haul Truck	Alton to Facilities area	
Area (m^2)	1,255,880	303,991	264,387	152,856			
Emissions (g/s)	0.0078	0.0041	0.0006	0.0000	0.0002	0.0002	
Initial Lateral Width (m)					45.77	45.77	
Road Segment Length (m)							
Model Emission Rate (g/s-m2)	6.1817E-09	1.34214E-08	2.34853E-09	0			
Road Segments					66	143	
Volume Source Emission Rate (g/s)					0.000004	0.000001	
					0.000005	Haul road and access road overlap	

APPENDIX L.
ALTON COAL TRACT LBA EIS NOISE MODELING REPORT

Alton Coal Tract LBA EIS
Noise Modeling Report

Prepared for

Bureau of Land Management,
Kanab Field Office

Prepared by

SWCA Environmental Consultants

March 2014

ALTON COAL TRACT LBA EIS
NOISE MODELING REPORT

Prepared for

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March 2014

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1. INTRODUCTION

Alton Coal Development, LLC has proposed to mine coal deposits primarily on federal land near the town of Alton, Utah (*Alton Coal Tract Lease by Application Draft Environmental Impact Statement* [DEIS]). The DEIS addresses existing soundscapes and the impacts to those soundscapes from the Proposed Action and action alternatives (Bureau of Land Management [BLM] 2011). Several comments were received regarding the need to provide additional analysis on potential noise impacts from the Proposed Action and action alternatives on existing soundscapes. Therefore, a computerized noise modeling study of potential noise impacts from the Proposed Action and action alternatives (hereinafter jointly referred to as *the project*) was conducted to address noise-related comments to the DEIS. This noise modeling study was done in accordance with the May 2013 *Alton Coal Tract LBA EIS Noise Modeling Protocol* (Appendix A), with the exceptions noted in Section 2.

Noise levels were modeled and analyzed from several sources of mining activity. Noise levels from mobile and stationary mining equipment, increased mining-related traffic levels on local roadways, and mining blasting events were analyzed and/or modeled to determine if noise impacts result above regulatory thresholds and/or existing ambient conditions within potentially affected residential/commercial areas and at specific sensitive receptors.

Increased ambient noise levels would result from intermittent use of project mining equipment and process operations. A variety of mobile-source mining equipment (excavators, front-end loaders, scrapers, graders, etc.) would be used to carry out the main mining function of the extraction and removal of soils and rock layers covering the coal. In addition to the mobile-source mining equipment, stationary processing equipment (crushers, screens, etc.) would be used to size and load the coal. Potential noise emissions from both mobile-source mining equipment and the fixed-position processing equipment were modeled assuming worst-case conditions (i.e., all the proposed equipment operating at the same time).

Increased off-site roadway noise would occur from increased vehicular traffic on public roadways from vehicles associated with the project. Both worker-commute trips to and from the mine site and coal haul truck trips were accounted for and computer modeled. Roadway noise and noise from mining activities were both accounted for in the same modeled output to account for any noise overlap between the two, where appropriate (i.e., noise sensitive receptors in Bryce Canyon National Park and in and around the town of Alton).

Additionally, mine blasting can result in substantial noise and vibration, particularly in the very low frequency range. However, because mine blasting is both highly transient and occurs at a low frequency range, noise from mine blasting is generally assessed using empirical equations rather than a computer model. Therefore, equations to calculate noise and vibration from blasting were used to estimate noise and vibration levels at specific points of interest.

Mining activities (i.e., mining equipment, increased traffic, and blasting) were analyzed to determine potential noise impacts to the town of Alton, sensitive receptors within Bryce Canyon National Park (i.e., Yovimpa point, Riggs Spring, and Farview Point), and to sensitive receptors in and around the tract. Additionally, the towns of Hatch and Panguitch, despite their distance from the tract, were evaluated to determine whether increased traffic levels on roadways through these towns could impact noise levels in these two towns.

2. CHANGES FROM DRAFT PROTOCOL TO FINAL MODELING REPORT

The following substantive changes were made from the modeling approach outlined in the draft protocol to the final modeling:

- Because US-89 does not run through or near the town of Alton, Alton Road and other local roadways (1st East Street, East 200 South Street, County Road 10) were added to the model as applicable. Baseline vehicle traffic data were gathered from the Utah Department of Transportation (UDOT). Modeling of roadways is discussed in further detail in Section 4.2.

- A drill rig was added to the mobile equipment roster (adding this piece of equipment increased the aggregated sound power level of the equipment by 0.1 dBA; therefore, when rounded to the nearest whole number, the 134 dBA remained valid and was still used in the model). Section 4.1 discusses the sound power levels of equipment in further detail.

- More representative equations were used from the protocol to derive blasting noise and vibration at fixed locations. The blasting equations proposed in the protocol were for a gold mine in Australia, whereas the blasting equations used in this report were derived from United States-based coal mine blasting data, and thus were identified as being more representative of project blasting. The equations used in this report, although of a different form than the ones identified in the protocol, give comparable results to the proposed equations from the protocol. Section 4.4 discusses the equations used to conservatively estimate blasting noise and vibration.

- Additional single-point receptors were added for both the modeling and the evaluation of blasting noise and vibration. These receptors were added to better portray noise and vibration impacts. Modeling receptor locations are discussed in further detail in Section 5.1. Blasting noise and vibration receptor locations are discussed in further detail in Section 5.2.

- The thresholds for assessing blasting noise and vibration impacts were changed to better reflect impact levels identified in the scientific literature, as discussed is Section 5.2. The protocol relied on threshold values determined solely from regulation, whereas an analysis of the state of the science of blasting noise and vibration conducted for this report was able to identify human awareness threshold values as well.

Other minor changes from the protocol are not explicitly addressed herein. Comments to the draft protocol were received from the BLM, Alton Coal Development, and the National Park Service (NPS). Suggested changes were made to the modeling and analysis, as appropriate.

3. NOISE FUNDAMENTALS

Airborne sound is the rapid fluctuation of air pressure caused by mechanical vibrations. Simply defined, noise is “unwanted sound” that interferes with normal activities or in some way reduces the quality of the environment. Response to noise varies according to its type, perceived importance, appropriateness in the setting, time of day, and the sensitivity of the individual receptor. This section provides definitions of common acoustical terms and an explanation of the noise assessment components used throughout this assessment.

3.1. Definition of Acoustical Terms

The following describes the acoustical terms used throughout this analysis:

- *Ambient sound level* is defined as the composite of noise from all sources near and far, the normal or existing level of environmental noise at a given location.
- A *decibel* (dB) is the dimensionless unit commonly used to measure sound levels. The dB scale is logarithmic; therefore, individual dB values for different sources cannot simply be added together to calculate the sound level for the two sources. For example, two 50-dB sources, added logarithmically, produce a collective noise level of 53 dB, not 100 db.
- Sound measurement is further refined by using a decibel *A-weighted* sound level (dBA) scale that more closely measures how a person perceives sound. There is a strong correlation between A-weighted sound levels and the way the human ear perceives sound.
- *Percentile sound level* (L_n) is the decibel value exceeded during n% of a measurement period. For example, L_{10} is a relatively loud noise exceeded only 10% of the measured time, whereas L_{90} is a relatively quiet sound exceeded 90% of the measured time.
- *Equivalent noise level* (L_{eq}) is the energy-averaged A-weighted noise level during a measurement period.
- *Intruding noise* is noise that intrudes over and above the existing ambient sound level at a given location. The relative intrusiveness of a sound depends on its amplitude, duration, frequency, time of occurrence, and tonal informational content, as well as the prevailing ambient sound level.
- *Natural ambient* sound level (L_{nat}) is derived by subtracting out all human-caused, mechanical, or electrical sounds from collected sound level data. This is done by calculating the percentage of extrinsic sounds either by listening to sound recordings collected contemporaneously with the data and/or by analyzing daily spectrograms and then using a mathematical formula to subtract calculated extrinsic sounds from the data.
- *Sound pressure level* (SPL) is the sound force per unit area, usually expressed in microPascals (µPa) or pounds per square inch (psi). The sound pressure level is expressed in decibels as 20 times the base 10 logarithm of the ratio between the pressures exerted by the sound to a reference sound pressure (usually 20 µPa or 2.9×10^{-9} psi, which are equivalent and which are both used as the reference sound pressure in this report).
- *Sound power level* (SWL) is the sound power emitted by a sound source, usually expressed in picoWatts (pW). The sound power level is expressed in decibels as 10 times the base 10 logarithm of the ratio between the pressures exerted by the sound to a reference sound power (usually 1 pW, which is used as the reference sound power in this report).
- *Peak particle velocity* (PPV) is the maximum velocity of ground particles (vibration) in any dimension (i.e., vertical, radial, or transverse). The peak particle velocity can be expressed as either an acceleration (usually in millimeters per square second [mm/s^2] or inches per square second [in/s^2]) or as a velocity (usually in millimeters per second [mm/s] or inches per second [in/s]).
- *Airblast overpressure* refers to the pressure caused by a shockwave (i.e., an abrupt, discontinuous change in a medium) from an explosion over and above normal atmospheric pressure. Airblast overpressure is expressed herein in linear (i.e., non-weighted) decibels.

3.2. Noise Assessment Components

A noise assessment is based on the following components: a sound-generating source, a medium through which the source transmits and the pathways taken by these sounds, and an evaluation of the proximity to receptors (i.e., noise sensitive areas [NSAs]). Soundscapes are affected by the following factors:

- Source: The sources of sound and vibration are any generators of small back-and-forth motions (i.e., motions that transfer their motional energy to the transmission path where it is propagated). The acoustic characteristics of the sources are very important. Sources must generate sound or vibration of sufficient strength, approximate pitch, and duration so that the sound or vibration may be perceived and is capable of causing adverse effects, compared with the natural ambient sounds.

  There are several potential sources of noise and/or vibration emissions from the project. Mobile mining equipment, coal processing equipment, increased traffic levels from mining activities on local roadways, and blasting events are analyzed and/or modeled to determine noise and/or vibration emissions from these sources. Each of these sources is discussed in further detail in Section 4.

- Proximity to receptors or NSAs: An NSA is defined as a location where a state of quietness is a basis for use or where excessive noise interferes with the normal use of the location. Typical NSAs include residential areas, parks, and wilderness areas, but also include passive parks and monuments, schools, hospitals, churches, and libraries.

  The NSAs analyzed to determine impacts from mining and mining-related noise and/or vibration sources include the Greater Sage-grouse habitats and lek in and around the mining tract; residential/commercial areas in and around the towns of Alton, Hatch, and Panguitch; and specific points of interest within Bryce Canyon National Park. The baseline conditions for these NSAs against which the proposed mining noise sources are evaluated are discussed in further detail in Section 5.

- Transmission path or medium: The *transmission path* or medium for sound or noise is most often the atmosphere (i.e., air), whereas for vibration, the medium is the earth or a human-made structure. For the noise/vibration to be transmitted, the transmission path must support the free propagation of the small vibratory motions that make up the sound and vibration energy. Atmospheric conditions (e.g., wind speed and direction, temperature, humidity, precipitation, etc.) influence the attenuation of sound. Barriers and/or discontinuities (existing structures, topography, foliage, ground cover, etc.) that attenuate the flow of sound or vibration energy may compromise the path. For example, sound will travel very well across reflective surfaces such as water and pavement, but can be attenuated when ground cover is field grass, lawns, or even loose soil.

  The attenuation of sound and vibration from the source to the receiver is empirically calculated through either equations or computer modeling. The specific equations or models used to calculate and determine noise and/or vibration impacts to NSAs from mining sources are discussed in further detail in Section 6.

4. SOURCE CHARACTERIZATION

There are several potential sources of noise emissions from the project. The noise sources that are analyzed in the following sections include noise from mining equipment and processes located on the mining tract; increased noise levels on public roadways from mine worker and coal haul truck trips to and from the mine; and intermittent noise and vibration from mine blasting events.

4.1. Noise from On-Tract Mining Activity

Sound generated by mining equipment and processes was modeled to determine noise levels at NSAs. For the purposes of modeling noise levels, project on-tract mining activity is divided into noise sources that are mobile in nature and can thus range over a wide area (i.e., wheeled, internal combustion engine-driven vehicles), and those that are generally fixed to a single location (i.e., processing equipment). Noise from mobile equipment is primarily produced from the internal combustion engines used to power the equipment. Noise from processing equipment is from a combination of the internal combustion engines used to power the equipment and the mechanical actions of processing the mined material. To model noise emissions from the project mobile and fixed sources, then, the sound power level of the equipment for input into the model first had to be quantified.

The project equipment and process sound power levels for input into the model were derived from measured sound power levels from representative mining equipment from other mining environmental assessments. The individual equipment or process, the estimated quantity, and the sound power level and data source for the equipment used in the model are provided in Table 1. Additionally, the aggregated sound power level of all the individual mobile sound sources is presented in Table 1.

Table 1. Plant and Equipment Fleet for Mining Activities

Source	Quantity	dBA per Equipment	Information Source
Mobile			
Haul truck	5	124	Cowal Gold Mine EIS (Barrick Gold Corporation 2009)
Front-end loader	3	117	Barrick Gold Corporation 2009
Excavator	1	123	Ensham Central Project Environmental Noise Assessment (Ensham Resources 2006)
Dozer	6	118	Barrick Gold Corporation 2009
Track hoe	2	121	Barrick Gold Corporation 2009
Skytrack*	1	123	Barrick Gold Corporation 2009
Grader	2	110	Ensham Resources 2006
Water truck	2	118	Ensham Resources 2006
Scraper	4	116	Barrick Gold Corporation 2009
Diesel generator	3	100	Ensham Resources 2006
Drill	1	118	Barrick Gold Corporation 2009
Total Mobile Equipment	**30**	**134**	**–**
Fixed			
Central processing area (e.g., coal crushing, conveying, stacking, and loading)	–	124	Barrick Gold Corporation 2009

Notes: Sources are intended to be reasonably representative of equipment that would be used during mining operations, but may vary depending on the availability of exact equipment at the time mining operations would occur.

* Sound power level was assumed to be equivalent to those of an excavator.

Modeling mobile equipment is difficult because the equipment can theoretically range over the entire proposed mining tract. To overcome this difficulty and still conservatively model equipment positions relative to areas with sensitive receptors, all mobile equipment is modeled together as a single 40-acre area source. The entire area source is assumed to emit at the highest emission level (134 dBA), as if all

the equipment was simultaneously operating at full capacity and was "stacked" together in a manner that maximizes the additive effects of noise levels from each piece of equipment. The highest decibel level from all the equipment summed together is calculated by the additive equation for incoherent sound sources:

$$L_{\Sigma} = 10 \times Log_{10}\left(10^{\frac{L_1}{10}} + 10^{\frac{L_2}{10}} + \ldots + 10^{\frac{L_n}{10}}\right) dB$$

Where:

L_{Σ} = Total sound power level

L_n = Sound power level of the separate source

Noise emissions from the coal processing operations (crushing, conveying, stacking, sorting, etc.) would take place at processing facilities located in the approximate center of the mining tract. Coal processing operations were modeled in the same manner as the mobile equipment: as a 35-acre area source where sound is conservatively assumed to be uniformly generated over the entire area. Measured sound power levels from mining process equipment (as provided in Table 1) from an analogous mine (Cowal Gold Mine located in New South Wales, Australia) were assumed representative of sound power levels for project coal processing equipment (Barrick Gold Corporation 2009).

Coal mining is proposed over a mining tract that has been divided into several different blocks. Mining operations would only take place on a single block at any given time. Therefore, each modeled 40-acre mobile area source is placed within each mining block closest to the noise sensitive receptor of greatest concern to mining in that block. Potential mining blocks and the locations of noise emitting area sources within these blocks are depicted on Figure 1.

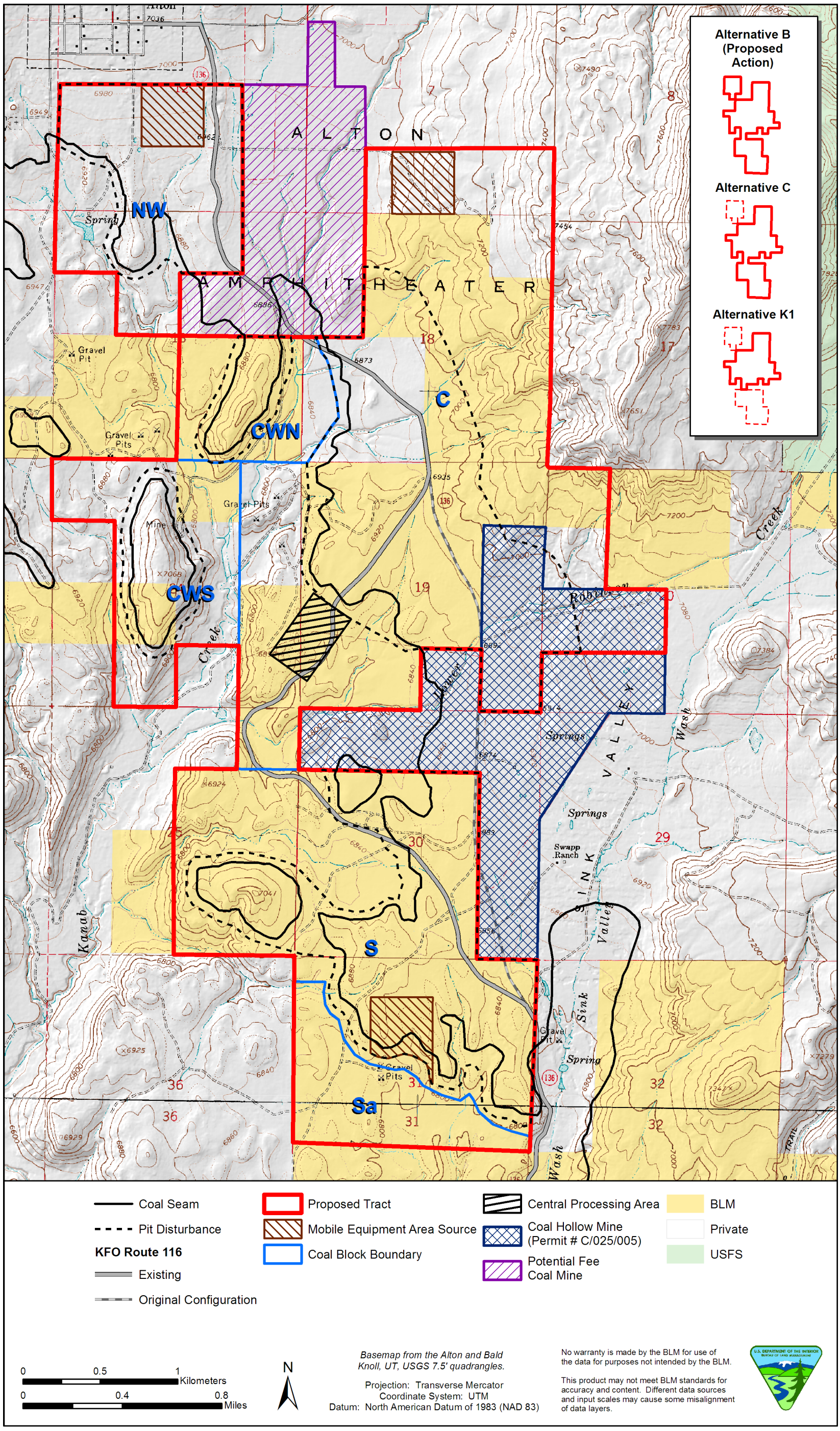

Figure 1. Mining blocks and source map.

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Of the mining blocks depicted on Figure 1, three are of particular concern due to their proximity to sensitive noise receptors. Block NW is the closest mining block to the town of Alton, Block C is closest to Bryce Canyon National Park, and Block S is close to the sage-grouse lek. Noise-emitting equipment and processes are only evaluated within these three blocks because noise levels from mining activities in the other mining blocks (CWN and CWS) would be of equal or less impact than the blocks analyzed due to their increased distance from sensitive receptors. Because mining would only take place on one block at a time, modeling of noise emissions from the mobile equipment was done in three separate iterations for Blocks NW, C, and S, with noise emissions from the central processing area modeled with each.

4.2. Roadway Noise

In addition to noise from mining equipment, transportation noise levels were modeled from increases to baseline traffic from both project coal haul trucks and commuter traffic from project workers. Project-related haul truck noise was only modeled on roadways that were off the mine tract, as noise from haul trucks located on the mine tract are accounted for in the modeling of project mobile equipment (as shown in Table 1). Additionally, baseline traffic conditions (i.e., the traffic level assuming the project did not exist) were not modeled separately from proposed project impacts to roadways; instead, roadway noise levels from total traffic (baseline plus project) were conservatively modeled and compared to the baseline noise levels at the NSAs (which would presumably already account for baseline traffic conditions).

Haul truck and commuter traffic would likely use existing roadways, in particular U.S. Route 89 (US-89). A traffic study by Fehr and Peers (2008) estimates average daily traffic (ADT) volumes for US-89 under four scenarios: currently existing conditions, currently existing conditions plus the addition of project coal haul truck traffic, estimated 2020 background conditions, and estimated 2020 background conditions plus project coal haul truck traffic. Fehr and Peers (2008) estimate ADT values of between 4,400 and 5,850 vehicles per day on US-89 for the year 2020 without the addition of project-related traffic. The DEIS estimates an increase of 2% in baseline traffic from mining commuter traffic from the project. Estimates from haul truck trips from the proposed project are approximately 153 truck round-trips per day (Fehr and Peers 2008). Therefore, for modeling purposes, ADT volumes on US-89 were assumed at 6,120 (5,850 + 2% increase from commuting trips + 153 round-trip haul truck trips), which represent the worst-case anticipated vehicle traffic on US-89 in the year 2020 with the inclusion of project haul truck trips and worker commuting trips.

The percentage of heavy trucks to light vehicle traffic along US-89 was only estimated in the Fehr and Peers (2008) report for existing traffic plus the addition of project haul truck trips. Therefore, the highest projected estimate in the Fehr and Peers (2008) report of 31% of heavy vehicles to light vehicles was used for modeling purposes. This conservatively represents the portion of heavy vehicles to light vehicles, because the increases in traffic projected in the 2020 scenario are likely to be proportionate to that of the currently existing baseline, whereas the mine haul truck trips are anticipated to be the same.

Roadway noise from US-89 was modeled for impacts to the towns of Alton, Hatch, and Panguitch. Roadway noise was modeled simultaneously with noise emissions from mining equipment and processes, where appropriate (i.e., in and around the town of Alton). The three modeling scenarios for mining impacts to the town of Alton from mining equipment and processes (one modeled run on each of Blocks NW, C, and S) each took into account approximately 6.0 kilometers (km) of US-89, stretching northward from the intersection of Alton Road and US-89. Based on posted speed limits, vehicle speeds of 65 mph (105 kilometers per hour [kph]) were assumed for light vehicles and 55 mph (90 kph) for heavy vehicles throughout the modeled portions of US-89.

In addition to the modeling of noise impacts from traffic on US-89, traffic from Alton Road and other local roadways within the town of Alton, including 1st East Street, East 200 South Street, and County Road 10, was modeled for noise impacts to Alton. Alton Road was modeled from where the road exits to the north of the town of Alton to where the road intersects with US-89, approximately 6.0 km of roadway. For Alton Road, UDOT data of 150 ADT was used as the baseline value. For modeling purposes, the conservative estimate was used that all the additional traffic from commuting trips from US-89 (2% of 5,850 vehicles per day) and all the coal haul truck round-trips per day will take place on Alton Road. For Alton Road, then, the total estimated ADT value used in the model was 420 (150 + [2% of 5,850] increase from commuting trips + 153 round-trip haul truck trips). Vehicle speeds of between 30 and 35 mph (55 kph) for both light and heavy vehicles were assumed on Alton Road.

Local roadways in and around the town of Alton leading from the mining tract boundary to Alton Road were also modeled. For these roadways, the UDOT data of 115 vehicles per day were used as the baseline value. For modeling purposes, the conservative estimate was used that all the additional traffic from commuting trips from US-89 (2% of 5,850 vehicles per day) and all the coal haul truck round-trips per day will take place on these local roadways in the town of Alton. For these other roadways, then, the total estimated ADT value used in the model was 384 (115 + [2% of 5,850] increase from commuting trips + 153 round-trip haul truck trips). Vehicle speeds of between 30 and 35 mph (55 kph) for both light and heavy vehicles were assumed on the modeled local roadways.

Modeling for the town of Hatch took into account approximately 6.2 km of US-89. A portion of the modeled US-89 runs through the town of Hatch and has a posted speed limit of 40 mph. Therefore, modeling of the approximately 1.2 km of US-89 that runs through the town used a speed on all vehicles of 40 mph (65 kph). Vehicle speeds of 65 mph (105 kph) were assumed for light vehicles and 55 mph (90 kph) for heavy vehicles were used throughout the rest of the modeling for traffic on US-89. Due to the distance of the project from the town of Hatch (approximately 15 miles to the nearest project boundary), modeling was not included for project mining equipment and process noise impacts to the town.

Modeling for the town of Panguitch took into account approximately 7.4 km of US-89. A portion of the modeled US-89 runs through the town of Panguitch and has a posted speed limit of 35 mph. Therefore, the approximately 3.4 km of US-89 that runs through the town uses a speed limit on all vehicles of 35 mph (60 kph). Vehicle speeds of 65 mph (105 kph) were assumed for light vehicles, and 55 mph (90 kph) for heavy vehicles throughout the remaining modeled portions of US-89. The town of Panguitch is located an even further distance than Hatch from the project boundaries, and therefore modeling of noise impacts from project mining equipment and processes was also not included for the town.

4.3. Modeling Mining and Roadway Noises

Three separate modeling runs of each of the mobile equipment area sources were evaluated in each of the mining blocks of concern. Each of these modeling runs also included modeling of the process area source and the roadways (i.e., US-89, Alton Road, and local roadways) around the town of Alton. Based on their distance from mining activities, two additional modeling runs were done just for the roadway (i.e., US-89) in and around the towns of Hatch and Panguitch. Table 2 outlines what was modeled in each run.

Table 2. Modeled Scenarios

Modeled Scenarios	Modeled Noise Source						
	Block NW Mobile Equipment	Block C Mobile Equipment	Block S Mobile Equipment	Central Processing Area	SR-89, Alton Road, and Local Roadways (town of Alton)	SR-89 (town of Hatch)	SR-89 (town of Panguitch)
1	X			X	X		
2		X		X	X		
3			X	X	X		
4						X	
5							X

Further details regarding the computer noise model parameters and limitations are discussed in Section 6.

4.4. Blasting Noise and Vibration

Blasting releases large amounts of energy to fracture, split apart, and/or displace the rock immediately surrounding the explosive charge. The explosive energy released decreases proportionally with distance to a point where shattering or displacement of the rock no longer occurs and the remaining blasting energy travels through the rock under multiple elastic vibration waveforms (i.e., radial, vertical, and transverse waveforms). Ground vibration at sufficiently high levels can be felt by people or wildlife and potentially damage buildings.

Air vibration (or airblast) emissions also result from the pressure or shockwaves from blasting activities. Pressure waves resulting from blasting increase and decrease the air pressure at a given point from the blast fairly rapidly. The airblast noise from blasting can be of sufficient loudness to be heard over great distances and even potentially damage the hearing of people or wildlife that are too close to the blast.

Multiple equations have been developed to estimate vibration and airblast emissions from blasting activities, depending on the type of blasting occurring (fully or partially confined blast holes, unconfined surfaces, etc.), the type of rock blasted, and additional variables that affect the transmission of sound through the medium (topography, shielding or amplification from barriers, meteorological conditions, whether there is a free-face or not, etc.). The Bureau of Mines for the U.S. Department of the Interior has characterized vibration and airblast noise from blasting at coal mines in several investigative reports. Vibration from blasting can be predicted using the equations presented in Report of Investigation (RI) 8507 – *Structure Response and Damage Produced by Ground Vibration from Surface Mine Blasting* (Siskind et al. 1984), whereas the equations to characterize airblast noise are found in RI 8485 *Structure Response and Damage Produced by Airblast from Surface Mining* (Siskind et al. 1980). The relevant equations used herein for calculating vibration and airblast overpressure from blasting are presented and discussed in Table 3.

Table 3. Airblast and Vibration Equations

Equation	Citation	Notes
$PPV = 119 \times \left(\frac{D}{W^{1/2}}\right)^{-1.51}$	RI 8507	Vibration equation representing the mean line from measured blasting data from coal mines. This equation represents the expected vibration from blasting.
$PPV = 438 \times \left(\frac{D}{W^{1/2}}\right)^{-1.51}$	RI 8507	Vibration equation representing two standard deviations above the mean line of measured coal mine blasting data. This equation thus conservatively represents the maximum expected vibration from blasting.
$AB = 0.162 \times \left(\frac{D}{W^{1/3}}\right)^{-0.794}$ $SPL = 20 \times \log_{10}\left(\frac{AB}{P_0}\right)$	RI 8485	Low-frequency cut-off equation (high-pass frequencies of greater than 0.1 hertz (Hz)) for airblast noise from highwall coal mine blasting. Blasts of this type tend to have a high degree of charge confinement and are representative of a typical coal mine blast.
$AB = 169 \times \left(\frac{D}{W^{1/3}}\right)^{-1.623}$	RI 8485	Low-frequency cut-off equation (high-pass frequencies of greater than 0.1 Hz) for airblast noise from parting coal mine blasting. Parting blasting takes place between coal seams and tends to have a lower degree of charge confinement than highwall blasting. As such, parting blasting has higher airblast overpressures than comparable highwall blasts over most distances and thus provides a more conservative representation of expected airblast noise than highwall blasting. However, due to a greater cube-root scaled distance slope, the equations for parting blasting can result in lower sound pressure levels than that of highwall blasting over great distances.

PPV = Peak particle vibration velocity (in/s).

AB = Peak airblast overpressure (psi).

SPL = Peak airblast noise level (dB Linear).

D = Distance between charge and receiver (feet]).

W = Charge mass per delay or maximum instantaneous charge (pounds).

P_0 = The reference sound pressure of 2.9×10^{-9} psi.

The vibration equations used in Table 3 conservatively represent the total vibration by combining both the horizontal and vertical components of vibration at a given location. Project blasting is characterized herein using both the mean and maximum blasting vibration equations presented in Table 3.

Additionally, airblast noise levels in this report are conservatively calculated by using the low-frequency cut-off equations that include the infrasound frequencies (below 20 Hz; the threshold of human hearing) that can be generated from blasting. These lower thresholds take into account those frequencies that can be "felt" at high enough pressures, but are generally not heard by humans or animal species. Both equations for calculating airblast noise levels (highwall and parting blasting) are used to comprehensively categorize project blasting impacts, as presented in Table 3.

Based on actual blasting design parameters provided by Alton Coal, the charge mass per delay is estimated as being between 17.3 and 266 pounds (lb). As such, 266 lb is conservatively used as the charge mass per delay for blasting modeling purposes. PPV (in in/s) and SPL (in dB Linear) values are

calculated and reported for given points of concern. The distances used to estimate PPV and SPL vary based on distance to the nearest point on the mining tract to the specific location of concern, as discussed in Section 5.

5. BASELINE CONDITIONS CHARACTERIZATION

Modeled and calculated noise and vibration levels are compared against regulatory thresholds and/or ambient background conditions at several NSAs to analyze the potential effects of noise levels associated with mining and mine-related activities at these areas. The analyzed NSAs are the towns of Alton, Panguitch, and Hatch; three individual noise receptors within Bryce Canyon National Park (identified as Yovimpa F, Farview F, and Riggs Spring B ("F" represents "Front-country" and "B" represents "Back-country"); and the Greater Sage-grouse habitat and lek in and adjacent to the proposed tract. Figure 2 shows an overview map of the locations of the coal mining tract and off-site roadways in relation to the NSAs, as well as individually modeled points within NSAs and the general noise modeling contour limit boundaries for the mining equipment and roadway noise.

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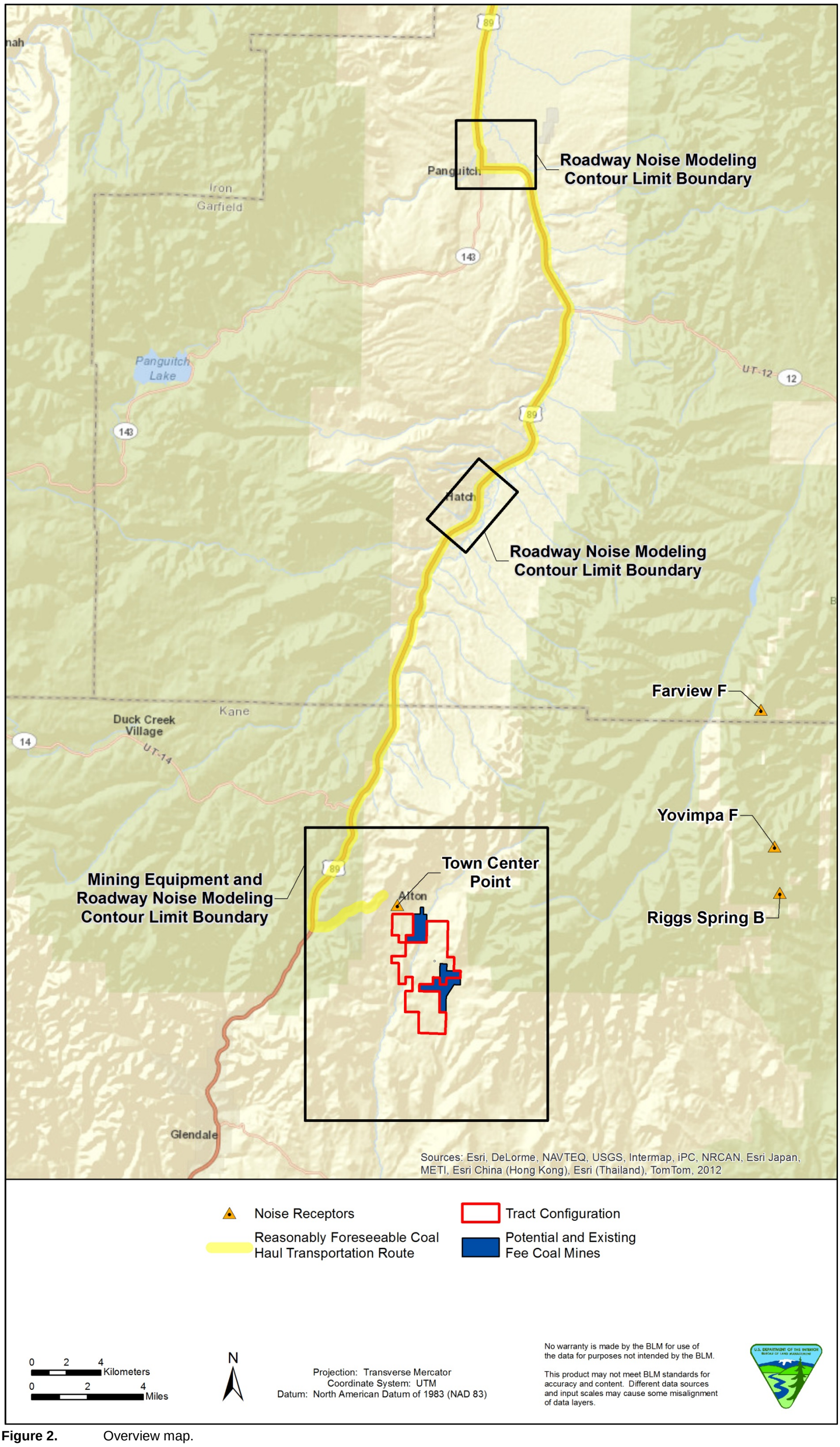

Figure 2. Overview map.

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5.1. Ambient Sound Levels

As outlined in the DEIS, ambient noise level surveys were conducted in the towns of Alton, Hatch, and Panguitch. Ambient noise level surveys for the town of Alton indicated average daytime noise levels ranging from 41 dBA L_{eq} to 55 dBA L_{eq}. In the town of Panguitch, ambient average daytime noise levels were recorded ranging from 64 dBA L_{eq} to 67 dBA L_{eq}. In the town of Hatch, average daytime noise levels were recorded at a single location of 64 dBA L_{eq}. The lowest ambient L_{eq} noise levels recorded in each of the towns were used as representative of the background sound levels for these towns in this analysis.

The background noise levels for Bryce Canyon National Park were determined from data collected by NPS personnel at several representative locations. NPS personnel used Larson Davis 831 sound level meters to take digital sound recordings and to collect and analyze sound pressure level data in both a range of dBA values and in one-third octave band frequencies ranging from 12.5 hertz (Hz) to 20,000 Hz. Noise data gathered by the NPS from 2009 to 2012 are presented in L_{eq}, L_n, and L_{nat} dBA values in Table 4 for the three areas within the park to be evaluated (Farview F, Yovimpa F, and Riggs Spring B).

Table 4. Bryce Canyon National Park Noise Level Survey Results

Receptor Location (year)	Sound Level Data (dBA re 20* µPa)				
	L_{90}	L_{nat}	L_{50}	L_{10}	L_{eq}
Farview F (2009)	30.0	31.8	37.8	45.8	53.0
Farview F (2010)	35.8	37.5	42.1	48.0	55.0
Yovimpa F (2009)	24.7	27.1	30.6	37.7	42.0
Yovimpa F (2010)	27.0	28.6	33.0	40.2	47.0
Riggs Spring B (2012)	24.5	24.5[†]	31.2	38.6	40.0

Source: BRCA Acoustical Data for Alton gathered by BLM from 2009 to 2012.

[*] *re 20 uPa* signifies the reference pressure used (i.e., 20 UPa).

[†] Estimated L_{nat} from L_{90}

Modeled project noise is compared in this analysis to the most conservative L_{nat} sound values recorded from the three areas in Bryce Canyon National Park (i.e., Farview F, Yovimpa F, and Riggs Spring B). The background values for these three park points is therefore 31.8 dBA for Farview F, 27.1 dBA for Yovimpa F, and 24.5 dBA for Riggs Spring B.

No ambient sound level data have been gathered at the sage-grouse habitat and lek in and around the project mining tract. Therefore, for conservatism, baseline conditions at the lek were assumed to be those of the lowest recorded L_{eq} value for Bryce Canyon National Park, or 40.0 dBA (recorded at Riggs Spring B).

Table 5 summarizes the source receptors and locations, ambient noise conditions, and the data source and/or methodology used for the evaluation of modeling impacts.

Table 5. Noise-sensitive Receptor Table

Receptor Location (description)	Ambient Noise Condition (dBA)	Data Sources and/or Methodology	Additional Supporting Information as Applicable
Yovimpa F (Bryce Canyon National Park)	27.1	BRCA acoustical data* gathered by BLM from 2009 to 2012	Lowest measured L_{nat} value used as representative of ambient conditions.
Riggs Spring B (Bryce Canyon National Park)	24.5	BRCA acoustical data* gathered by BLM from 2009 to 2012.	Lowest measured L_{nat} value used as representative of ambient conditions.
Farview F (Bryce Canyon National Park)	31.8	BRCA acoustical data* gathered by BLM from 2009 to 2012.	Lowest measured L_{nat} value used as representative of ambient conditions.
Town of Alton (single point and area receptor)	41.0	Morro Group, Inc. environmental noise data gathered from points in the town in 2008.	Lowest measured L_{eq} value used as representative of ambient conditions.
Town of Hatch (area receptor)	64.0	Morro Group, Inc. environmental noise data gathered from point in the town in 2008.	Measured L_{eq} value used as representative of ambient conditions.
Town of Panguitch (area receptor)	64.0	Morro Group, Inc. environmental noise data gathered from point in the town in 2008.	Measured L_{eq} value used as representative of ambient conditions.
Sage-grouse Lek (area receptor)	40.0	BRCA acoustical data* gathered by BLM for BRCA from 2009 to 2012 used as proxy.	Lowest measured L_{eq} value from the Bryce Canyon National Park data taken as representative of ambient conditions.

*Data were collected by the NPS.

The three Bryce Canyon National Park points analyzed (i.e., Farview F, Yovimpa F, and Riggs Spring B) are located closest to Block C on the mining tract, at distances from the east edge of this block of approximately 12.3 miles (19.8 km) for both Yovimpa F and Riggs Spring B and approximately 14.0 miles (22.6 km) from Farview F. Due to the distance of these park points from the project, single point calculations were made in the computer noise model for project impacts at each of these points, as presented in Section 7. Otherwise, project noise impacts were modeled out to a distance of approximately 5 km from the mine tract, as discussed further in Section 6.2. For impacts to the towns for which only roadway noise was modeled (i.e., Hatch and Panguitch), noise impacts were modeled out to a distance of approximately 1 km from the town boundaries in all directions.

5.2. Baseline Conditions for Blasting Noise and Vibration

Federal regulations governing the use of explosives for mines specify maximum limits for blasting noise and vibration at “any dwelling, public building, school, church, or community or institutional building” according to the levels presented in Tables 6 and 7 (30 Code of Federal Regulations (CFR) 816.67(b)(i)).

Table 6. Federal Airblast Noise Limits

Lower Frequency Limit of Measuring System (Hz; + / - 3 dB)	Maximum Level (dB Linear)
0.1 Hz or lower, flat response	134 peak
2 Hz or lower, flat response	133 peak
6 Hz or lower, flat response	129 peak
C-weighted, slow response	105 peak dBC

Source: adapted from table in 30 CFR 816.67(b).

Table 7. Federal Blasting Vibration Limits

Distance from the Blasting Site (feet)	Maximum Allowable Peak Particle Velocity for Ground Vibration (in/s)
0 to 300	1.25
301 to 5,000	1.00
5,001 and beyond	0.75

Source: Adapted from table in 30 CFR 816.67(d)(2).

The federal limits for airblast noise from blasting outlined in Table 6 were derived from studies to determine the "probability of the most superficial type of damage in residential-type structures" (Siskind 1980). These limits also generally correspond to the threshold for human annoyance identified in the literature, which range from 132 to 137 dB linear (as summarized in Siskind 1980). Because the equations used to calculate airblast noise assume a high-pass frequency of 0.1 Hz (Table 3, Section 4.4), the threshold of 134 dB linear from Table 6 for 0.1 Hz lower frequency limit is used as the threshold for both impacts to buildings and people. The noise threshold for human annoyance, however, is not the same as the level at which humans become aware of an intrusive noise; therefore, an additional threshold of human awareness of airblast overpressure needs to be identified.

The lowest identified level for human awareness of airblast overpressure has been cited as 100 dB linear in the literature (see Richards 2009 and *Acoustic Investigation, Virginia Development Plan Amendment* [AECOM 2011]; also see Richards 1997). This value has been cited as a value below which "airblast overpressure is barely noticed" (AECOM 2011) by communities. Higher thresholds than this have also been identified in the literature, such as by the U.S. Department of the Interior, Office of Surface Mining Reclamation and Enforcement, which notes that airblasts at or below 120 dB linear should be expected to offer "minimal" annoyance (Rosenthal 1987). Therefore, peak airblast noise levels (SPL) calculated using the equations outlined in Table 3, Section 4.4, are compared against the threshold for impact to buildings and human annoyance of 134 db linear, as well as the lowest identified threshold for human awareness of 100 dB linear.

The federal blasting vibration limits as outlined in Table 7 are the limits for measuring blasting vibration impacts to buildings. More stringent criteria have been identified in blasting studies by Chae (1978), which classifies the maximum tolerable vibration response to buildings by the age and condition of the building, as summarized in Table 8.

Table 8. Chae Building Vibration Criteria

Class	PPV (single blast) (in/s)	PPV (repeated blast) (in/s)
Structures of substantial construction	4	2
Relatively new residential structures in sound condition	2	1
Relatively old residential structures in poor condition	1	0.5
Relatively old residential structures in very poor condition	0.5	–

Source: Chae (1978).

Siskind (1980) has also identified from blasting studies building damage thresholds and has quantified the percentage of blasting events that would be expected to cause damage at that threshold. The lowest threshold to building damage (e.g., loosening of paint, plaster cracking at joints) at the lowest percentile of probabilistic damage expected per blasting event (5%) identified by Siskind (1980) was also 0.5 in/s PPV. Project vibration from blasting calculated by the equations outlined in Table 3, Section 4.4 are therefore compared against the most stringent criteria identified in the literature for impact to buildings of 0.5 in/s PPV.

As with awareness to airblast overpressure, human awareness to vibration extends below the lowest vibration threshold identified for building damage. Reiher and Meister performed the classic study in 1931 measuring subjective human tolerance to vibration and identified the lowest threshold of awareness in humans to steady-state vibrations of 0.012 in/s PPV (as identified in Jones & Stokes 2004). However, blasting vibrations are transient events and therefore likely have a different level of perceptibility than steady-state vibrations. A study by Wiss (1974) identified the "barely perceptible" threshold for human awareness from transient vibrations of 0.035 in/s PPV. Therefore, project vibration blasting calculations are compared against the 0.035 in/s PPV value identified as the threshold for human awareness. However, neither of these studies took into account the differences in human awareness of vibration when inside buildings, which has a lower threshold due to human perception of non-damaging vibratory phenomena (rattling windows, movement of objects, etc.). The California Department of Transportation (Caltrans) has developed guidance for blasting associated with transportation and construction projects. Using the International Standards of Organization (ISO) *Guide to the Evaluation of Human Exposure to Vibration and Shock in Buildings (1 Hz to 80 Hz)* (ISO 2631), Caltrans has identified the lowest threshold of human awareness in the most sensitive of building environments (e.g., hospital operating room) of 0.004 in/s PPV (Jones & Stokes 2004). This is below the threshold at which humans perceive vibration outside of buildings; therefore, for conservatism, the 0.004 in/s PPV threshold is used as the lowest threshold of human awareness to vibration from project blasting within buildings.

Table 9 summarizes the baseline threshold values against which the calculated project blasting SPL values are compared. The baseline threshold values include both the thresholds for building damage and for human awareness and annoyance of blasting noise. Also summarized in Table 9 are the thresholds for vibration damage and human awareness against which blasting vibration PPV values are compared.

Table 9. Airblast and Vibration Blasting Threshold Values

Airblast Threshold	SPL (dB linear)	Source
Lowest threshold for building damage and human disturbance	134	30 CFR 816.67(b)
Barely noticeable threshold for humans	100	Richards (2009); AECOM (2011)
Vibration Threshold	**PPV (in/s)**	**Source**
Lowest threshold for building damage	0.5	Chae (1978); Siskind (1980)
Lowest threshold for human awareness (outdoors)	0.035	Wiss (1974)
Lowest threshold for human awareness (indoors)	0.004	Jones & Stokes (2004)

Blasting noise and vibration are estimated at each of the site boundaries out to a distance of 50 feet from the blast, because this is the minimum safe distance from a mine blast, regardless of the amount of charge used, as prescribed by mine blasting regulations (30 CFR 56.2). Blasting noise and vibration were also estimated from the nearest site boundary to the three locations in the Bryce Canyon National Park, as well as the nearest identified building to the mining boundaries (approximately 500 feet north of the northernmost boundary of Block C). Additionally, the equations for calculating blasting noise and vibration are inversed to determine the maximum distance over which impacts could exist above a given threshold. Calculation results from blasting are presented in Section 7.2

6. SOUNDSCAPE MODELING APPROACH

The following sections provide a summary of the technical parameters that were used in the model to evaluate noise impacts at receptor locations.

6.1. Description of Model: SoundPLAN

SoundPLAN Essential, Version 2.0, was used to evaluate the noise emissions of the project. Based on the sound power levels input for each source, SoundPLAN estimates noise contours of the overall facility in accordance with a variety of standards, primarily ISO 9613-2 standards for noise propagation calculations. All sound propagation losses, such as geometric spreading, air absorption, ground absorption, and barrier shielding, are calculated automatically in accordance with these recognized standards. The model uses industry-accepted propagation algorithms and accepts sound power levels (in decibels) provided by the equipment manufacturer or other sources.

6.2. Technical Capabilities and Limitations

As discussed in Section 5.1, single point calculations were made in the computer noise model for project impacts at the three Bryce Canyon National Park points (i.e., Farview F, Yovimpa F, and Riggs Spring B). Additionally, project noise impacts were modeled using noise contour lines and grid noise maps out to a distance of approximately 5 km from the mining tract boundaries. Therefore, project impacts were also modeled for any park points that lie within approximately 5 km from the project boundaries, as shown in the contour line and grid noise map figures included in Section 7.

Due to the multiple dispersed residential and commercial receptors located within each of the towns for which project impacts were modeled (i.e., Alton, Hatch, and Panguitch), modeling analysis of individual receptors was not generally conducted in the towns (the exception being a single, centrally located point within the town of Alton for which noise modeling was conducted to show a representative, single numeric value for project noise impact to the town). Mining and/or vehicle traffic impacts to the towns were modeled and analyzed using noise contour lines and grid noise maps depicting project impacts over an area. Due to the dispersed and transient nature of the sage-grouse, impacts to the lek and birds were analyzed using the noise contour line and grid noise maps. For all receptors, a receiver height of 2 m was used in the model.

As discussed in Section 4.1, equipment sound power levels from mobile equipment were summed together to produce a single emitting 40-acre area source in several of the potential mining blocks to generate a representative noise level from mining operations in each block. As mobile noise sources were summed, a single dBA sound power level was input into the model for each area calculation from the mobile equipment. A single representative sound power level was also input into the model for the 35-acre area source representing the central processing facility. Sound power was entered in A-weighted values at a mean representative frequency of 500 Hz for both the mobile equipment and central processing facility area sources (model default if frequency spectrum data are unavailable). Noise sources from mobile and fixed mining equipment and processes were assumed to have a uniform height of 3 m off the ground for modeling purposes. Noise emissions from mobile and stationary sources on the blocks were modeled per ISO 9613-2:1996 (ISO 1996).

Roadways were modeled using the SoundPLAN 2.0 roadway option. Roadway noise emissions were modeled per Federal Highway Administration (FHWA) Traffic Noise Model standards (FHWA 1998). Traffic data entered into the model are discussed in Section 4.2. Both roadway and mine tract emissions were modeled simultaneously, where appropriate (i.e., in and around the town of Alton).

No noise barriers were modeled from buildings, foliage, or mining high walls, even though these barriers to noise levels from mining activities will likely be present to some degree. Therefore, the model conservatively estimated peak noise levels in the absence of any attenuation due to barriers between the noise source and the receptor of interest.

6.3. Technical Options Used in Modeling

Single receiver, noise limit contour lines, and grid noise maps were calculated for the noise emission sources associated with mining activities and roadways using the SoundPLAN model. Noise limit contour lines were based on a grid noise calculation with grid spacing of 100 m. Grid noise maps show all noise contours and fill in the areas between contour lines. Noise emissions from mobile and stationary sources were modeled out to a distance of approximately 5 km from the proposed mining tract. The roadway noise emissions were modeled out to a distance of approximately 1 km from the existing roadways. Table 10 outlines the technical parameters that were used in the modeling.

Table 10. Technical Parameters to Be Used in Modeling

Technical Parameter	Standard	Input Parameters/Notes
Geometric attributes	ISO 9613-2:1996 (ISO 1996)	Automatically calculated by SoundPLAN.
Meteorological conditions	ISO 1996	Air absorption was determined using "standard day" conditions derived from the nearest representative meteorological station. Daily data were analyzed for calendar year 2012. The annual mean was used in the model for temperature, humidity, and air pressure levels. The modeled meteorological data are discussed further below.
Ground absorption	ISO 1996	The model default of "soft ground" (i.e., fields, forests, or grass) was assumed. Roadways were regarded as "hard ground" (i.e., dense-graded asphaltic concrete) for the roadway effects portion of the calculations.
Topographic features	–	U.S. Geologic Survey (USGS) topographic data for the project site and surrounding area were digitized and input into the model to account for how topographic conditions affect the geometric divergence of the sound pressure levels. Ten-meter spacing was used between topographic lines for modeling project roadway impacts to the towns of Hatch and Panguitch. However, due to the larger area modeled in and around the town of Alton, 100-meter spacing between topographic lines was employed for modeling of mining and roadway impacts to NSAs in and around the mining tract.

6.3.1. Meteorological Conditions

The relationship between temperature, humidity, and air pressure levels to that of sound attenuation is complicated and nonlinear. Although there are general trends in the relationship of each of these variables to the atmospheric attenuation of sound (e.g., when temperature decreases, sound attenuation tends to decrease), the interrelationship of all of these elements together is not so simple (e.g., sound attenuation due to temperature fluctuations peaks at different temperatures depending on the humidity). To further complicate matters, different frequencies of sound attenuate differently for each of these meteorological variables. As such, increases or decreases in one variable (temperature, humidity, air pressure) do not directly lead to increases or decreases in sound attenuation, but are interrelated with one another. Therefore, because a "maximum case" between all three variables cannot be easily established, representative mean variables were used in the modeling.

The nearest identified meteorological monitor that records all three of these variables is located at the Cedar City Regional Airport in Cedar City, Utah (latitude and longitude of 37.70097N, -113.09884W, respectively), approximately 30 miles northwest of the project. The average temperature, humidity, and atmospheric pressure for the year 2012 were used from recorded data from this airport in the model of 11°C, 48% humidity, and 1,016 millibars pressure, respectively (the daily meteorological data are included in Appendix B) (Cedar City Regional Airport data from http://www.wunderground.com/). For consistency, these values were used in all of the model runs, including for the towns of Hatch and Panguitch.

7. NOISE AND VIBRATION IMPACTS

The following section evaluates the potential impacts from noise and vibration from the project.

7.1. Operational Noise Modeling

Noise modeling was conducted for the various scenarios as discussed below.

7.1.1. Mining on Block C

Figure 3 depicts the point receptor and source map for mining activities conducted on Block C. This figure depicts the roadways and area sources (both aggregated mobile equipment and the central processing facility) that were modeled, the overall mining tract boundary, individual point receptors (receivers) for which impacts were modeled and the expected impact in dBA from the modeled mining and roadway activities, and the general topography of the area.

As discussed, calculations were done using the SoundPLAN model at several individual point receptors in Bryce Canyon National Park and one in the town of Alton. Table 11 presents the results of these modeled calculations. The receiver numbers on Figure 3 correspond to the following receivers discussed in Table 11. The background level that is presented in the table is the assumed background sound level for that individual receptor, as discussed in Section 5.1. The calculated impact value presented in both Figure 3 and Table 11 is the impact from modeled activities at the particular point receptor (i.e., all modeled roadways, the block mobile equipment, and the central processing facility). If the calculated impact level is greater than the background level, then noise impacts from mining activities are anticipated for the receiver. If calculated impact levels are below background level, then no impacts from mining activities would be anticipated at the receiver.

Table 11. Calculated Sound Levels at Individual Point Receptors from Mining on Block C.

Receiver	Receiver Description	Background Level (dBA)	Calculated Impact Level (dBA)
1	Farview F (Bryce Canyon National Park)	31.8	0
2	Riggs Spring B (Bryce Canyon National Park)	24.5	0
3	Town of Alton (southwest corner of Center Street and 1st East Street)	41.0	**50.2**
4	Yovimpa F (Bryce Canyon National Park)	27.1	0

Note: Calculated values in excess of background are bolded.

As shown in Table 11, calculated noise impact levels from mining equipment and roadway noise at each of the national park receptors would be 0 dBA. Calculated noise levels at a central point in the town of Alton would exceed expected background by approximately 9 dBA. Noise level contributions from the different sources to each receptor are presented in Appendix C. As shown in Appendix C, noise level contributions from mining activities on Block C account for the greatest source of modeled noise to the receptor analyzed in Alton, accounting for 49.2 dBA of the 50.2-dBA impact.

Figure 3 only depicts impacts to specific receivers. To obtain a more generalized picture of the dispersion of noise levels from the mining impacts and roadways, a contour line and grid noise map was generated from the model. Figure 4 depicts the contour line and grid noise map for modeled mining activities on Block C and roadways.

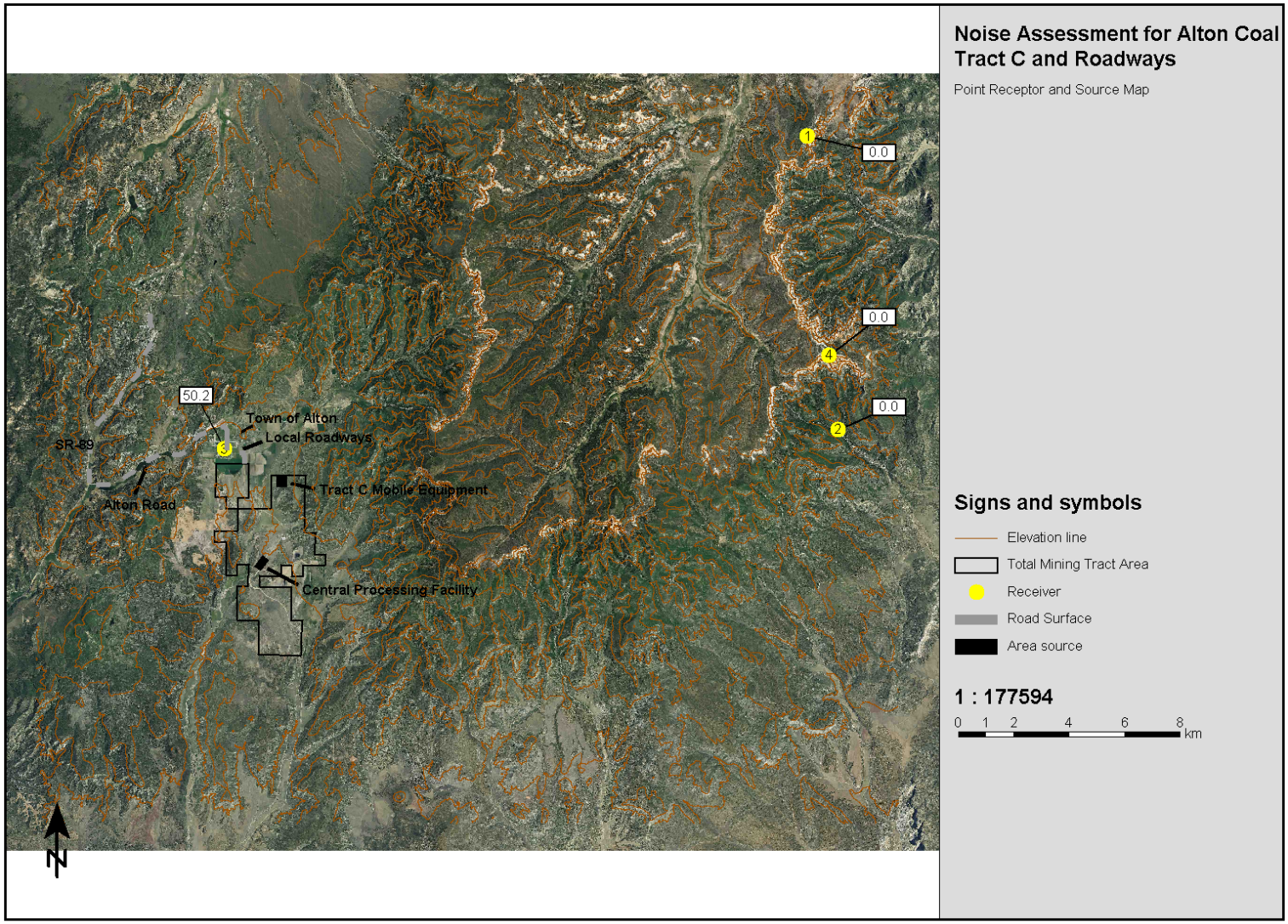

Figure 3. Point receptor and source map for mining on Block C.

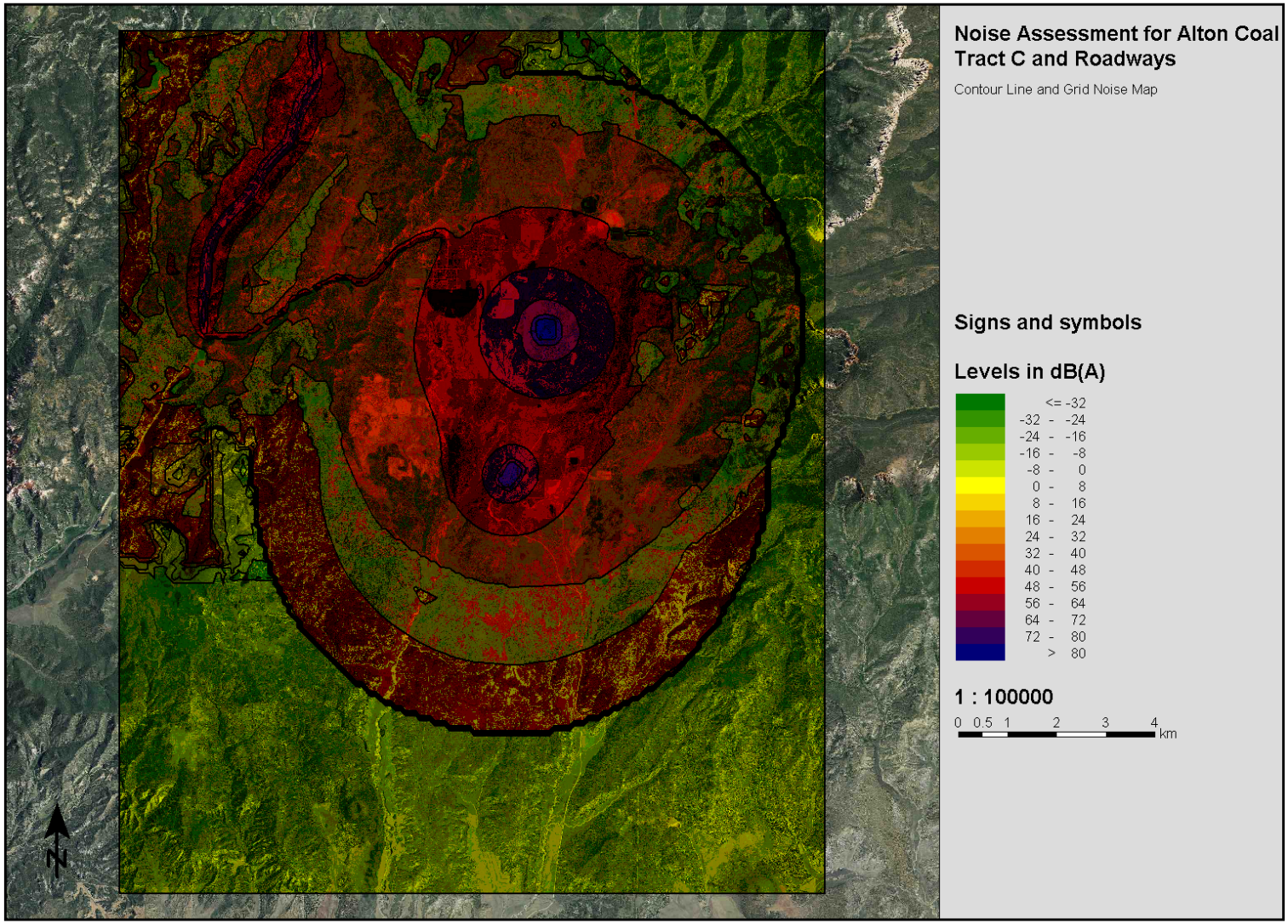

Figure 4. Contour line and grid noise map for mining on Block C.

The receiver point chosen as representative for the town of Alton is not the closest potential receiver to mining activities (this receiver was modeled because it was centrally located, and thus representative of impacts to the town from both roadway and mining noise emissions). However, as Figure 4 indicates, other receivers in the town could expect to have noise levels comparably impacted from the combination of mining and roadway activities.

The sage-grouse lek NSA is located within and around the tract. Noise levels cannot be precisely modeled for the lek for two reasons: 1) the lek is not fixed to an exact location, and 2) the species is highly mobile and has been documented using all available habitat on the tract. As can be observed from Figure 4, however, noise levels could range from as low as 48 dBA to over 80 dBA within approximately 1 km of the modeled equipment and processes. Potential project impacts occur at levels as high as 56 dBA from 1 to 5 km out from the range of the modeled equipment and processes, with intermittent locations of no project impacts (0 dBA or less) occurring at increasing frequency the further away from the equipment and processes one moves. Potential project impacts to ambient noise levels cease out to distances greater than 5 km from modeled equipment and processes. Therefore, sage-grouse located within a 5-km radius from Block C or the central processing equipment on the mining tract could be impacted at levels greater than the 40-dBA baseline sound levels expected at the lek.

7.1.2. Mining on Block NW

Figure 5 depicts the point receptor and source map for mining activities conducted on Block NW. This figure depicts the roadways and area sources (both aggregated mobile equipment and the central processing facility) that were modeled, the overall mining tract boundary, individual point receptors (receivers) for which impacts were modeled and the expected impact in dBA from the modeled mining and roadway activities, and the general topography of the area.

As discussed, calculations were done using the SoundPLAN model at several individual point receptors in Bryce Canyon National Park and one centralized location within the town of Alton. Table 12 presents the results of these modeled calculations. The receiver numbers on Figure 5 correspond to the following receivers discussed in Table 12. The background level that is presented in the table is the measured background sound level as discussed in Section 4. The calculated impact value presented in both Figure 5 and Table 12 is the impact from modeled activities at the particular point receptor (i.e., all modeled roadways, the mobile equipment, and the central processing facility). If the calculated impact level is greater than the background level, then noise impacts from mining activities are anticipated for the receiver. If calculated impact levels are below background level, then no impacts from mining activities would be anticipated at the receiver.

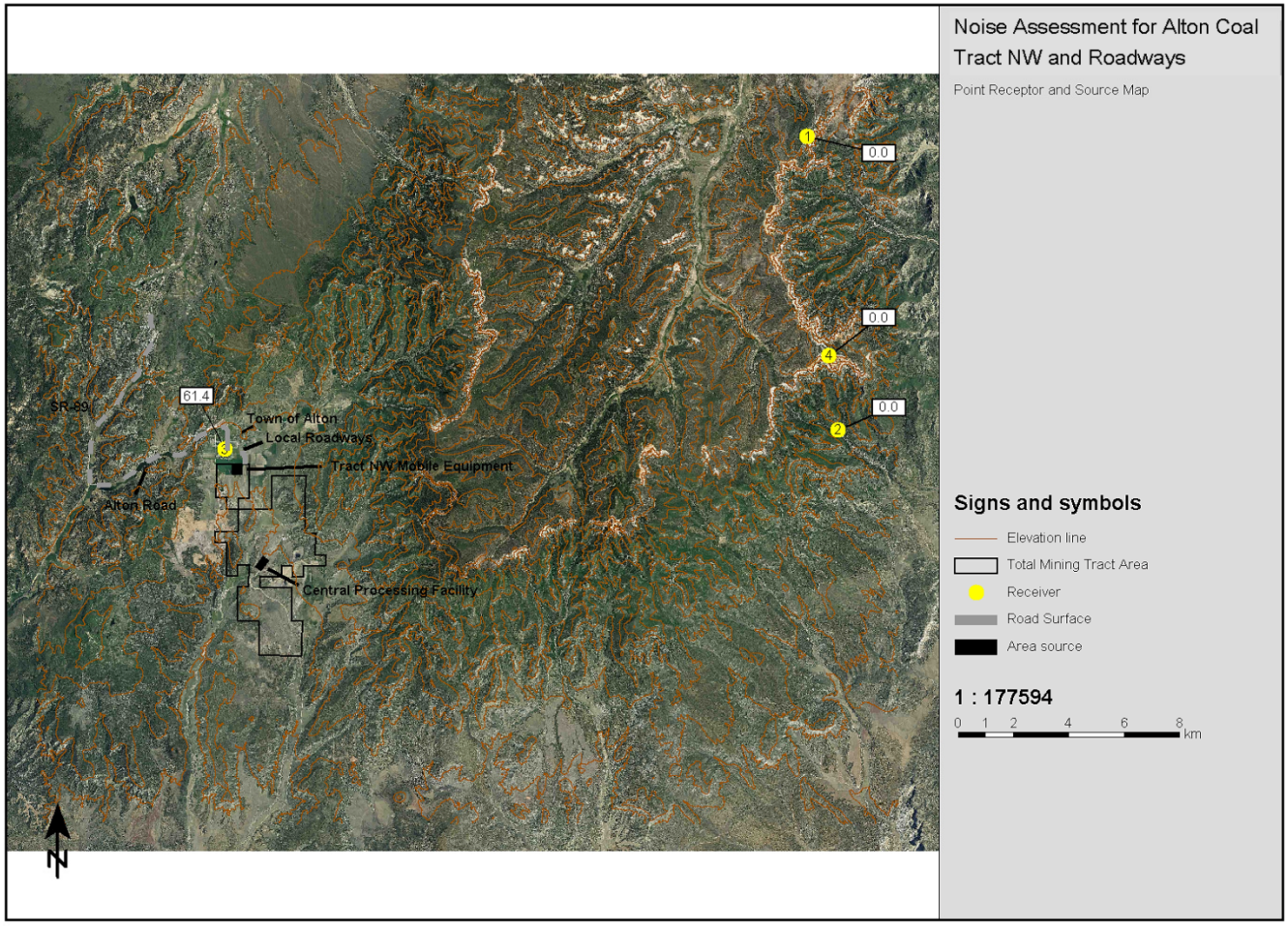

Figure 5. Point receptor and source map for mining on Block NW.

Table 12. Calculated Sound Levels at Individual Point Receptors from Mining on Block NW

Receiver	Receiver Description	Background Level (dBA)	Calculated Impact Level (dBA)
1	Farview Point (Bryce Canyon National Park)	31.8	0
2	Riggs Spring (Bryce Canyon National Park)	24.5	0
3	Town of Alton (southwest corner of Center Street and 1st East Street)	41.0	**61.4**
4	Yovimpa Point (Bryce Canyon National Park)	27.1	0

Note: Calculated values in excess of background are bolded.

As shown in Table 12, calculated noise impact levels from mining equipment and roadway noise at each of the national park receptors would be 0 dBA. Calculated noise levels at a central point in the town of Alton would exceed expected background by approximately 20 dBA. Noise level contributions from the different sources to each receptor are presented in Appendix C. As shown in Appendix C, noise level contributions from mining activities on Block NW account for the greatest source of modeled noise to the receptor analyzed in the town, accounting for 61.3 dBA of the 61.4-dBA impact.

Figure 5 only depicts impacts to specific receivers. To obtain a more generalized picture of the dispersion of noise levels from the mining impacts and roadways, a contour line and grid noise map was created. Figure 6 depicts the contour line and grid noise map for modeled mining activities on Block NW and roadways.

The receiver point chosen as representative for the town of Alton is not the closest potential receiver to mining activities (this receiver was modeled because it was centrally located, and thus representative of impacts to the town from both roadway and mining noise emissions). However, as Figure 6 indicates, other receivers in the town could expect to have noise levels comparably impacted from the combination of mining and roadway activities.

The sage-grouse lek NSA is located within and around the tract. Noise levels cannot be precisely modeled for the lek for two reasons: 1) the lek is not fixed to an exact location, and 2) the species is highly mobile and has been documented using all available habitat on the tract. As can be observed from Figure 6, noise levels could range from as low as 48 dBA to over 80 dBA within approximately 1 km of the modeled equipment and processes. Potential project impacts occur at levels as high as 56 dBA from 1 to 5 km out from the range of the modeled equipment and processes, with intermittent locations of no project impacts (0 dBA or less) occurring at increasing frequency the further away from the equipment and processes one moves. Potential project impacts to ambient noise levels cease out to distances greater than 5 km from modeled equipment and processes. Therefore, sage-grouse located within a 5-km radius from Block NW or the central processing equipment on the mining tract could be impacted at levels greater than the 40 dBA baseline sound levels expected at the lek.

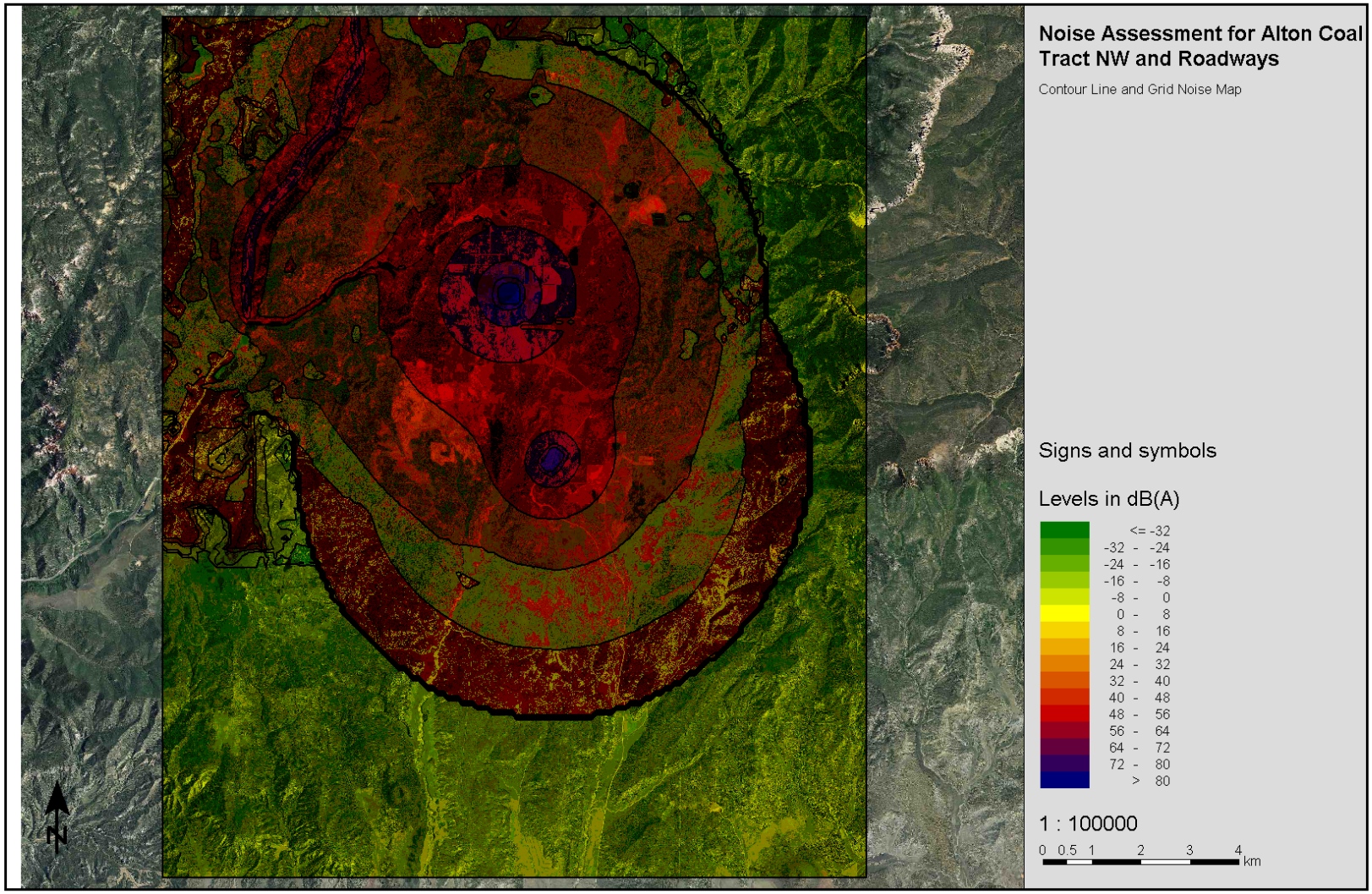

Figure 6. Contour line and grid noise map for mining on Block NW.

7.1.3. Mining on Block S

Figure 7 depicts the point receptor and source map for mining activities conducted on Block S. This figure depicts the roadways and area sources (both aggregated mobile equipment and the central processing facility) that were modeled, the overall mining tract boundary, individual point receptors (receivers) for which impacts were modeled and the expected impact in dBA from the modeled mining and roadway activities, and the general topography of the area.

As discussed, calculations were done using the SoundPLAN model at several individual point receptors in Bryce Canyon National Park and one in the town of Alton. Table 13 presents the results of these modeled calculations. The receiver numbers on Figure 7 correspond to the following receivers discussed in Table 13. The background level that is presented in the table is the assumed background sound level as discussed in Section 4. The calculated impact value presented in both Figure 7 and Table 13 is the impact from modeled activities at the particular point receptor (i.e., all modeled roadways, the block mobile equipment, and the central processing facility). If the calculated impact level is greater than the background level, then noise impacts from mining activities are anticipated for the receiver. If calculated impact levels are below background level, then no noise impacts from mining activities would be anticipated at the receiver.

Table 13. Calculated Sound Levels at Individual Point Receptors from Mining on Block S

Receiver	Receiver Description	Background Level (dBA)	Calculated Impact Level (dBA)
1	Farview F (Bryce Canyon National Park)	31.8	0
2	Riggs Spring B (Bryce Canyon National Park)	24.5	0
3	Town of Alton (SW corner of Center Street and 1st East Street)	41.0	**43.3**
4	Yovimpa F (Bryce Canyon National Park)	27.1	0

Note: Calculated values in excess of background are bolded.

As shown in Table 13, calculated noise impact levels from mining equipment and roadway noise at each of the national park receptors would be 0 dBA. Calculated noise levels at a central point in the town of Alton would exceed expected background by approximately 2 dBA. Noise level contributions from the different sources to each receptor are presented in Appendix C. As shown in Appendix C, noise level contributions from the local roadways running from the mine site through the town of Alton are the greatest source of modeled noise to the receptor analyzed in the town, accounting for 43.1 dBA of the 43.3-dBA impact.

Figure 7 only depicts impacts to specific receivers. To obtain a more generalized picture of the dispersion of noise levels from the mining impacts and roadways, a contour line and grid noise map was created. Figure 8 depicts the contour line and grid noise map for modeled mining activities on Block S and roadways.

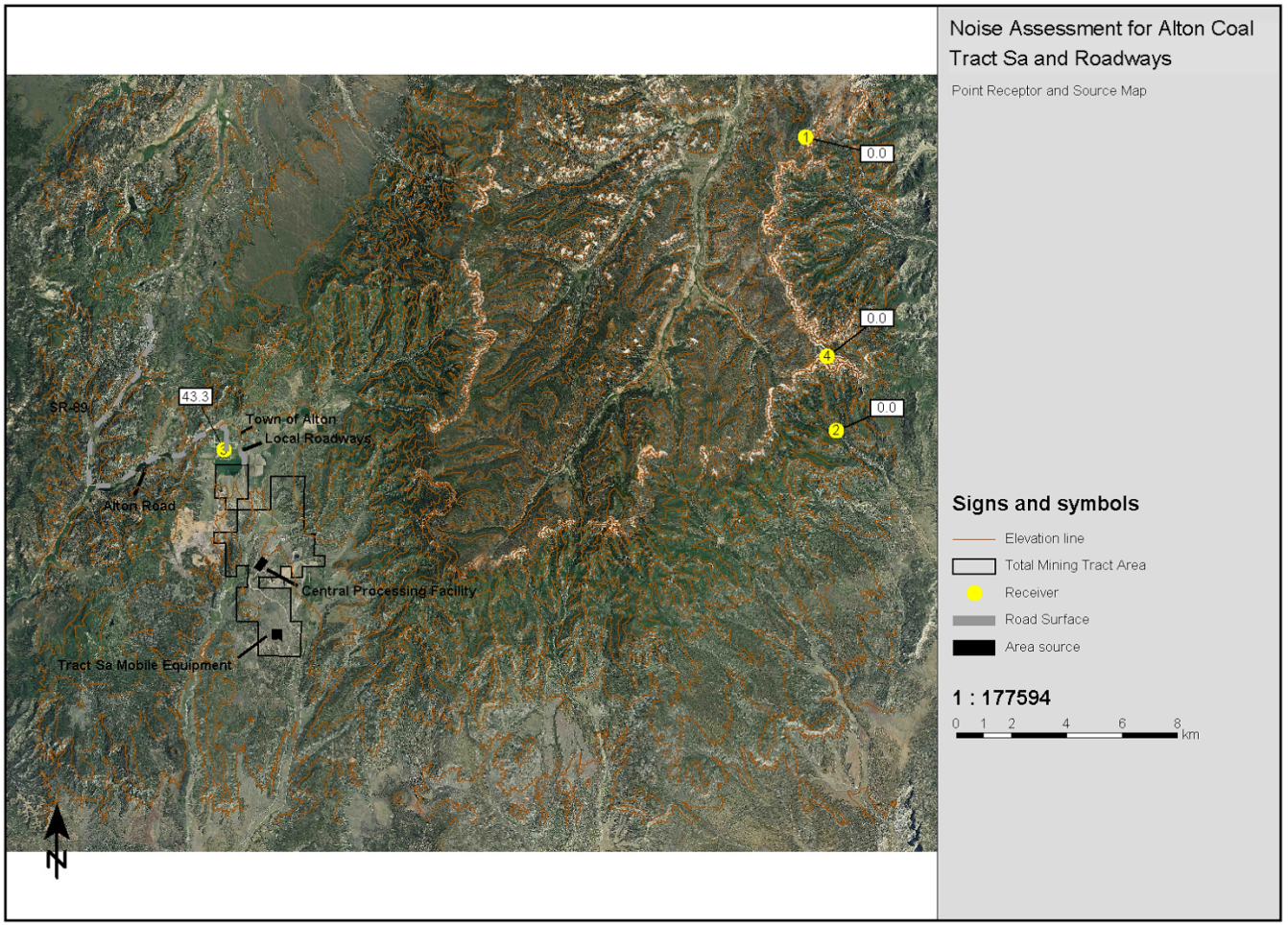

Figure 7. Point receptor and source map for mining on Block S.

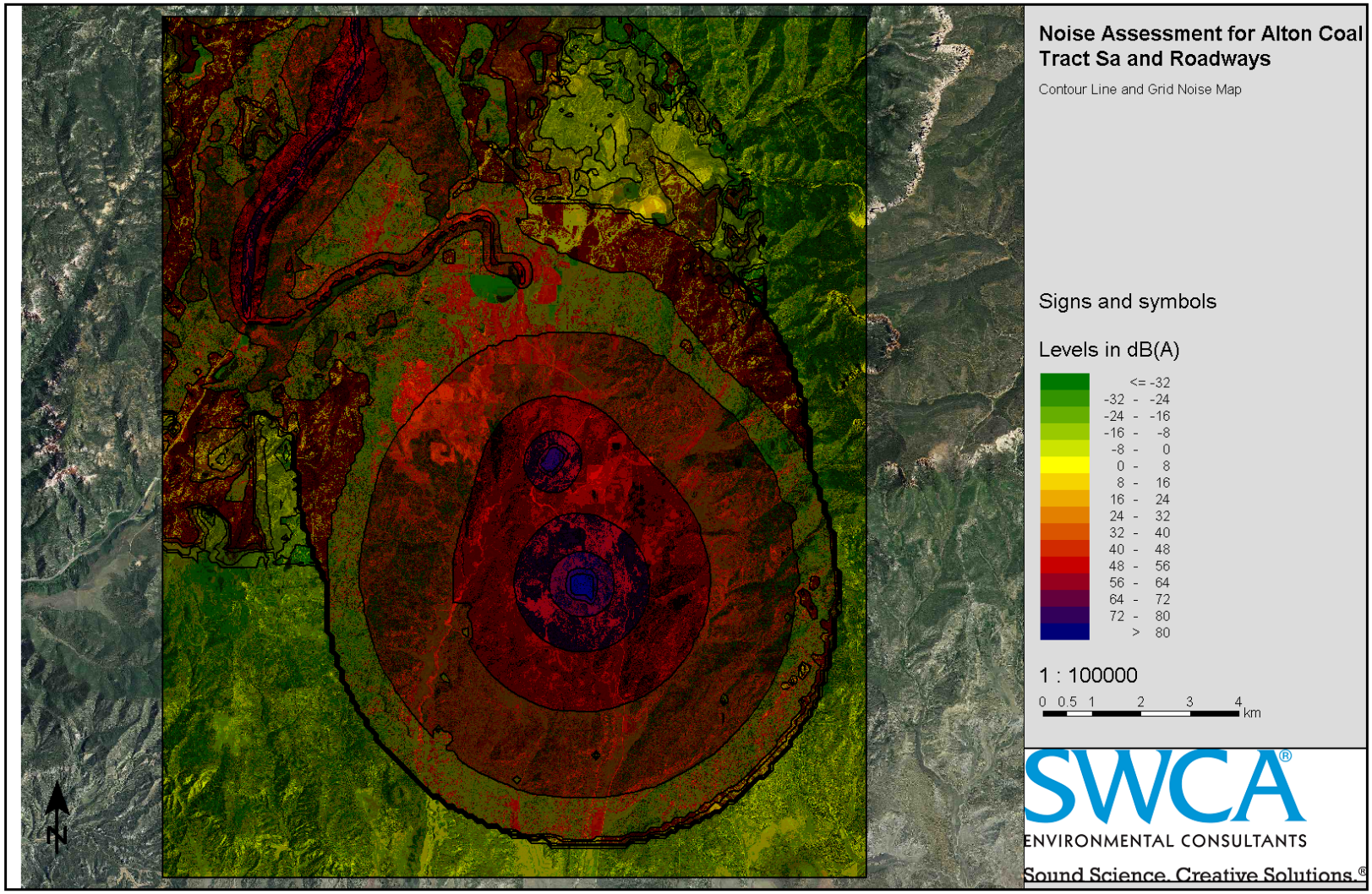

Figure 8. Contour line and grid noise map for mining on Block S.

The receiver point chosen as representative for the town of Alton is not the closest potential receiver to mining activities (this receiver was modeled because it was centrally located, and thus representative of impacts to the town from both roadway and mining noise emissions). However, as Figure 8 indicates, other receivers in the town could expect to have noise levels comparably impacted from the combination of mining and roadway activities.

The sage-grouse lek NSA is located within and around the mine tract. Noise levels cannot be precisely modeled for the lek for two reasons: 1) the lek is not fixed to an exact location, and 2) the species is highly mobile and has been documented using all available habitat on the tract. As can be observed from Figure 8, noise levels could range from as low as 48 dBA to over 80 dBA within approximately 1 km of the modeled equipment and processes. Potential project impacts occur at levels as high as 56 dBA from 1 to 5 km out from the range of the modeled equipment and processes, with intermittent locations of no project impacts (0 dBA or less) occurring at increasing frequency the further away from the equipment and processes one moves. Potential project impacts to ambient noise levels cease out to distances greater than 5 km from modeled equipment and processes. Therefore, sage-grouse located within a 5-km radius from Block S or the central processing equipment on the mining tract could potentially be impacted at levels greater than the 40 dBA baseline sound levels expected at the lek.

7.1.4. Roadway Impacts to the Town of Hatch

Figure 9 depicts the contour line and grid noise map for modeled roadway impacts to the town of Hatch.

As can be seen from Figure 9, impacts from SR-89 to residences and commercial enterprises adjacent to or near the roadway could result in audible noise levels ranging as high as 60 to 68 dBA. This is within the range of the currently measured baseline value of 64 dBA, as presented in Section 4. The modeled noise results when compared to baseline noise conditions for the town of Hatch therefore do not indicate a measurable increase in noise from the proposed project.

7.1.5. Roadway Impacts to the Town of Panguitch

Figure 10 depicts the contour line and grid noise map for modeled roadway impacts to the town of Panguitch.

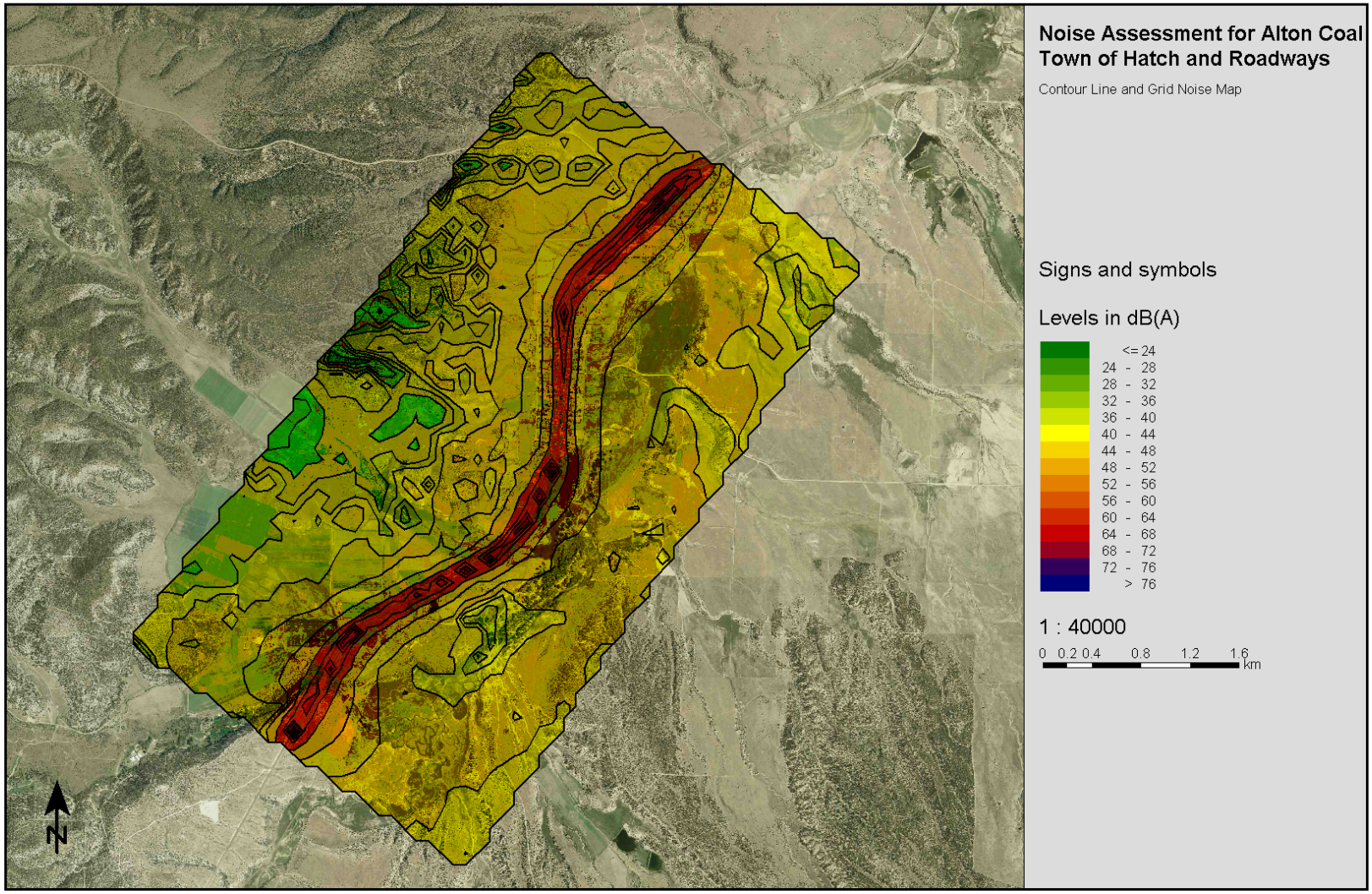

Figure 9. Contour line and grid noise map for town of Hatch.

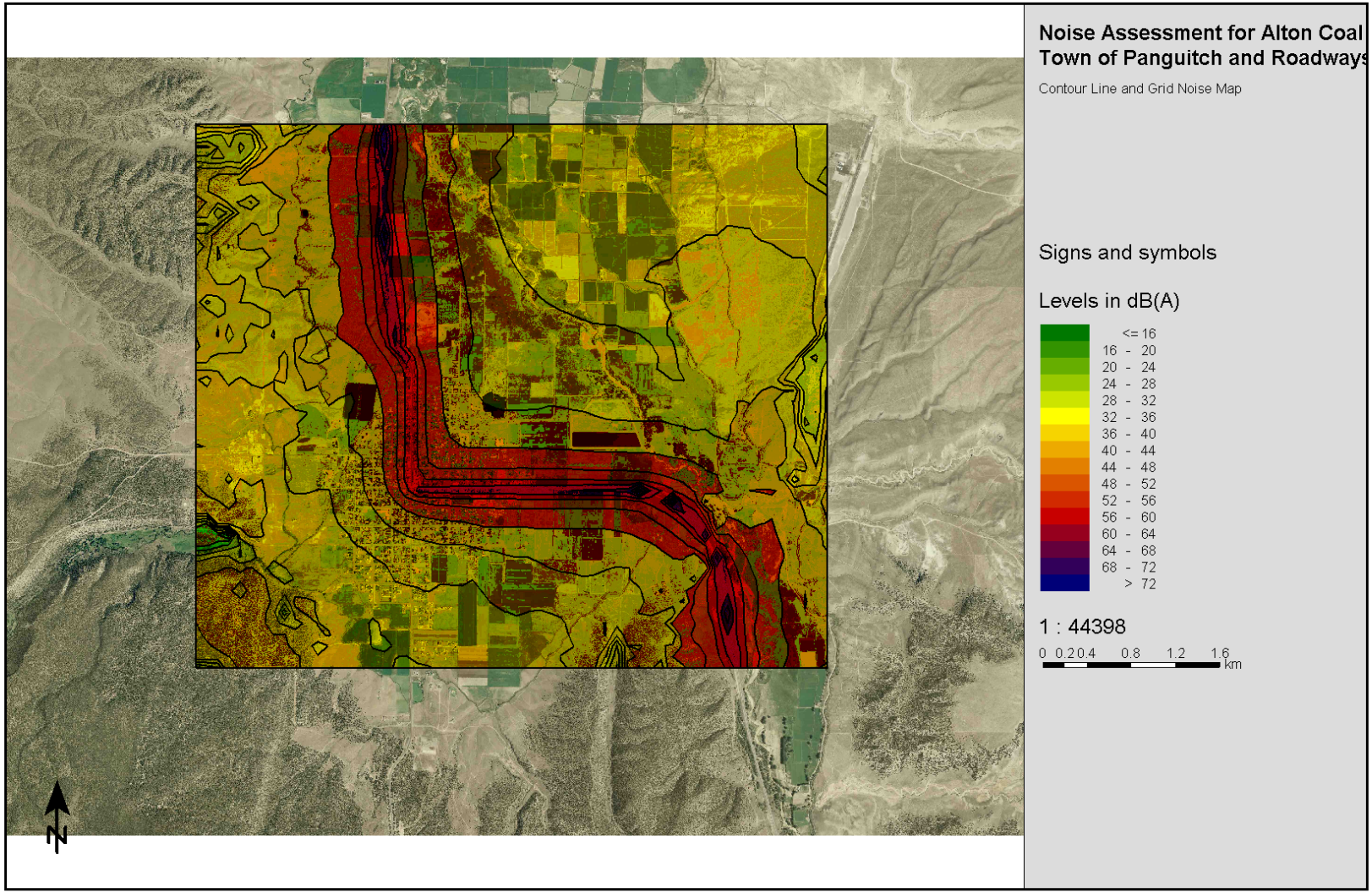

Figure 10. Contour line and grid noise map for town of Panguitch.

As can be seen from Figure 10, impacts from SR-89 to residences and commercial enterprises adjacent to or near the roadway could result in audible noise levels ranging as high as 56 to 64 dBA. This is within the range of the currently measured baseline value of 64 dBA, as presented in Section 4. The modeled noise results when compared to baseline noise conditions for the town of Panguitch therefore do not indicate a measurable increase in noise from the proposed project.

7.2. Blasting Calculation Results

Table 14 outlines the highest calculated PVS and SPL values from blasting operations conducted from the closest edge of the analyzed mining block (Blocks C, NW, and S) to the point of interest or NSA. The maximum impacts from vibration and blasting were analyzed at 50 feet from the blast (the minimum safe distance from blasting as prescribed by regulation) for illustrative purposes of the maximum possible impact from blasting, even though no critical receptors (e.g., humans, buildings, animals) are expected to be that close to a blast. The calculations for blasting noise and vibration impacts at these receptors are presented in greater detail in Appendix D.

As Table 14 indicates, blasting noise at the three Bryce Canyon National Park receiver points were below the 100-dB linear threshold of human annoyance as identified in Section 5.2. Vibration impacts to Bryce Canyon National Park receiver points analyzed would be well below the threshold of human perception.

Both noise and vibration impacts from blasting conducted at the closest point within the mining tract (Block NW) to an identified building within the town of Alton would be well in excess of both vibration and noise regulatory thresholds. Damage to the building may occur, and any persons within may experience noise levels in excess of regulatory thresholds and human comfort levels from blasting. However, blasting was calculated assuming the maximum charge mass per delay at the closest point of blasting from this building to the mining tract; actual impacts from noise and vibration to this building would therefore likely be lower.

Blasting noise and vibration calculated from the closest point on other mining blocks (Blocks C and S) to this same building in the town of Alton indicated vibration levels well below those that could damage buildings. However, vibration levels did exceed the lowest identified level for human perception within a building from blasting on both mining blocks. Additionally, calculated noise levels from blasting on these mining blocks could exceed the threshold for human perception and annoyance, but not the threshold for building damage.

In addition to blasting noise and vibration calculations at individual points, the maximum distance out to which blasting noise and vibration could be expected to exceed threshold values (as identified in Section 5.2) was calculated using the equations for blasting noise and vibration (as identified in Section 4.4). Tables 15 and 16 present the maximum calculated threshold distances out to which these impacts could be expected based on the blasting parameters discussed in Section 4.4 (i.e., 266 lb charge mass per delay).

Table 14. Blasting Calculation Results

Receptor	Closest Mine Block	Distance from Blast (feet)	Threshold Value				Highest Calculated Value	
			PPV (building damage) (in/s)	PPV (human awareness) (in/s)	SPL (building damage) (dB linear)	SPL (human annoyance/ awareness) (dB linear)	PPV (in/s)	SPL (dB linear)
50 feet from blast	Block C, NW, or S	50	0.5	0.035	134	100	**79.8**	**186**
Yovimpa F	Block C	65,000	0.5	0.035	134	100	0.0015	91
Riggs Spring B	Block C	65,000	0.5	0.035	134	100	0.0015	91
Farview F	Block C	74,000	0.5	0.035	134	100	0.0012	90
Town of Alton (nearest building)	Block NW	500	0.5	0.004	134	100	**2.4**	**154**
Town of Alton (nearest building)	Block C	5,400	0.5	0.004	134	100	**0.065**	**120**
Town of Alton (nearest building)	Block S	20,000	0.5	0.004	134	100	**0.0088**	**102**

Note: Calculated values in excess of threshold are bolded.

Table 15. Maximum Airblast Impact Distances

Airblast Threshold Value		Airblast Overpressure	Blasting Impact Distance Limit			
			Highwall		Parting	
(db linear)	Interpretation	(psi)	(feet)	(mile)	(feet)	(mile)
134	Lowest threshold at which building damage and human annoyance could be expected	1.45E-02	134	0.03	2,057	0.39
100	Barely noticeable threshold for human awareness/lowest reported threshold of human annoyance	2.90E-04	18,541	3.5	22,943	4.3

Table 16. Maximum Vibration Impact Distances

Vibration Threshold Value		Blasting Impact Distance Limit			
		Mean		Maximum	
(in/s)	Interpretation	(feet)	(mile)	(feet)	(mile)
0.5	Lowest threshold at which building damage could be expected	597	0.11	1,407	0.27
0.035	Minimum noticeable threshold for human awareness (outdoors)	3,434	0.7	8,093	1.5
0.004	Minimum noticeable threshold for human awareness (indoors)	14,306	2.7	33,717	6.4

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Appendix A

Alton Coal Tract LBA EIS Noise Modeling Protocol

Alton Coal Tract LBA EIS
Final Noise Modeling Protocol

Prepared for

Bureau of Land Management,
Kanab Field Office

Prepared by

SWCA Environmental Consultants

May 2013

ALTON COAL TRACT LBA EIS
FINAL NOISE MODELING PROTOCOL

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May 2013

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1. CHANGES FROM DRAFT TO FINAL PROTOCOL

The following substantive changes were made from the draft to the final protocol:

- Because U.S. Route 89 (US-89) does not run through or near the Town of Alton, Alton Road was added for modeling purposes to the model for that town. Vehicle traffic data were gathered from the Utah Department of Transportation (UDOT).

- A drill was added to the equipment roster. Adding this piece of equipment increased the aggregated sound power level of the equipment by 0.1 A-weighted decibels (dBA); therefore, the 134-dBA value discussed in the text will still be used in the model.

Comments to the draft protocol were received from the Bureau of Land Management (BLM), Alton Coal Development, and the National Park Service (NPS). Suggested changes were made to the modeling protocol, as appropriate. These comments are addressed in a separate comment matrix attached to this document (Attachment 1).

2. INTRODUCTION

Alton Coal Development, LLC has proposed to mine coal deposits primarily on federal land near the town of Alton, Utah (*Alton Coal Tract Lease by Application Draft Environmental Impact Statement* [DEIS]). The DEIS addresses existing soundscapes and the impacts to those soundscapes from the Proposed Action and action alternatives (BLM 2011). Several comments were received regarding the need to more quantitatively address noise impacts from the Proposed Action and action alternatives on existing soundscapes. Therefore, a computerized noise modeling study of potential noise impacts from the Proposed Action and action alternatives (hereinafter jointly referred to as *the project*) is being proposed to address noise-related comments to the DEIS.

Increased ambient noise levels would result from intermittent mining equipment and process operations. A variety of mobile-source mining equipment (excavators, front-end loaders, scrapers, graders, etc.) would be used to carry out the main mining function of the extraction and removal of soils and rock layers covering the coal. In addition to the mobile-source mining equipment, stationary processing equipment (crushers, screens, etc.) would be used to size and load the coal. Potential noise emissions from both mobile-source mining equipment and the fixed-position processing equipment will be modeled assuming worst-case conditions (i.e., all the proposed equipment operating at the same time).

Increased off-site roadway noise would occur from increased vehicular traffic on public roadways from vehicles associated with the project. Both worker-commute trips to and from the mine site and coal haul truck trips will be accounted for and computer modeled. Roadway noise and noise from mining activities will both be accounted for in the same model to account for any noise overlap between the two, where appropriate (i.e., in and around the Town of Alton).

Additionally, mine blasting can result in substantial noise and vibration, particularly in the very low frequency range. However, because mine blasting noise emissions are both highly transient and occur at a low frequency range, noise from mine blasting emissions is generally assessed using empirical equations rather than a computer model. Therefore, equations to calculate noise and vibration from blasting emissions are proposed to estimate noise and vibration levels at specific points of interest.

Noise levels will be modeled and analyzed from several sources of mining activity. Noise levels from mobile and stationary mining equipment, increased traffic levels on local roadways, and blasting events

will all be analyzed and/or modeled to determine if noise impacts result above existing ambient conditions at several designated sensitive receptors, as discussed in the following sections.

3. BASELINE CONDITIONS CHARACTERIZATION

Modeled and calculated noise levels will be compared against ambient background locations at several areas of concern to analyze the potential effects of noise levels associated with mining and mine-related activities at these areas. The analyzed areas of concern are the towns of Alton, Panguitch, and Hatch; Bryce Canyon National Park; and the Greater Sage-Grouse habitat and lek in and adjacent to the proposed mining blocks. Figure 1 shows an overview map of the locations of the coal mining blocks and off-site roadways in relation to the sensitive noise receptors, as well as the proposed noise modeling contour boundaries for both the mining equipment and roadway noise.

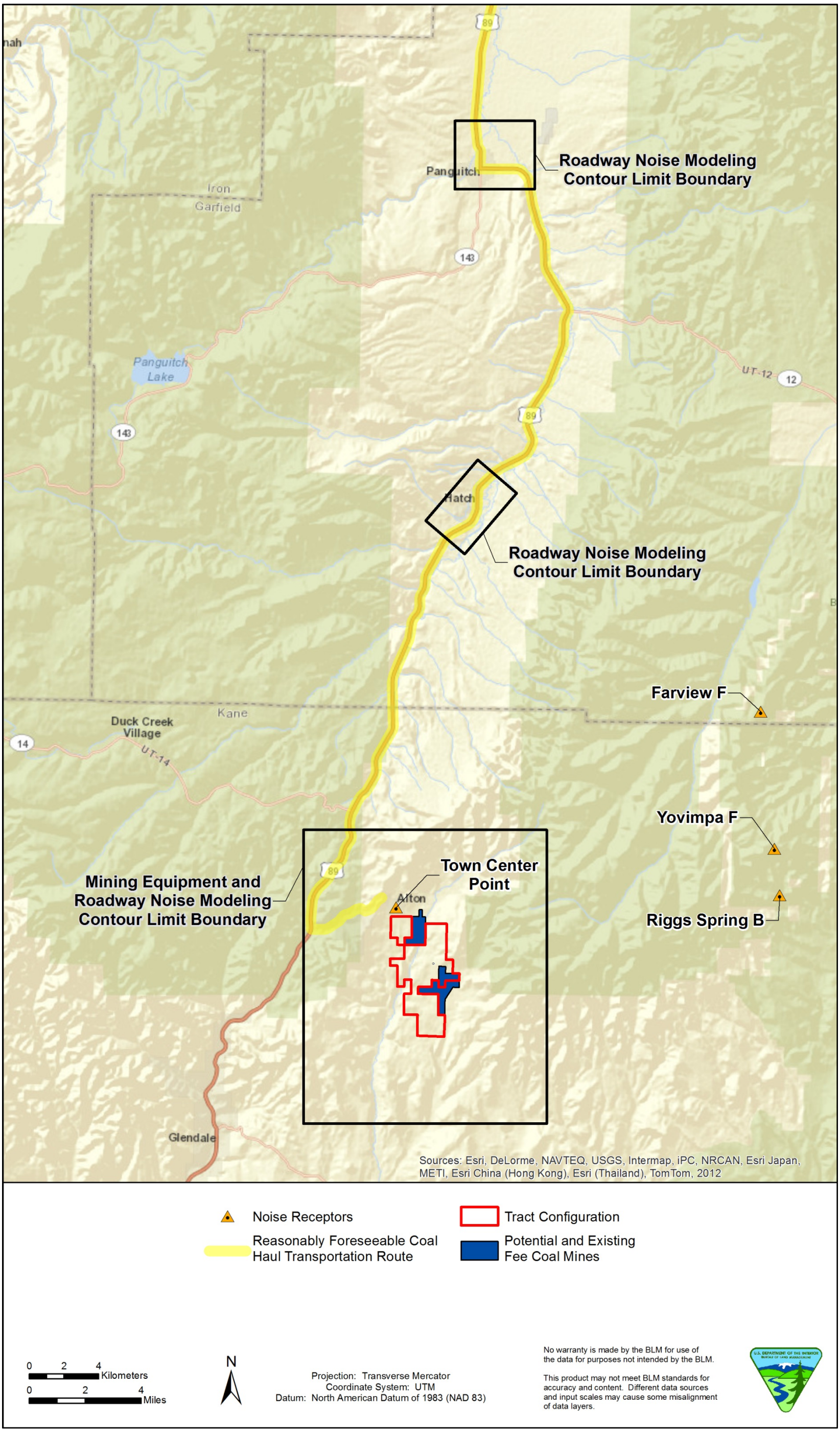

Figure 1. Overview map.

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Baseline traffic conditions will not be modeled separately from proposed project impacts to roadways; instead, roadway noise levels from total traffic (both baseline plus project) will be conservatively evaluated and compared to baseline conditions at the sensitive receptors.

As discussed in the DEIS, the Environmental Protection Agency (EPA) has offered general recommendations regarding noise thresholds. EPA has identified 55 A-weighted decibels (dBA) as the outdoor noise level above which humans can be expected to experience annoyance (EPA 1974). As outlined in the DEIS, ambient noise level surveys were conducted in the towns of Alton, Hatch, and Panguitch. Ambient noise level surveys for the town of Alton indicated average daytime noise levels ranging from 41 dBA equivalent continuous noise level (L_{eq}) to 55 dBA L_{eq}. In the towns of Hatch and Panguitch, ambient noise levels were each recorded at single locations of 64 dBA L_{eq} and 67 dBA L_{eq}, respectively. The ambient noise levels recorded in the towns will be used for this analysis.

The background levels for Bryce Canyon National Park were determined by data collected by NPS personnel at several representative locations. NPS personnel used Larson Davis 831 sound level meters to record digital recordings and to collect and analyze sound pressure levels in dBA and in one-third octave band data ranging from 12.5 hertz (Hz) to 20,000 Hz. Noise data gathered by the NPS are presented in both percentage exceedance levels (L_x) and "natural ambient" sound levels (L_{nat}). This natural ambient sound level is derived from the collected sound level data by subtracting out all human-caused, mechanical, or electrical sounds. This is done by calculating the percentage of extrinsic sounds either by listening to the sound recording collected contemporaneously with the data collected or by analyzing daily spectrograms and then using a mathematical formula to subtract these sounds from the data.

Table 1 presents noise data from Bryce Canyon National Park noise level surveys gathered by the NPS personnel from 2009 to 2012 for the three areas within the park to be evaluated in both various L_x values and L_{nat} values.

Table 1. Bryce Canyon National Park Noise Level Survey Results

Receptor Location (Year)	Sound Level Data				
	L_{90}	L_{nat}	L_{50}	L_{10}	L_{eq}
Farview F (2009)	30.0	31.8	37.8	45.8	53.0
Farview F (2010)	35.8	37.5	42.1	48.0	55.0
Yovimpa F (2009)	24.7	27.1	30.6	37.7	42.0
Yovimpa F (2010)	27.0	28.6	33.0	40.2	47.0
Riggs Spring B (2012)	24.5	24.5*	31.2	38.6	40.0

Source: BRCA Acoustical Data for Alton gathered by BLM from 2009 to 2012.

* Estimated L_{nat} from L_{90}

Based on the results, modeled project noise will be compared to the most conservative L_{nat} sound values from the three areas analyzed in Bryce Canyon National Park (i.e., Farview F, Yovimpa F, and Riggs Spring B). The background values to be used from the park for these points will be 31.8 dBA for Farview F, 27.1 dBA for Yovimpa F, and 24.5 dBA for Riggs Spring B.

Sound level data were gathered by the park service in several locations for each general area analyzed (Farview, Yovimpa, and Riggs Spring). To calculate project noise level impacts at these areas, noise levels will be modeled at a fixed point within each area as follows: Farview F (12 U 0389788 4155879),

Yovimpa F (12 U 0390580 4147992), and Riggs Spring B (12 U 0390888 4145310). Additionally, noise contour lines and grid noise maps will reveal sound pressure levels for any area of the park located within 5 kilometers of the modeled sound source, as discussed in Section 4.3. The individual town and lek area receptors will be analyzed using noise contour lines and grid noise maps. Individual receptor locations will not be analyzed for these locations.

No data have been gathered for ambient sound levels at the sage-grouse lek. Therefore, for conservatism, baseline conditions at the lek will be assumed to be those of the lowest recorded L_{eq} value for Bryce Canyon National Park, or 40.0 dBA (Riggs Spring B).

Table 2 summarizes the source receptors, ambient noise conditions, and the data source and/or methodology used for the evaluation of modeling impacts.

Table 2. Noise Sensitive Receptor Table

Receptor Location (individual point UTMs; NAD 83)	Ambient Noise Condition (dBA)	Data Sources and/or Methodology	Additional Supporting Information as Applicable
Yovimpa Point (12 U 0390580 4147992)	30.6	BRCA acoustical data gathered by BLM from 2009 to 2012.	L_{nat} value used as representative of ambient conditions.
Riggs Spring (12 U 0390888 4145310)	24.5	BRCA acoustical data gathered by BLM from 2009 to 2012.	L_{nat} value used as representative of ambient conditions.
Farview Point (12 U 0389788 4155879)	31.8	BRCA acoustical data gathered by BLM from 2009 to 2012.	L_{nat} value used as representative of ambient conditions.
Town of Alton (area receptor)	41.0	Morro Group, Inc. environmental noise data gathered from points in the town in 2008.	Lowest L_{eq} value used as representative of ambient conditions.
Town of Hatch (area receptor)	64.0	Morro Group, Inc. environmental noise data gathered from point in the town in 2008.	L_{eq} value used as representative of ambient conditions.
Town of Panguitch (area receptor)	67.0	Morro Group, Inc. environmental noise data gathered from point in the town in 2008.	L_{eq} value used as representative of ambient conditions.
Sage-grouse Lek (area receptor)	40.0	BRCA acoustical data gathered by BLM for BRCA from 2009 to 2012 used as proxy.	Lowest L_{eq} value from the Bryce Canyon National Park data taken as representative of ambient conditions.

4. SOURCE CHARACTERIZATION

There are several potential sources of noise emissions from mining activities for the project. The noise sources that are analyzed in the following sections include noise levels from mining equipment and processes located on the mining blocks, increased noise levels on public roadways from mine worker and vendor commuter trips and coal haul truck trips to and from the mine, and mine blasting events.

4.1. On-Tract Activity Noise

Mining activities would occur on several potential blocks. Potential mining blocks and the locations of noise emitting area sources within these blocks are depicted on Figure 2.

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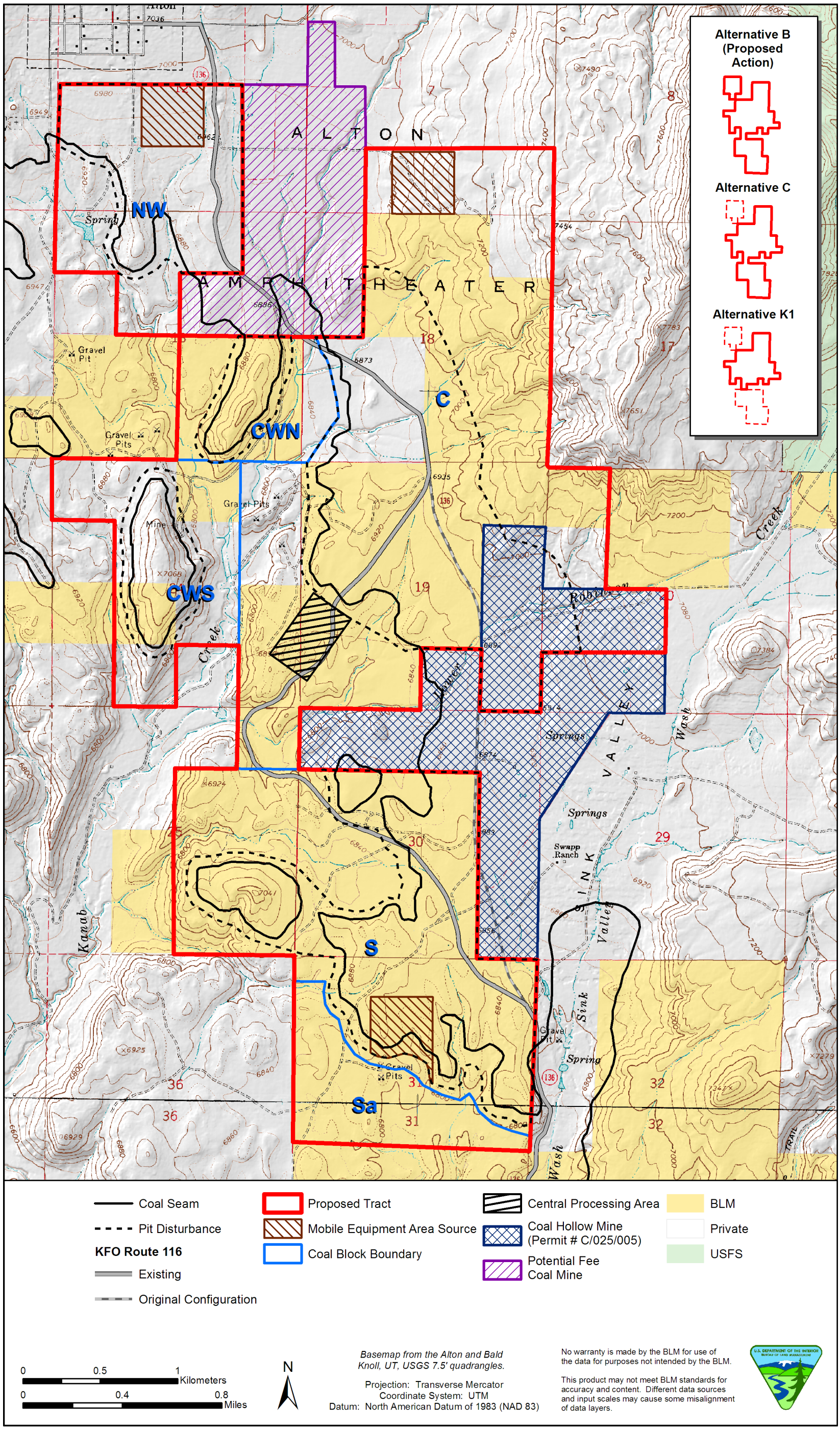

Figure 2. Mining blocks and source map.

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Of the mine blocks depicted on Figure 2, three are of particular concern due to their proximity to sensitive noise receptors. Block NW is the closest mining block to the town of Alton, Block C is closest to Bryce Canyon National Park, and Block S is close to a sage-grouse lek. Noise-emitting equipment and processes will only be evaluated within these three blocks because noise levels from mining activities in the other mining blocks (CWN and CWS) would be of equal or less impact than the blocks analyzed due to increased distance from sensitive receptors.

4.1.1. Mobile Sources

The project plant and equipment noise levels are calculated from representative measured sound power levels for other mining environmental assessments. The individual equipment or process, the estimated quantity, and the sound power level and data source are provided in Table 3.

Table 3. Plant and Equipment Fleet for Mining Activities

Source	Quantity	dBA per equipment	Information Source
Mobile			
Haul truck	5	124	Cowal Gold Mine EIS (Barrick Gold Corporation 2009)
Front-end loader	3	117	Barrick Gold Corporation 2009
Excavator	1	123	Ensham Central Project Environmental Noise Assessment (Ensham Resources 2006)
Dozer	6	118	Barrick Gold Corporation 2009
Track hoe	2	121	Barrick Gold Corporation 2009
Skytrack*	1	123	Barrick Gold Corporation 2009
Grader	2	110	Ensham Resources 2006
Water truck	2	118	Ensham Resources 2006
Scraper	4	116	Barrick Gold Corporation 2009
Diesel generator	3	100	Ensham Resources 2006
Drill	1	118	Barrick Gold Corporation 2009
Total Mobile Equipment	**30**	**134**	**–**
Fixed			
Central processing area (e.g., coal crushing, conveying, stacking, and loading)	–	124	Barrick Gold Corporation 2009

Notes: Sources are intended to be reasonably representative of equipment that would be used during mining operations but may vary depending on the availability of exact equipment at the time mining operations would occur.

* Sound power levels were assumed to be equivalent to those of an excavator.

Modeling mobile equipment is difficult because the equipment can theoretically range over the entire proposed mining tract. To overcome this difficulty and still conservatively model equipment positions relative to areas with sensitive receptors, all mobile equipment is modeled together as a single 40-acre area source. The entire area source is assumed to emit at the highest emission level (134 dBA), as if all the equipment were simultaneously operating at full capacity and were "stacked" together in a manner that maximizes the additive effects of noise levels from each piece of equipment. The highest decibel

level from all the equipment summed together is calculated via the additive equation for incoherent sound sources (Sengpielaudio 2013):

$$L_{\sum} = 10Log_{10}\left(10^{\frac{L_1}{10}} + 10^{\frac{L_2}{10}} + \ldots + 10^{\frac{L_n}{10}}\right) dB$$

Where:

$L_{\sum}$ = Total sound power level

L_n = Sound power level of the separate source

Equipment of the same category (5 haul trucks, 6 dozer, etc.) was summed using the simplified equation below for the summation of equal sound power sources (The Engineering Toolbox 2013):

$$L_{\sum} = L_s + 10Log_{10}(n)$$

Where:

L_s = sound power level from each single source

n = number of sources

Furthermore, each modeled 40-acre mobile area source will be placed within each mining block closest to the noise sensitive receptor of greatest concern to mining in that block (the town of Alton for Block C, Bryce Canyon National Park for Block C, the sage-grouse lek for Block S), as depicted on Figure 2.

4.1.2. Central Processing Operations

Noise emissions from the coal processing operations (crushing, conveying, stacking, sorting, etc.) would take place at the central processing facilities as shown on Figure 2, which will be modeled in the same manner as the mobile equipment: as a 35-acre area source where noise is conservatively assumed to be equally distributed over the entire area. Measured sound power levels from mining process equipment (provided in Table 2) located at a gold mine (Cowal Gold Mine located in New South Wales, Australia) were assumed representative of project sound power levels of coal processing equipment (Barrick Gold Corporation 2009).

4.2. Roadway Noise

Transportation noise levels from mine-related haul road traffic will be accounted for in the model. Haul truck traffic would likely use existing roadways, in particular US-89 and Alton Road. Alton Road will be modeled from where the road exits to the north of the town of Alton to where the road intersects with US-89; this is approximately 5.6 kilometers of roadway. Portions of US-89 stretching from the town of Alton to approximately 1 kilometer north of the town of Panguitch (see Figure 1) will be modeled to determine noise level impacts from increased haul truck traffic along this roadway. The potential impact of increased vehicular activity from mining operations to other roadways (e.g., SR-20, Interstate 15, local roadways with the exception of Alton Road) will not be analyzed in the modeling due to the distance from the mine source and the lack of receptors of interest.

A traffic study by Fehr and Peers (2008) estimates average daily traffic (ADT) volumes for US-89 under four scenarios: currently existing conditions, currently existing conditions plus the addition of project coal haul truck traffic, estimated 2020 background conditions, and estimated 2020 background conditions plus

project coal haul truck traffic. The estimated 2020 background conditions plus project coal haul truck traffic will be modeled as the most conservative estimation of impacts from the project to roadway noise.

Fehr and Peers (2008) estimate ADT values of between 4,400 and 5,850 vehicles per day on US-89 for the year 2020 without the addition of project-related traffic. The DEIS estimates an increase of 2% in baseline traffic from mining commuter traffic from the project. Estimates from haul truck trips from the proposed project are approximately 153 truck round-trips per day (Fehr and Peers 2008). Therefore, for modeling purposes, ADT volumes on US-89 will be assumed at 6,120 (5,850 + 2% increase from commuting trips + 153 round-trip haul truck trips), which represent the worst-case anticipated vehicle traffic on US-89 in the year 2020 with the inclusion of project haul truck trips and worker commuting trips.

The percentage of heavy trucks to light vehicle traffic along US-89 was only estimated in the Fehr and Peers (2008) report for existing traffic plus the addition of project haul truck trips. Therefore, the highest projected estimate in the Fehr and Peers (2008) report of 31% of heavy vehicles to light vehicles (with current vehicle trips used as the baseline) will be used for modeling purposes. This is likely to conservatively represent the portion of heavy vehicles to light vehicles, because the increases in traffic projected in the 2020 scenario are likely to be proportionate to that of the currently existing baseline, whereas the mine haul truck trips are anticipated to be the same.

For Alton Road, UDOT data of 150 vehicles per day will be used as the baseline value. For modeling purposes, the conservative estimate that will be used is as follows: all the additional traffic from commuting trips from US-89 (2% of 5,850 vehicles per day) and all the coal haul truck round-trips per day will take place on Alton Road. For Alton Road, then, the total estimated ADT value that will be used in the model will be 420 (150 + [2% of 5,850] increase from commuting trips + 153 round-trip haul truck trips).

The level of service (LOS) describes traffic operating conditions on roadways through several qualitative “grades” ranging from “A” (free flow of traffic) to “F” (unpredictable traffic flow with excessive delays). The Fehr and Peers (2008) report indicates that LOS on the US-89 roadway would range from A to C in 2020, without project impacts. Because the project is only expected to marginally increase traffic levels, the traffic LOS will be assumed to remain the same for modeling purposes. Although the traffic impact to Alton Road from mine-related activities will be greater than that to US-89 because of the lower baseline for Alton Road, the roadway capacity will still allow for a favorable traffic LOS (the increase in traffic from mine-related activities will result in a less than a 1-mile-per-hour reduction in average travel speed using the Highway Performance Monitoring System Field Manual Equation 20-5, estimating average travel speed for rural two-lane capacity roadway). As discussed in Section 4.2, traffic flow will be modeled assuming “steady” flow conditions based on the LOS.

4.3. Blasting Noise

Air vibration (or airblast) emissions result from the pressure or shock waves from blasting activities. Pressure waves resulting from blasting increase and decrease the air pressure at a given point from the blast fairly rapidly. Multiple equations in the literature have been developed to estimate vibration and airblast emissions from blasting activities, depending on the type of blasting occurring (fully or partially confined blast holes, unconfined surfaces, etc.), the type of rock blasted, and additional variables that affect the transmission of sound through the air (topography, shielding or amplification from barriers, meteorological conditions, whether there is a free-face or not, etc.).

4.3.1. Description of Blasting Calculations

The vibration and airblast emissions can be predicted using the relevant vibration and airblast formula presented in AS 2187.2-2006 (Standards Australia 2006).

The relevant formulae are as follows:

$$PVS = 3{,}272\ (R/Q^{1/2})^{-1.60}$$

$$SPL = 173.4 - 24(\log_{10} R - \log_{10} Q)$$

Where,

PVS = Peak Vector Sum vibration velocity (millimeters per second [mm/s])

SPL = Peak airblast noise level (dB Linear)

R = Distance between charge and receiver (meters [m])

Q = Charge mass per delay or maximum instantaneous charge (kilograms [kg])

Based on actual blasting design parameters provided by the mine, the charge mass per delay was estimated as being between 8 and 120 kg. As such, 120 kg will conservatively be used as the charge mass per delay for blasting modeling purposes. PVS (in mm/s) and SPL (in dB Linear) values will be calculated and reported for given points of concern. PVS values will be compared against the threshold for the most stringent structural damage of 6.4 mm/s (Department of Transportation Federal Transit Administration 2006), whereas SPL values will be compared against the same background noise values at receptor locations as will be used for modeling purposes.

4.3.2. Blasting Receptor Locations

Blasting noise and vibration will be estimated from the nearest site boundary to the three locations in the Bryce Canyon National Park discussed in Section 2, as well as the town of Alton and nearby sage-grouse lek.

5. SOUNDSCAPE MODELING APPROACH

The following sections provide a summary of the technical parameters that will be used in the model to evaluate noise impacts at receptor locations. Noise modeling will be conducted on portions of the SR-89 roadway of the proposed coal haul truck route and the proposed mining equipment and processes located on the mining tracts.

5.1. Description of Model: SoundPLAN

SoundPLAN Essential, Version 2.0, will be used to evaluate the noise emissions of the project. Based on the sound power levels input for each source, SoundPLAN estimates noise contours of the overall facility in accordance with a variety of standards, primarily International Organization for Standardization (ISO) 9613-2 standards for noise propagation calculations. All sound propagation losses, such as geometric spreading, air absorption, ground absorption, and barrier shielding, are calculated automatically in accordance with these recognized standards. Reflection off of adjacent structures and the ground will be

accounted for in the modeling. The model uses industry-accepted propagation algorithms and accepts sound power levels (in decibels) provided by the equipment manufacturer and other sources.

5.2. Technical Capabilities and Limitations

Equipment noise sources will be summed together to produce a single emitting area source in several of the potential mining parcel blocks to generate a representative noise level assuming that all the equipment is operating at maximum capacity simultaneously. Process noise sources have already been aggregated, as discussed in Section 3.1.2; therefore, this single aggregated value will be modeled as a continuous area source. Noise from process equipment and mobile operational equipment will therefore be treated by the model as fixed areas of evenly distributed point sources. Three separate modeling runs of each of the equipment area sources will be evaluated in each of the mining blocks of concern. Each of these modeling runs will also include modeling of the process area source and the roadway area source around the town of Alton. Based on their distance from mining activities, two additional modeling runs will be done just for the roadways around the towns of Hatch and Panguitch, respectively. Table 4 outlines what will be modeled in each run.

Table 4. Proposed Modeling Run

Model Run	Modeled Noise Source						
	Block NW Mobile Equipment	Block C Mobile Equipment	Block S Mobile Equipment	Central Processing Area	SR-89 Roadway and Alton Road (town of Alton)	SR-89 Roadway (town of Hatch)	SR-89 Roadway (town of Panguitch)
1	X			X	X		
2		X		X	X		
3			X	X	X		
4						X	
5							X

As noise sources are summed, a single dBA value will be input into the model for each area calculation. Sound power will therefore be entered as a single value A-weighted sum level at a mean representative frequency of 500 Hz for all the equipment and processes (model default if frequency spectrum data are unavailable). Noise sources from mobile and fixed mining equipment and processes will have a uniform assumed height of 3 m off the ground.

Roadways will be modeled using the SoundPLAN 2.0 roadway option. Road surfaces will be modeled assuming smooth asphalt surfaces as per ISO 11819-1:1997 (ISO 1997). Traffic data to be entered into the model are discussed in Section 3.2. Because the LOS is expected to remain generally favorable all the way out to 2020, and project traffic levels are not expected to substantively increase traffic, traffic flow will be assumed to be steady for modeling purposes.

No noise barriers will be modeled from buildings, foliage, or mining high walls, even though these barriers to noise levels from mining activities will likely be present to some degree. Therefore, the model will conservatively estimate peak noise levels in the absence of any attenuation due to barriers between the noise source and the receptor of interest.

5.3. Technical Options Used in Modeling

Single receiver, noise limit contour lines, and grid noise maps will be calculated for the noise emission sources associated with mining activities and roadways, as discussed in Section 3, using the SoundPLAN model. Noise limit contour lines will be based on a grid noise calculation with grid spacing of 100 m. Grid noise maps will show all noise contours and will fill in the areas between contour lines. Noise emissions from mobile and stationary sources will be measured out to a distance of 5 kilometers from the proposed mining blocks. The roadway noise emissions will be measured out to a distance of 1 kilometer from the existing roadways. For the three single receiver emission sources in the Bryce Canyon National Park, a receiver height of 2 m will be used.

Roadway noise emissions will be modeled per Federal Highway Administration (FHWA) traffic noise model standards (FHWA 1998). Noise emissions from mobile and stationary sources on the blocks will be modeled per ISO 9613-2:1996 (ISO 1996). Both roadway and mine tract emissions will be modeled simultaneously, where appropriate (i.e., in and around the Town of Alton).

Table 5 outlines the technical parameters that will be used in the modeling.

Table 5. Technical Parameters to be used in Modeling

Technical Parameter	Standard	Input Parameters/Notes
Geometric attributes	ISO 9613-2:1996 (ISO 1996)	Automatically calculated by SoundPLAN
Meteorological conditions	ISO 1996	Air absorption will be determined using “standard day” conditions derived from the nearest representative meteorological station. Monthly data will be analyzed, and the annual mean will be used in the model for temperature, humidity, and air pressure levels.
Ground absorption	ISO 1996	The model default of “soft ground” (i.e., fields, forests, or grass) will be assumed. Roadways will be regarded as “hard ground” (i.e., asphalt) for the roadway effects portion of the calculations.
Topographic features	–	U.S. Geologic Survey (USGS) Topographic data for the project site and surrounding area will be digitized and input into the model to account for how topographic conditions will affect the geometric divergence of the sound pressure levels.

6. LITERATURE CITED

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Attachment A

Comment Matrix

Alton Coal Tract Lease by Application Noise Analysis Protocol DRAFT
May 2013

Please Read: *Enter comments in the table below. The* ***Section #/Title*** *column is important because page and line numbers shift once revisions begin, but section numbers and titles change less often. In the* ***Page #*** *and* ***Line #*** *columns, write ONLY the NUMBER of the page and the line within the page. Also, please put your name on every comment so if we have questions, we can call you. Please avoid putting comments such as "see above." It is better to paste the same comment in another row. Submit your comments to Keith Rigtrup (krigtrup@blm.gov), and Ben Gaddis (bgaddis@swca.com, AltonCoalEIS@swca.com). Based on the current schedule the deadline for comments is May 24, 2013.*

Commenter	Section #/Title	Page #	Line #	Comment	Comment Disposition
JD McKenzie	1	1	9	~~…redress project…~~ address	This change has been made.
JD McKenzie	1	1	11	from *intermittent* mining equipment and process *operations*	This change has been made.
Byard Kershaw – Kane County	1	1	12	In the list of equipment in parentheses, "scrappers" is a misspelling. It should be "scrapers."	This change has been made.
JD McKenzie	1	1	13	~~geologic material from the earth~~ *soils and rock layers covering the coal*	This change has been made.
ACD	1	1	14	Remove "grinders"	This change has been made.
ACD	1	1	15	Change to "would be used to size the coal before shipping."	
JD McKenzie	1	1	15	~~separate the coal from the gangue~~ *to size and load the coal*	This change has been made.
JD McKenzie	1	1	18	Increased *offsite* roadway	This change has been made.
JD McKenzie	1	1	28	traffic levels on ~~*offsite*~~ local roadways	This change has been made.
JD McKenzie	1	1	37	blocks and *offsite* roadways	This change has been made.
Byard Kershaw – Kane County	2. Baseline Conditions Characterization	6	Line 1 and Table 2.	Include the datum used in the UTM Coordinates.	This change has been made.
JD McKenzie	3.1.1	12	4	"…equal sound power sources…" But these are not equal. Ok to approximate as equal?	Equipment that is within the same category (5 haul trucks, 6 dozers, etc.) is assumed to be of the same sound power level. For this equipment, the simpler summation equation is used. For adding together all the equipment of disparate sound power levels, the incoherent source equation is used.

Commenter	Section #/Title	Page #	Line #	Comment	Comment Disposition
ACD	3.1.1 Mobile Sources	11	10	In "Table 3" where are these noise levels taken. The average noise level that an employee can work around for an 8 hour period is 90 dbA	These are measured noise power levels of the equipment category – sources for each value are provided. The OSHA PEL for noise exposure is for a sound pressure level, which is not equivalent to a sound power level (sound power level is what will be modeled to derive sound pressures at given distances). Furthermore, PPE can be used to mitigate personal exposure, which makes the 90 dBA value irrelevant for sound modeling purposes.
ACD	3.1.1 Mobile Sources	11	10	Should add a DML45 Drill or equivalent for analysis.	This equipment has been added to the sound modeling protocol. Adding this equipment did not change the rounded sound power level that will be used for the purposes of the modeling (adding this equipment increased the total mobile equipment sound power level by 0.1 dBA, so the 134 dBA value proposed is still accurate).
Byard Kershaw – Kane County	3.1.1 Mobile Sources	11	Table 3	Same as first comment. "scrappers" should be "scrapers."	This change has been made.
ACD	3.1.2. Central Processing Operations	12	14	The proposed Facility Area is 35 acres	This change has been made.
Byard Kershaw – Kane County	3.2 Roadway Noise	12	20–31	This paragraph describes vehicle traffic on Highway 89 from the mine to Panguitch and states that past Panguitch, "The potential impact of increased vehicular activity from mining operations to other roadways…will not be analyzed…due to the distance from the mine source and the lack of receptors of interest." The map – Figure 1 on Page 3 suggests that the "Mining Equipment Modeling Boundary" doesn't extend beyond north of the town of Alton. Figure 1 appears to contradict this statement.	Figure 1 was revised to better clarify the modeling boundaries. The modeling boundaries on the figure are for the contour boundaries – noise grid maps and contour lines will only extend to the modeled boundaries depicted on Figure 1. The statement that impacts to roadways from increased vehicular activity from mining operations beyond Panguitch will not be modeled is meant to relate to the potential of increased vehicle traffic outside of the three evaluation areas of the Towns of Alton, Hatch, and Panguitch.

Commenter	Section #/Title	Page #	Line #	Comment	Comment Disposition
Byard Kershaw – Kane County	3.2 Roadway Noise	13	1–4	Are tour busses and large recreational vehicles included in this traffic study? These vehicles are likely to contribute to the noise levels in the "worst-case anticipated vehicle traffic" on Highway 89.	As cited in the protocol, the Fehr and Peers traffic technical report was relied on for vehicle traffic data. The Fehr and Peers report utilized industry standard traffic counting and other methods to establish baseline traffic conditions; therefore, any tour busses and recreational vehicles utilizing roadways should have been counted in the study. Future roadway traffic conditions are based on estimates of percentage increases to existing traffic conditions and, therefore, would also capture any anticipated roadway traffic, including tour busses and recreational vehicles.
JD McKenzie	3.2	13	3	commuting trips + 153 *round-trip* haul truck trips	This change has been made.
JD McKenzie	4.2	15	1	sources ~~were~~ *are* summed	This change has been made.
ACD	4.2. Technical Capabilities and Limitations	15	11–14	Are topographical barriers to noise Modeled?	Existing topographic conditions, including barriers due to topography, will be modeled. Impacts to topography from mining activities, since these are variable and largely unknown, will not be modeled.
JD McKenzie	4.3	16	Table 5	"…and the annual mean will be used …" Also good to run the maximum case?	The relationship between temperature, humidity, and air pressure levels to that of sound attenuation is complicated and non-linear. Increases or decreases in one variable (temperature, humidity, air pressure) do not directly lead to increases or decreases in sound attenuation, but are interrelated with one another. Therefore, since a "maximum case" between all three variables cannot be easily established, representative mean variables will be used.

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Appendix B

Daily Meteorological Data for the Alton Area (Cedar City Regional Airport)

Table B1. Daily Meteorological Data for the Alton Area (Cedar City Regional Airport)

Date	Max. Temperature (°F)	Mean Temperature (°F)	Min. Temperature (°F)	Max. Humidity (%)	Mean Humidity (%)	Min. Humidity (%)	Max. Sea Level Pressure (in Hg)	Mean Sea Level Pressure (in Hg)	Min. Sea Level Pressure (in Hg)
1/1/2012	46	31	15	88	61	33	30.64	30.56	30.43
1/2/2012	54	36	17	92	60	28	30.60	30.50	30.39
1/3/2012	59	43	26	75	47	19	30.46	30.38	30.29
1/4/2012	55	39	22	81	50	19	30.58	30.50	30.44
1/5/2012	58	40	21	92	59	25	30.45	30.27	30.05
1/6/2012	54	38	22	81	54	26	30.17	30.06	29.95
1/7/2012	39	32	24	100	74	52	30.25	30.08	29.91
1/8/2012	36	27	18	92	72	52	30.46	30.34	30.25
1/9/2012	40	28	15	88	68	48	30.53	30.43	30.30
1/10/2012	53	35	17	92	62	32	30.33	30.19	30.05
1/11/2012	39	29	18	91	63	35	30.36	30.25	30.09
1/12/2012	39	27	14	84	57	30	30.38	30.32	30.23
1/13/2012	46	27	8	83	51	19	30.52	30.42	30.33
1/14/2012	55	34	13	80	46	12	30.38	30.26	30.09
1/15/2012	51	42	32	29	22	15	30.06	29.93	29.77
1/16/2012	42	26	10	83	62	40	30.22	29.89	29.70
1/17/2012	43	24	4	86	55	24	30.39	30.28	30.16
1/18/2012	50	35	19	73	48	22	30.27	30.20	30.12
1/19/2012	51	38	25	68	46	23	30.13	30.01	29.86
1/20/2012	55	40	24	53	38	22	30.07	29.95	29.83
1/21/2012	48	39	29	100	64	28	29.87	29.65	29.45
1/22/2012	36	23	9	91	74	56	30.16	30.08	29.89
1/23/2012	37	34	30	85	69	52	30.05	29.89	29.77

Table B1. Daily Meteorological Data for the Alton Area (Cedar City Regional Airport)

Date	Max. Temperature (°F)	Mean Temperature (°F)	Min. Temperature (°F)	Max. Humidity (%)	Mean Humidity (%)	Min. Humidity (%)	Max. Sea Level Pressure (in Hg)	Mean Sea Level Pressure (in Hg)	Min. Sea Level Pressure (in Hg)
1/24/2012	36	27	18	100	82	64	30.41	30.19	29.96
1/25/2012	48	32	16	84	67	50	30.51	30.40	30.32
1/26/2012	57	40	23	92	66	39	30.31	30.17	30.03
1/27/2012	40	29	18	96	66	35	30.50	30.27	30.08
1/28/2012	44	28	11	88	55	22	30.62	30.54	30.43
1/29/2012	49	33	17	84	52	19	30.53	30.38	30.18
1/30/2012	54	38	22	74	46	18	30.16	30.03	29.93
1/31/2012	52	37	22	75	49	22	30.18	30.09	29.97
2/1/2012	53	39	24	74	49	24	30.19	30.08	29.96
2/2/2012	34	32	29	100	86	72	30.11	30.03	29.96
2/3/2012	37	29	20	88	74	59	30.26	30.16	30.08
2/4/2012	41	28	14	91	68	45	30.33	30.26	30.20
2/5/2012	42	29	16	88	62	36	30.30	30.21	30.10
2/6/2012	43	29	14	88	59	29	30.23	30.17	30.11
2/7/2012	48	31	13	84	58	31	30.23	30.16	30.08
2/8/2012	55	41	26	78	53	28	30.33	30.19	30.11
2/9/2012	52	37	21	88	62	35	30.38	30.31	30.24
2/10/2012	61	41	21	92	57	22	30.29	30.16	30.04
2/11/2012	57	43	29	85	55	24	30.06	29.85	29.74
2/12/2012	41	33	25	100	85	70	29.88	29.80	29.70
2/13/2012	42	31	19	100	88	76	29.87	29.76	29.67
2/14/2012	35	26	16	92	81	69	29.95	29.82	29.67
2/15/2012	36	30	24	92	84	75	30.06	29.91	29.85

Table B1. Daily Meteorological Data for the Alton Area (Cedar City Regional Airport)

Date	Max. Temperature (°F)	Mean Temperature (°F)	Min. Temperature (°F)	Max. Humidity (%)	Mean Humidity (%)	Min. Humidity (%)	Max. Sea Level Pressure (in Hg)	Mean Sea Level Pressure (in Hg)	Min. Sea Level Pressure (in Hg)
2/16/2012	41	27	13	92	76	59	30.31	30.18	30.03
2/17/2012	45	33	20	92	65	37	30.29	30.21	30.14
2/18/2012	49	33	17	84	61	38	30.19	30.02	29.80
2/19/2012	40	33	25	100	74	48	30.12	29.86	29.76
2/20/2012	38	19	-1	92	71	49	30.28	30.18	30.03
2/21/2012	47	31	14	80	59	37	30.29	30.23	30.17
2/22/2012	56	40	24	88	63	38	30.25	30.11	29.87
2/23/2012	43	36	29	82	60	38	30.18	30.03	29.84
2/24/2012	51	35	18	84	53	21	30.31	30.24	30.12
2/25/2012	56	43	30	63	40	16	30.10	29.96	29.87
2/26/2012	45	33	20	68	44	20	30.13	30.02	29.86
2/27/2012	51	38	24	55	42	29	29.79	29.68	29.59
2/28/2012	41	35	28	100	85	69	30.13	29.87	29.60
2/29/2012	44	33	22	88	62	36	30.09	29.98	29.83
3/1/2012	44	36	27	78	49	20	29.99	29.88	29.76
3/2/2012	35	23	11	81	58	35	30.43	30.28	30.01
3/3/2012	50	31	12	76	54	31	30.48	30.43	30.40
3/4/2012	60	40	19	88	54	19	30.44	30.31	30.19
3/5/2012	66	43	20	84	48	12	30.19	30.05	29.83
3/6/2012	59	50	40	33	24	14	29.76	29.48	29.24
3/7/2012	29	24	19	92	78	63	30.27	29.83	29.50
3/8/2012	45	29	12	81	61	40	30.58	30.46	30.31
3/9/2012	56	36	16	84	52	19	30.56	30.38	30.17

Table B1. Daily Meteorological Data for the Alton Area (Cedar City Regional Airport)

Date	Max. Temperature (°F)	Mean Temperature (°F)	Min. Temperature (°F)	Max. Humidity (%)	Mean Humidity (%)	Min. Humidity (%)	Max. Sea Level Pressure (in Hg)	Mean Sea Level Pressure (in Hg)	Min. Sea Level Pressure (in Hg)
3/10/2012	61	40	18	92	54	16	30.15	30.01	29.87
3/11/2012	60	45	30	53	36	19	29.90	29.84	29.78
3/12/2012	61	48	35	38	27	16	29.94	29.88	29.81
3/13/2012	62	49	35	30	23	16	29.95	29.86	29.79
3/14/2012	63	47	31	47	32	17	30.04	29.97	29.90
3/15/2012	66	47	27	69	44	19	30.13	30.03	29.96
3/16/2012	65	49	33	56	39	22	29.98	29.81	29.63
3/17/2012	56	44	32	96	64	32	29.62	29.49	29.41
3/18/2012	35	31	26	96	80	63	29.65	29.48	29.37
3/19/2012	38	30	22	92	78	64	29.97	29.72	29.63
3/20/2012	47	33	19	96	62	28	30.16	30.08	29.96
3/21/2012	60	42	24	88	55	21	30.18	30.09	30.01
3/22/2012	70	48	26	85	52	19	30.02	29.92	29.83
3/23/2012	66	53	39	59	41	22	29.93	29.87	29.81
3/24/2012	68	51	33	75	47	18	30.07	29.92	29.85
3/25/2012	65	52	39	45	33	20	29.84	29.72	29.59
3/26/2012	52	42	32	82	56	29	30.04	29.83	29.57
3/27/2012	61	42	22	81	51	20	30.07	30.00	29.93
3/28/2012	62	49	36	48	34	19	29.94	29.90	29.86
3/29/2012	64	46	27	78	51	23	30.02	29.96	29.92
3/30/2012	72	52	31	64	43	22	29.99	29.92	29.85
3/31/2012	72	55	38	57	40	22	29.86	29.72	29.53
4/1/2012	57	45	32	100	62	24	30.00	29.81	29.50

Table B1. Daily Meteorological Data for the Alton Area (Cedar City Regional Airport)

Date	Max. Temperature (°F)	Mean Temperature (°F)	Min. Temperature (°F)	Max. Humidity (%)	Mean Humidity (%)	Min. Humidity (%)	Max. Sea Level Pressure (in Hg)	Mean Sea Level Pressure (in Hg)	Min. Sea Level Pressure (in Hg)
4/2/2012	45	33	20	92	68	43	30.10	30.05	29.98
4/3/2012	60	39	18	84	55	25	30.13	30.03	29.92
4/4/2012	68	51	34	64	40	16	29.99	29.82	29.67
4/5/2012	64	56	47	36	24	12	29.68	29.60	29.51
4/6/2012	51	39	27	69	40	10	30.22	30.00	29.61
4/7/2012	68	41	14	67	37	7	30.31	30.21	30.12
4/8/2012	73	47	21	55	31	7	30.19	30.11	30.03
4/9/2012	75	52	29	53	31	9	30.07	29.99	29.90
4/10/2012	75	56	36	41	25	8	30.00	29.84	29.70
4/11/2012	60	53	46	77	49	20	29.83	29.69	29.56
4/12/2012	52	42	32	100	69	38	29.94	29.89	29.82
4/13/2012	51	44	36	53	41	29	29.86	29.71	29.55
4/14/2012	39	34	29	100	82	64	29.91	29.68	29.43
4/15/2012	52	39	26	100	71	41	30.11	30.03	29.88
4/16/2012	61	44	26	92	56	20	30.22	30.15	30.11
4/17/2012	67	50	32	70	48	26	30.15	30.07	29.98
4/18/2012	70	54	38	76	48	20	29.99	29.92	29.86
4/19/2012	70	54	37	86	56	25	30.08	29.98	29.91
4/20/2012	75	54	32	82	54	25	30.23	30.10	30.05
4/21/2012	81	58	35	82	48	13	30.11	30.03	29.96
4/22/2012	84	62	39	73	43	12	30.05	29.97	29.91
4/23/2012	86	64	42	65	38	10	30.03	29.90	29.81
4/24/2012	78	61	44	53	31	9	30.05	29.87	29.83

Table B1. Daily Meteorological Data for the Alton Area (Cedar City Regional Airport)

Date	Max. Temperature (°F)	Mean Temperature (°F)	Min. Temperature (°F)	Max. Humidity (%)	Mean Humidity (%)	Min. Humidity (%)	Max. Sea Level Pressure (in Hg)	Mean Sea Level Pressure (in Hg)	Min. Sea Level Pressure (in Hg)
4/25/2012	68	59	49	50	39	27	30.15	29.92	29.84
4/26/2012	66	54	41	76	49	22	29.87	29.74	29.67
4/27/2012	62	50	37	93	61	28	30.12	29.99	29.79
4/28/2012	62	47	32	75	49	22	30.04	29.97	29.90
4/29/2012	68	48	27	75	45	14	30.08	29.96	29.91
4/30/2012	75	52	29	69	42	14	29.96	29.88	29.71
5/1/2012	76	65	53	41	30	19	29.89	29.67	29.59
5/2/2012	74	63	51	41	30	19	29.75	29.69	29.61
5/3/2012	74	62	50	48	35	22	29.97	29.78	29.72
5/4/2012	74	60	45	42	28	13	29.84	29.81	29.77
5/5/2012	66	51	36	53	35	16	30.06	29.98	29.82
5/6/2012	66	46	26	46	30	13	30.13	30.08	30.01
5/7/2012	62	43	23	54	37	19	30.09	30.02	29.95
5/8/2012	75	53	31	69	42	15	30.07	30.00	29.92
5/9/2012	79	56	33	56	32	8	30.05	29.92	29.79
5/10/2012	83	60	37	46	28	9	29.95	29.77	29.67
5/11/2012	76	57	37	52	32	12	29.97	29.88	29.80
5/12/2012	79	57	34	59	33	7	30.11	30.04	29.96
5/13/2012	77	56	35	59	33	7	30.15	30.10	30.06
5/14/2012	85	59	32	48	28	8	30.15	30.02	29.85
5/15/2012	86	72	57	17	12	6	29.84	29.78	29.70
5/16/2012	83	62	41	31	20	8	29.83	29.80	29.75
5/17/2012	86	65	44	36	22	8	29.82	29.66	29.44

Table B1. Daily Meteorological Data for the Alton Area (Cedar City Regional Airport)

Date	Max. Temperature (°F)	Mean Temperature (°F)	Min. Temperature (°F)	Max. Humidity (%)	Mean Humidity (%)	Min. Humidity (%)	Max. Sea Level Pressure (in Hg)	Mean Sea Level Pressure (in Hg)	Min. Sea Level Pressure (in Hg)
5/18/2012	72	60	47	63	39	15	29.88	29.66	29.44
5/19/2012	74	54	33	92	51	10	30.01	29.96	29.88
5/20/2012	84	61	37	53	32	10	30.04	29.98	29.92
5/21/2012	88	66	44	49	28	7	30.00	29.92	29.82
5/22/2012	88	71	54	26	17	8	29.81	29.72	29.55
5/23/2012	80	64	47	39	26	12	29.81	29.59	29.48
5/24/2012	76	56	36	59	33	6	29.72	29.61	29.39
5/25/2012	77	69	60	42	28	14	29.40	29.31	29.26
5/26/2012	58	51	44	49	32	15	29.91	29.61	29.36
5/27/2012	65	50	35	59	39	18	30.00	29.95	29.88
5/28/2012	75	53	31	64	38	12	30.04	29.97	29.90
5/29/2012	80	58	36	44	26	7	29.96	29.91	29.87
5/30/2012	85	64	42	33	21	9	29.98	29.93	29.88
5/31/2012	86	65	44	42	28	14	30.01	29.94	29.86
6/1/2012	91	70	48	50	31	12	29.95	29.83	29.72
6/2/2012	91	71	51	48	28	7	29.93	29.72	29.67
6/3/2012	92	74	56	30	19	8	30.02	29.78	29.70
6/4/2012	88	71	53	35	22	8	30.03	29.75	29.64
6/5/2012	77	71	65	34	21	8	29.89	29.64	29.50
6/6/2012	72	52	31	56	36	16	30.00	29.92	29.85
6/7/2012	82	58	33	56	32	8	30.00	29.92	29.82
6/8/2012	85	69	53	24	16	8	30.00	29.74	29.60
6/9/2012	84	74	64	28	20	12	29.90	29.63	29.52

Table B1. Daily Meteorological Data for the Alton Area (Cedar City Regional Airport)

Date	Max. Temperature (°F)	Mean Temperature (°F)	Min. Temperature (°F)	Max. Humidity (%)	Mean Humidity (%)	Min. Humidity (%)	Max. Sea Level Pressure (in Hg)	Mean Sea Level Pressure (in Hg)	Min. Sea Level Pressure (in Hg)
6/10/2012	73	54	34	35	21	7	30.03	29.98	29.91
6/11/2012	82	56	30	44	25	6	30.21	30.03	29.95
6/12/2012	88	65	41	35	20	5	30.15	29.93	29.82
6/13/2012	89	67	45	29	18	6	30.02	29.75	29.66
6/14/2012	89	68	46	34	21	7	29.79	29.73	29.68
6/15/2012	88	68	48	36	22	8	29.97	29.76	29.70
6/16/2012	89	70	50	41	27	12	30.16	29.93	29.84
6/17/2012	93	71	48	41	23	4	30.19	29.88	29.77
6/18/2012	91	75	58	23	14	5	29.76	29.68	29.59
6/19/2012	91	73	54	24	16	7	29.91	29.69	29.58
6/20/2012	86	67	47	39	24	9	30.14	29.90	29.74
6/21/2012	97	70	42	37	22	6	29.94	29.82	29.70
6/22/2012	91	78	64	24	15	6	29.70	29.65	29.59
6/23/2012	90	72	54	14	10	5	29.91	29.65	29.58
6/24/2012	93	77	61	13	10	7	30.07	29.82	29.73
6/25/2012	90	73	55	42	29	15	29.90	29.83	29.74
6/26/2012	90	77	64	20	13	6	30.02	29.75	29.68
6/27/2012	91	74	57	26	18	9	29.86	29.81	29.76
6/28/2012	92	74	56	43	28	13	30.16	29.92	29.87
6/29/2012	93	79	65	32	21	10	29.94	29.89	29.81
6/30/2012	95	73	50	31	18	5	29.88	29.80	29.73
7/1/2012	90	71	51	28	18	7	30.01	29.78	29.71
7/2/2012	92	72	51	38	24	9	29.84	29.80	29.76

Table B1. Daily Meteorological Data for the Alton Area (Cedar City Regional Airport)

Date	Max. Temperature (°F)	Mean Temperature (°F)	Min. Temperature (°F)	Max. Humidity (%)	Mean Humidity (%)	Min. Humidity (%)	Max. Sea Level Pressure (in Hg)	Mean Sea Level Pressure (in Hg)	Min. Sea Level Pressure (in Hg)
7/3/2012	92	72	52	33	23	13	30.00	29.80	29.74
7/4/2012	90	72	53	32	25	18	30.02	29.81	29.77
7/5/2012	84	73	62	72	49	26	29.95	29.89	29.82
7/6/2012	90	70	50	71	46	20	30.23	30.01	29.94
7/7/2012	92	74	55	66	38	10	30.21	29.97	29.89
7/8/2012	95	75	55	51	32	12	30.00	29.95	29.90
7/9/2012	98	76	53	55	33	10	29.99	29.92	29.86
7/10/2012	99	79	58	42	26	10	30.16	29.88	29.81
7/11/2012	98	84	70	27	20	12	30.17	29.89	29.81
7/12/2012	98	81	64	40	26	12	30.24	29.92	29.81
7/13/2012	85	74	62	84	58	32	30.22	29.98	29.89
7/14/2012	81	70	58	100	68	36	30.14	29.97	29.90
7/15/2012	79	69	59	78	58	37	30.18	29.99	29.89
7/16/2012	84	68	52	77	52	26	30.08	29.91	29.84
7/17/2012	85	68	50	89	53	17	30.06	29.90	29.83
7/18/2012	88	71	54	40	24	7	30.18	29.94	29.90
7/19/2012	85	67	48	56	36	16	30.07	30.03	29.96
7/20/2012	91	74	57	80	51	21	30.29	30.06	29.96
7/21/2012	92	76	60	73	49	24	30.25	30.07	29.94
7/22/2012	89	75	60	90	57	23	30.14	29.99	29.88
7/23/2012	88	75	62	78	51	24	30.24	30.02	29.87
7/24/2012	80	69	58	86	67	47	30.22	30.01	29.90
7/25/2012	88	74	60	72	49	25	29.96	29.92	29.85

Table B1. Daily Meteorological Data for the Alton Area (Cedar City Regional Airport)

Date	Max. Temperature (°F)	Mean Temperature (°F)	Min. Temperature (°F)	Max. Humidity (%)	Mean Humidity (%)	Min. Humidity (%)	Max. Sea Level Pressure (in Hg)	Mean Sea Level Pressure (in Hg)	Min. Sea Level Pressure (in Hg)
7/26/2012	92	74	55	72	45	17	29.95	29.89	29.84
7/27/2012	90	74	58	67	43	18	30.17	29.92	29.86
7/28/2012	92	76	59	60	41	21	30.21	29.94	29.87
7/29/2012	85	74	63	61	47	33	30.26	30.03	29.91
7/30/2012	80	72	63	81	60	38	30.27	30.07	29.98
7/31/2012	85	71	56	93	65	37	30.25	30.07	29.96
8/1/2012	81	70	59	90	66	42	30.27	30.09	29.99
8/2/2012	91	74	57	67	41	15	30.22	30.00	29.84
8/3/2012	88	74	60	64	44	23	30.16	29.89	29.81
8/4/2012	85	73	61	49	37	25	30.17	29.96	29.83
8/5/2012	88	70	52	83	51	18	30.09	30.04	29.99
8/6/2012	89	76	62	67	45	22	30.36	30.11	30.03
8/7/2012	93	74	55	86	54	21	30.23	30.09	29.95
8/8/2012	93	76	58	65	43	21	30.24	30.03	29.96
8/9/2012	93	76	58	78	49	20	30.23	30.03	29.92
8/10/2012	94	78	62	65	41	16	30.22	29.91	29.82
8/11/2012	93	74	55	77	46	14	30.18	29.94	29.87
8/12/2012	92	75	58	72	46	19	30.17	29.99	29.88
8/13/2012	90	76	62	72	48	24	30.25	30.00	29.86
8/14/2012	87	73	58	90	61	32	30.25	29.97	29.85
8/15/2012	88	73	57	84	54	23	30.14	29.91	29.84
8/16/2012	92	74	55	80	48	16	30.14	29.93	29.86
8/17/2012	91	79	66	63	46	28	30.23	30.01	29.85

Table B1. Daily Meteorological Data for the Alton Area (Cedar City Regional Airport)

Date	Max. Temperature (°F)	Mean Temperature (°F)	Min. Temperature (°F)	Max. Humidity (%)	Mean Humidity (%)	Min. Humidity (%)	Max. Sea Level Pressure (in Hg)	Mean Sea Level Pressure (in Hg)	Min. Sea Level Pressure (in Hg)
8/18/2012	88	73	58	84	53	22	30.01	29.92	29.83
8/19/2012	87	74	60	73	54	35	30.27	29.97	29.84
8/20/2012	85	71	56	100	66	32	30.28	29.98	29.88
8/21/2012	86	74	61	78	58	37	30.22	29.99	29.87
8/22/2012	74	66	58	93	73	53	30.15	29.98	29.89
8/23/2012	76	68	59	93	70	46	30.13	29.93	29.87
8/24/2012	84	70	56	80	62	43	30.07	29.92	29.82
8/25/2012	85	70	54	83	54	25	30.09	29.92	29.80
8/26/2012	86	71	55	86	59	31	30.14	29.92	29.85
8/27/2012	87	71	54	80	53	25	30.27	30.00	29.94
8/28/2012	90	72	53	77	51	24	30.25	30.00	29.93
8/29/2012	91	74	57	72	46	19	30.19	29.97	29.83
8/30/2012	88	72	56	72	46	20	30.04	29.87	29.78
8/31/2012	77	69	61	84	64	44	30.19	29.94	29.85
9/1/2012	83	70	56	84	55	26	29.97	29.93	29.87
9/2/2012	85	68	51	83	53	22	30.21	29.97	29.91
9/3/2012	87	69	50	71	45	18	30.05	29.99	29.94
9/4/2012	85	69	53	61	42	23	30.25	30.03	29.96
9/5/2012	88	69	50	83	48	13	30.08	29.98	29.91
9/6/2012	84	70	55	72	51	29	30.13	29.93	29.88
9/7/2012	87	70	52	86	55	23	30.10	30.02	29.96
9/8/2012	86	68	50	63	39	14	30.29	30.09	29.99
9/9/2012	88	67	45	58	37	16	30.26	30.01	29.91

Table B1. Daily Meteorological Data for the Alton Area (Cedar City Regional Airport)

Date	Max. Temperature (°F)	Mean Temperature (°F)	Min. Temperature (°F)	Max. Humidity (%)	Mean Humidity (%)	Min. Humidity (%)	Max. Sea Level Pressure (in Hg)	Mean Sea Level Pressure (in Hg)	Min. Sea Level Pressure (in Hg)
9/10/2012	81	68	55	60	43	26	30.16	29.92	29.84
9/11/2012	68	62	55	100	82	63	30.17	29.99	29.90
9/12/2012	76	65	54	100	64	27	30.23	30.10	30.02
9/13/2012	79	60	40	70	42	14	30.34	30.26	30.19
9/14/2012	81	61	41	73	44	15	30.32	30.22	30.14
9/15/2012	84	65	46	66	40	14	30.21	30.13	30.06
9/16/2012	81	63	45	61	38	15	30.13	30.05	29.97
9/17/2012	81	64	46	56	36	15	30.19	30.02	29.95
9/18/2012	81	59	36	59	34	9	30.19	30.11	30.06
9/19/2012	83	60	37	64	37	9	30.20	30.09	30.02
9/20/2012	85	64	42	53	32	11	30.26	30.07	29.99
9/21/2012	85	64	42	57	34	10	30.13	30.03	29.97
9/22/2012	85	64	42	53	34	14	30.23	30.02	29.97
9/23/2012	81	68	55	51	36	21	30.04	29.99	29.94
9/24/2012	76	64	51	50	38	25	30.17	29.98	29.82
9/25/2012	68	58	47	100	68	35	30.10	29.97	29.85
9/26/2012	73	55	36	92	61	29	30.11	30.01	29.95
9/27/2012	76	58	39	92	58	23	30.12	30.05	29.99
9/28/2012	79	60	40	82	48	13	30.09	30.00	29.93
9/29/2012	82	61	39	67	40	13	30.11	30.05	29.99
9/30/2012	83	62	41	62	38	13	30.19	30.13	30.09
10/1/2012	83	61	39	62	38	13	30.22	30.12	30.04
10/2/2012	84	61	37	64	37	10	30.09	29.98	29.88

Table B1. Daily Meteorological Data for the Alton Area (Cedar City Regional Airport)

Date	Max. Temperature (°F)	Mean Temperature (°F)	Min. Temperature (°F)	Max. Humidity (%)	Mean Humidity (%)	Min. Humidity (%)	Max. Sea Level Pressure (in Hg)	Mean Sea Level Pressure (in Hg)	Min. Sea Level Pressure (in Hg)
10/3/2012	85	65	45	49	30	11	29.96	29.91	29.85
10/4/2012	79	61	43	42	28	13	30.04	29.97	29.91
10/5/2012	75	59	42	58	38	17	30.07	29.99	29.91
10/6/2012	71	54	36	40	26	12	30.09	30.01	29.93
10/7/2012	70	49	28	51	31	10	30.13	30.05	29.98
10/8/2012	74	54	33	48	32	16	30.05	29.96	29.90
10/9/2012	76	58	39	60	38	15	30.00	29.92	29.87
10/10/2012	73	59	45	60	45	29	30.00	29.92	29.85
10/11/2012	68	55	42	70	49	27	30.02	29.90	29.84
10/12/2012	49	45	40	93	77	60	30.10	29.98	29.81
10/13/2012	64	51	38	100	72	43	30.26	30.16	30.05
10/14/2012	67	51	35	92	63	34	30.33	30.24	30.17
10/15/2012	73	54	34	92	57	22	30.14	30.06	29.99
10/16/2012	75	56	37	85	54	23	30.00	29.90	29.79
10/17/2012	64	50	36	71	44	16	30.16	30.05	29.89
10/18/2012	69	49	28	69	42	14	30.27	30.19	30.13
10/19/2012	74	51	28	75	45	14	30.18	30.04	29.89
10/20/2012	73	55	37	60	37	14	29.89	29.78	29.69
10/21/2012	69	59	48	59	46	32	29.75	29.71	29.68
10/22/2012	65	59	53	66	50	34	29.71	29.68	29.63
10/23/2012	64	57	49	50	33	16	29.75	29.70	29.65
10/24/2012	53	42	30	82	59	36	30.11	29.90	29.73
10/25/2012	53	36	19	96	59	22	30.31	30.18	30.09

Table B1. Daily Meteorological Data for the Alton Area (Cedar City Regional Airport)

Date	Max. Temperature (°F)	Mean Temperature (°F)	Min. Temperature (°F)	Max. Humidity (%)	Mean Humidity (%)	Min. Humidity (%)	Max. Sea Level Pressure (in Hg)	Mean Sea Level Pressure (in Hg)	Min. Sea Level Pressure (in Hg)
10/26/2012	52	35	18	84	52	19	30.44	30.31	30.20
10/27/2012	63	42	21	68	42	16	30.22	30.15	30.09
10/28/2012	68	47	25	69	43	16	30.19	30.11	30.03
10/29/2012	71	50	28	69	42	14	30.21	30.13	30.08
10/30/2012	73	53	32	64	41	17	30.19	30.12	30.05
10/31/2012	73	52	30	69	40	11	30.14	30.06	29.98
11/1/2012	66	55	44	37	25	12	29.98	29.95	29.91
11/2/2012	65	46	26	63	40	16	30.10	30.03	29.96
11/3/2012	66	46	26	68	42	16	30.23	30.16	30.07
11/4/2012	68	47	25	69	45	20	30.35	30.29	30.22
11/5/2012	68	49	30	72	48	24	30.40	30.32	30.24
11/6/2012	69	49	28	78	51	23	30.35	30.24	30.16
11/7/2012	71	51	30	78	47	16	30.15	30.04	29.86
11/8/2012	65	51	37	71	46	20	29.89	29.74	29.62
11/9/2012	51	44	37	86	76	66	29.71	29.59	29.49
11/10/2012	36	31	25	92	70	47	30.06	29.78	29.64
11/11/2012	35	25	14	92	64	35	30.50	30.32	30.05
11/12/2012	47	29	11	88	57	25	30.53	30.43	30.34
11/13/2012	52	34	15	84	56	28	30.42	30.33	30.25
11/14/2012	59	39	18	88	54	19	30.31	30.22	30.12
11/15/2012	55	38	20	75	50	24	30.29	30.21	30.13
11/16/2012	58	48	37	70	49	28	30.09	30.05	30.01
11/17/2012	56	45	33	82	67	51	30.10	30.01	29.96

Table B1. Daily Meteorological Data for the Alton Area (Cedar City Regional Airport)

Date	Max. Temperature (°F)	Mean Temperature (°F)	Min. Temperature (°F)	Max. Humidity (%)	Mean Humidity (%)	Min. Humidity (%)	Max. Sea Level Pressure (in Hg)	Mean Sea Level Pressure (in Hg)	Min. Sea Level Pressure (in Hg)
11/18/2012	55	46	37	85	62	38	30.15	30.05	29.96
11/19/2012	57	43	28	85	60	35	30.27	30.22	30.15
11/20/2012	61	44	26	85	55	25	30.27	30.16	30.06
11/21/2012	61	44	27	69	45	20	30.11	30.03	29.96
11/22/2012	55	40	25	75	55	35	30.46	30.29	30.07
11/23/2012	54	38	22	92	62	32	30.54	30.43	30.34
11/24/2012	65	44	22	81	48	15	30.36	30.21	30.04
11/25/2012	64	45	26	55	36	16	30.07	29.98	29.89
11/26/2012	55	39	22	77	53	28	30.28	30.18	30.03
11/27/2012	62	40	18	84	51	17	30.35	30.26	30.19
11/28/2012	62	46	29	59	42	25	30.21	30.11	30.02
11/29/2012	56	44	32	64	51	38	30.12	30.07	30.04
11/30/2012	52	46	39	79	65	50	30.02	29.98	29.94
12/1/2012	54	43	32	89	70	50	30.09	30.04	30.00
12/2/2012	54	43	31	85	68	50	30.03	29.92	29.83
12/3/2012	53	42	30	96	73	50	30.27	30.11	29.93
12/4/2012	61	45	29	92	62	32	30.36	30.27	30.21
12/5/2012	62	46	29	72	48	23	30.19	30.07	29.97
12/6/2012	56	47	37	85	64	43	29.98	29.94	29.86
12/7/2012	50	37	24	92	66	39	30.09	30.02	29.92
12/8/2012	54	39	23	81	50	19	30.01	29.94	29.87
12/9/2012	34	23	12	84	61	38	30.40	30.23	30.01
12/10/2012	46	28	9	83	58	33	30.37	30.27	30.17

Table B1. Daily Meteorological Data for the Alton Area (Cedar City Regional Airport)

Date	Max. Temperature (°F)	Mean Temperature (°F)	Min. Temperature (°F)	Max. Humidity (%)	Mean Humidity (%)	Min. Humidity (%)	Max. Sea Level Pressure (in Hg)	Mean Sea Level Pressure (in Hg)	Min. Sea Level Pressure (in Hg)
12/11/2012	49	32	14	81	55	29	30.21	30.07	29.88
12/12/2012	51	42	33	44	34	23	29.84	29.78	29.73
12/13/2012	50	45	39	37	30	22	29.78	29.74	29.68
12/14/2012	39	35	30	100	86	72	29.84	29.66	29.52
12/15/2012	36	32	28	92	85	78	29.92	29.83	29.78
12/16/2012	35	30	25	92	81	69	30.07	29.99	29.89
12/17/2012	41	34	26	89	80	70	30.05	29.97	29.86
12/18/2012	43	36	29	96	85	73	29.85	29.67	29.53
12/19/2012	22	10	-2	91	77	62	30.60	30.17	29.71
12/20/2012	27	9	-10	91	76	61	30.64	30.51	30.37
12/21/2012	39	21	2	80	59	37	30.40	30.24	30.16
12/22/2012	42	28	13	73	54	34	30.16	30.06	29.94
12/23/2012	42	30	18	68	59	49	30.12	30.01	29.90
12/24/2012	39	34	29	92	73	54	30.17	29.87	29.76
12/25/2012	31	17	3	92	74	55	30.34	30.20	29.93
12/26/2012	31	27	23	92	67	42	29.88	29.77	29.72
12/27/2012	32	26	20	88	79	69	30.10	29.89	29.77
12/28/2012	31	19	6	96	72	47	30.29	30.21	30.10
12/29/2012	35	23	10	84	61	38	30.25	30.15	30.01
12/30/2012	25	19	13	91	76	60	30.04	29.93	29.85
12/31/2012	24	12	0	92	79	65	30.40	30.11	29.94
Annual Averages	***67***	***52***	***36***	***70***	***48***	***25***	***30.13***	***29.99***	***29.89***

Source: Weather Underground, Inc. (2013)

Modeled Values	Value	Units
Mean Temperature	11	°C
Mean Humidity	48	%
Mean Atmospheric Pressure	1,016	mbar

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Appendix C

Noise Level Contributions from Different Sources to each Receptor

Table C1. Noise Emissions of Road Traffic - Hatch

Stationing (km)	ADT Veh./24h	Traffic Values				Control Device	Constr. Speed (km/h)	Affect. Veh. %	Road Surface	Gradient Min./Max.%
		Vehicles Type	Vehicle Name	Veh./h	Speed (km/h)					
SR-89 Traffic direction: In entry direction										
0+000	6120	Total	-	255	-	none	-	-	DGAC (dense-graded asphaltic concrete)	2.1/-0.1
		Automobiles	-	175	105					
		Medium trucks	-	-	-					
		Heavy trucks	-	80	90					
		Buses	-	-	-					
		Motorcycles	-	-	-					
		Auxiliary Vehicle	-	-	-					
3+319	6120	Total	-	255	-	none	-	-	DGAC (dense-graded asphaltic concrete)	1.1
		Automobiles	-	175	65					
		Medium trucks	-	-	-					
		Heavy trucks	-	80	65					
		Buses	-	-	-					
		Motorcycles	-	-	-					
		Auxiliary Vehicle	-	-	-					
4+518	6120	Total	-	255	-	none	-	-	DGAC (dense-graded asphaltic concrete)	1.1/0
		Automobiles	-	175	105					
		Medium trucks	-	-	-					
		Heavy trucks	-	80	90					
		Buses	-	-	-					
		Motorcycles	-	-	-					
		Auxiliary Vehicle	-	-	-					
6+240	-					-	-	-	-	-

Table C2. Noise Emissions of Road Traffic - Panguitch

Stationing (km)	ADT Veh./24h	Traffic Values				Control Device	Constr. Speed (km/h)	Affect. Veh. %	Road Surface	Gradient Min./Max.%
		Vehicles type	Vehicle name	Veh./h	Speed (km/h)					
SR-89 Traffic direction: In entry direction										
0+000	6120	Total	-	255	-	none	-	-	DGAC (dense-graded asphaltic concrete)	-6.8/5.3
		Automobiles	-	175	105					
		Medium trucks	-	-	-					
		Heavy trucks	-	80	90					
		Buses	-	-	-					
		Motorcycles	-	-	-					
		Auxiliary Vehicle	-	-	-					
2+035	6120	Total	-	255	-	none	-	-	DGAC (dense-graded asphaltic concrete)	-1/0.3
		Automobiles	-	175	60					
		Medium trucks	-	-	-					
		Heavy trucks	-	80	60					
		Buses	-	-	-					
		Motorcycles	-	-	-					
		Auxiliary Vehicle	-	-	-					
5+421	6120	Total	-	255	-	none	-	-	DGAC (dense-graded asphaltic concrete)	-1.3/0
		Automobiles	-	175	105					
		Medium trucks	-	-	-					
		Heavy trucks	-	80	90					
		Buses	-	-	-					
		Motorcycles	-	-	-					
		Auxiliary Vehicle	-	-	-					
7+436	-					-	-	-	-	-

Table C3. Noise Emissions of Road Traffic - Track C

Stationing (km)	ADT Veh./24h	Traffic Values				Control Device	Constr. Speed (km/h)	Affect. Veh. %	Road Surface	Gradient Min./Max.%
		Vehicles type	Vehicle name	Veh./h	Speed (km/h)					
Alton Road Traffic direction: In entry direction										
0+000	420	Total	-	18	-	none	-	-	DGAC (dense-graded asphaltic concrete)	2.8/0.2
		Automobiles	-	9	55					
		Medium trucks	-	-	-					
		Heavy trucks	-	9	55					
		Buses	-	-	-					
		Motorcycles	-	-	-					
		Auxiliary Vehicle	-	-	-					
6+028	-					-	-	-	-	-
SR-89 Traffic direction: In entry direction										
1+907	6120	Total	-	255	-	none	-	-	DGAC (dense-graded asphaltic concrete)	0.0/11.8
		Automobiles	-	175	105					
		Medium trucks	-	-	-					
		Heavy trucks	-	80	90					
		Buses	-	-	-					
		Motorcycles	-	-	-					
		Auxiliary Vehicle	-	-	-					
8+390	6120	Total	-	255	-	none	-	-	DGAC (dense-graded asphaltic concrete)	0.7
		Automobiles	-	175	105					
		Medium trucks	-	-	-					
		Heavy trucks	-	80	90					
		Buses	-	-	-					
		Motorcycles	-	-	-					
		Auxiliary Vehicle	-	-	-					
8+760	-					-	-	-	-	-

Table C3. Noise Emissions of Road Traffic - Track C

Local Roadways Traffic direction: In entry direction										
0+306	384	Total	-	16	-	none	-	-	DGAC (dense-graded asphaltic concrete)	5.1/5.9
		Automobiles	-	8	55					
		Medium trucks	-	-	-					
		Heavy trucks	-	8	55					
		Buses	-	-	-					
		Motorcycles	-	-	-					
		Auxiliary Vehicle	-	-	-					
0+695	384	Total	-	16	-	none	-	-	DGAC (dense-graded asphaltic concrete)	0.3/5.6
		Automobiles	-	8	55					
		Medium trucks	-	-	-					
		Heavy trucks	-	8	55					
		Buses	-	-	-					
		Motorcycles	-	-	-					
		Auxiliary Vehicle	-	-	-					
1+865	-					-	-	-	-	-

Table C4. Noise Emissions of Road Traffic - Tract NW

Stationing (km)	ADT Veh./24h	Traffic Values				Control Device	Constr. Speed (km/h)	Affect. Veh. %	Road Surface	Gradient Min./Max.%
		Vehicles Type	Vehicle Name	Veh./h	Speed (km/h)					
Alton Road Traffic direction: In entry direction										
0+000	420	Total	-	18	-	none	-	-	DGAC (dense-graded asphaltic concrete)	2.8/0.2
		Automobiles	-	9	55					
		Medium trucks	-	-	-					
		Heavy trucks	-	9	55					
		Buses	-	-	-					
		Motorcycles	-	-	-					
		Auxiliary Vehicle	-	-	-					
6+028	-					-	-	-	-	-
SR-89 Traffic direction: In entry direction										
1+907	6120	Total	-	255	-	none	-	-	DGAC (dense-graded asphaltic concrete)	0.0/11.8
		Automobiles	-	175	105					
		Medium trucks	-	-	-					
		Heavy trucks	-	80	90					
		Buses	-	-	-					
		Motorcycles	-	-	-					
		Auxiliary Vehicle	-	-	-					
8+390	6120	Total	-	255	-	none	-	-	DGAC (dense-graded asphaltic concrete)	0.7
		Automobiles	-	175	105					
		Medium trucks	-	-	-					
		Heavy trucks	-	80	90					
		Buses	-	-	-					
		Motorcycles	-	-	-					
		Auxiliary Vehicle	-	-	-					
8+760	-					-	-	-	-	-

Table C4. Noise Emissions of Road Traffic - Tract NW

Local Roadways Traffic direction: In entry direction										
0+306	384	Total	-	16	-	none	-	-	DGAC (dense-graded asphaltic concrete)	5.1/5.9
		Automobiles	-	8	55					
		Medium trucks	-	-	-					
		Heavy trucks	-	8	55					
		Buses	-	-	-					
		Motorcycles	-	-	-					
		Auxiliary Vehicle	-	-	-					
0+695	384	Total	-	16	-	none	-	-	DGAC (dense-graded asphaltic concrete)	0.3/5.6
		Automobiles	-	8	55					
		Medium trucks	-	-	-					
		Heavy trucks	-	8	55					
		Buses	-	-	-					
		Motorcycles	-	-	-					
		Auxiliary Vehicle	-	-	-					
1+865	-					-	-	-	-	-

Table C5. Noise Emissions of Road Traffic - Tract S

Stationing (km)	ADT Veh./24h	Traffic Values				Control Device	Constr. Speed (km/h)	Affect. Veh. %	Road Surface	Gradient Min./Max.%
		Vehicles Type	Vehicle Name	Veh./h	Speed (km/h)					
Alton Road Traffic direction: In entry direction										
0+000	420	Total	-	18	-	none	-	-	DGAC (dense-graded asphaltic concrete)	2.8/0.2
		Automobiles	-	9	55					
		Medium trucks	-	-	-					
		Heavy trucks	-	9	55					
		Buses	-	-	-					
		Motorcycles	-	-	-					
		Auxiliary Vehicle	-	-	-					
6+028	-					-	-	-	-	-
SR-89 Traffic direction: In entry direction										
1+907	6120	Total	-	255	-	none	-	-	DGAC (dense-graded asphaltic concrete)	0.0/11.8
		Automobiles	-	175	105					
		Medium trucks	-	-	-					
		Heavy trucks	-	80	90					
		Buses	-	-	-					
		Motorcycles	-	-	-					
		Auxiliary Vehicle	-	-	-					
8+390	6120	Total	-	255	-	none	-	-	DGAC (dense-graded asphaltic concrete)	0.7
		Automobiles	-	175	105					
		Medium trucks	-	-	-					
		Heavy trucks	-	80	90					
		Buses	-	-	-					
		Motorcycles	-	-	-					
		Auxiliary Vehicle	-	-	-					
8+760	-					-	-	-	-	-

Table C5. Noise Emissions of Road Traffic - Tract S

Local Roadways Traffic direction: In entry direction										
0+306	384	Total	-	16	-	none	-	-	DGAC (dense-graded asphaltic concrete)	5.1/5.9
		Automobiles	-	8	55					
		Medium trucks	-	-	-					
		Heavy trucks	-	8	55					
		Buses	-	-	-					
		Motorcycles	-	-	-					
		Auxiliary Vehicle	-	-	-					
0+695	384	Total	-	16	-	none	-	-	DGAC (dense-graded asphaltic concrete)	0.3/5.6
		Automobiles	-	8	55					
		Medium trucks	-	-	-					
		Heavy trucks	-	8	55					
		Buses	-	-	-					
		Motorcycles	-	-	-					
		Auxiliary Vehicle	-	-	-					
1+865	-					-	-	-	-	-

Appendix D

Calculations for Blasting Noise and Vibration Impacts at each Receptor

Table D1. Blasting Impact Noise Calculations

Receptor	Closest Mine Block	Distance (D) (ft)	Cube root scaled distance (D/W^3)[1] (ft/lb^3)	Airblast Overpressure (AB)		Blasting Impact (SPL)	
				Highwall[2] (psi x 10^6)	Parting[3] (psi x 10^6)	Highwall[4] (dB linear)	Parting[4] (dB linear)
Tract (50 ft)	Block C, NW, S	50	8	31,792	6,057,862	141	186
Yovimpa Point	Block C	65,000	10,107	107	54	91	85
Riggs Spring	Block C	65,000	10,107	107	54	91	85
Farview Point	Block C	74,000	11,506	97	43	90	83
Town of Alton (nearest building)	Block NW	500	78	5,109	144,318	125	154
Town of Alton (nearest building)	Block C	5,400	840	772	3,034	109	120
Town of Alton (nearest building)	Block S	20,000	3,110	273	362	99	102

1 The cube-root scaled distance is calculated based on a maximum instantaneous charge of 266 lb per delay.

2 Calculated via the equation for airblast overpressure from highwall coal mine blasting (high-pass frequencies of greater than 0.1 Hz):

$$AB = 0.162 \times \left(\frac{D}{W^{1/3}}\right)^{-0.794}$$

3 Calculated via the equation for airblast overpressure from parting coal mine blasting (high-pass frequencies of greater than 0.1 Hz)

$$AB = 169 \times \left(\frac{D}{W^{1/3}}\right)^{-1.623}$$

4 Calculated via the standard equation for deriving sound pressure levels in decibels:

$$SPL = 20 \times \log_{10}\left(\frac{AB}{P_0}\right)$$

Table D2. Blasting Impact Vibration Calculations

Receptor	Closest Mine Block	Distance (ft)	Square root scaled distance[1] (ft/lb^2)	Vibration Impact	
				Mean[2] (in/s)	Maximum[3] (in/s)
Tract (50 ft)	Block C, NW, S	50	3	21.7	79.8
Yovimpa Point	Block C	65,000	3,985	0.0004	0.0015
Riggs Spring	Block C	65,000	3,985	0.0004	0.0015
Farview Point	Block C	74,000	4,537	0.0003	0.0012
Town of Alton (nearest building)	Block NW	500	31	0.7	2.4
Town of Alton (nearest building)	Block C	5,400	331	0.0176	0.0647
Town of Alton (nearest building)	Block S	20,000	1,226	0.0024	0.0088

[1] The square-root scaled distance is calculated based on a maximum instantaneous charge of 266 lb per delay.

[2] Calculated via the equation for mean expected vibration from blasting:

$$PPV = 119 \times \left(\frac{D}{W^{1/2}}\right)^{-1.52}$$

[3] Calculated via the equation for maximum expected vibration from blasting:

$$PPV = 438 \times \left(\frac{D}{W^{1/2}}\right)^{-1.52}$$

APPENDIX M.

PROGRAMMATIC AGREEMENT BETWEEN THE USDI BUREAU OF LAND MANAGEMENT, KANAB FIELD OFFICE; USDI OFFICE OF SURFACE MINING RECLAMATION AND ENFORCEMENT; UTAH DIVISION OF OIL, GAS, AND MINING; AND UTAH STATE HISTORIC PRESERVATION OFFICER REGARDING THE ALTON COAL TRACT LEASE BY APPLICATION PROJECT

PROGRAMMATIC AGREEMENT
BETWEEN THE
U.S.D.I. BUREAU OF LAND MANAGEMENT, KANAB FIELD OFFICE;
U.S.D.I. OFFICE OF SURFACE MINING RECLAMATION AND ENFORCEMENT;
UTAH DIVISION OF OIL, GAS, AND MINING;
AND UTAH STATE HISTORIC PRESERVATION OFFICER
REGARDING
THE ALTON COAL TRACT LEASE BY APPLICATION PROJECT

WHEREAS, the Bureau of Land Management, Kanab Field Office (BLM KFO) has received a Lease by Application (LBA) filed by Alton Coal Development, LLC to mine federal coal using primarily surface-mining methods near the town of Alton, Utah (hereafter "Project"); and

WHEREAS, the Bureau of Land Management is a federal land management agency responsible for receiving and processing applications for leasing of solid leasable minerals pursuant to 42 CFR 3425, Leasing on Application, and for establishing multiple uses of federal lands in providing for present and future generations as authorized by the Federal Land Policy and Management Act (FLPMA) of 1976 (43 USC 1701 et seq.); and

WHEREAS, BLM KFO has determined that issuing a lease to mine federal coal is an undertaking as defined in 36 CFR 800.16(y); and

WHEREAS, the Federal Office of Surface Mining Reclamation and Enforcement (OSM) is responsible for preparing and submitting a mining plan recommendation package upon issuance of a lease by BLM KFO to the Assistant Secretary of the Department of the Interior, Land and Minerals Management pursuant to the Surface Mining Control and Reclamation Act (SMCRA) of 1977 (30 USC 1201 et seq.); and

WHEREAS, OSM has determined that submission of a Federal Mine Plan package to the Assistant Secretary of the Department of the Interior, Land and Minerals Management is an undertaking as defined in 36 CFR 800.16(y); and

WHEREAS, the Department of the Army, U. S. Army Corps of Engineers has designated BLM to act on their behalf (Attachment A) for this Project as the lead Federal agency pursuant to 36 CFR 800.2(a)(2); and

WHEREAS, BLM KFO will be the lead Federal agency and shall coordinate overall actions required under this Agreement as specified herein until a lease to mine federal coal is issued after which OSM will be the lead Federal agency an shall coordinate overall actions required under this Agreement; and

WHEREAS, The Utah Division of Oil , Gas and Mining (UDOGM) is responsible for permitting of coal mining in the State of Utah under an approved program issued by the Office of Surface Mining Reclamation and Enforcement pursuant to Surface Mining Control and Reclamation Act of 1977 (30 USC 1201 et seq.) and is a consulting party to this agreement; and

WHEREAS, UDOGM, as an agency in the State of Utah that has a responsibility to comply with Utah Code Annotated §9-8-404, intends to employ this Agreement to address the applicable requirements for

actions resulting from this Agreement and has therefore been invited to be an Invited Signatory to this Agreement pursuant to 36 CFR 800.2(c)(3); and

WHEREAS, the Advisory Council on Historic Preservation (ACHP) has elected to not participate in the consultation process for this Project under 36 CFR 800.2(b) (1); and

WHEREAS, Federal agencies consult with the Utah State Historic Preservation Officer (SHPO) to ensure that historic properties are taken into consideration at all levels of project planning and development for undertakings that may affect historic properties pursuant to 36 CFR 800.2(c)(1); and

WHEREAS, BLM KFO and OSM, in consultation with the SHPO, have agreed to develop a Programmatic Agreement (hereafter "Agreement") for this complex project pursuant to 36 CFR 800.14(b) because the effect on historic properties cannot be fully determined prior to approval, and because the phased approach adopted by this agreement is a departure from the consultation process detailed in 36 CFR 800.1 et seq.; and

WHEREAS, BLM KFO and OSM are responsible for government-to-government consultation with federally recognized Indian Tribes for this undertaking and are the lead Federal agencies for all Native American consultation and coordination, and has formally invited the Indian Tribes and Native American organizations listed in Attachment B to participate in consultation, and continue to be consulted regarding the potential effects of the Project on historic properties pursuant to 36 CFR 800.2(c)(2); and

WHEREAS, the Office of the Governor, Public Lands Policy Coordination Office, Kane County, and the City of Panguitch have participated in consultation and have been invited to be Concurring Parties to this Agreement pursuant to 36 CFR 800.2(c)(3); and

WHEREAS, the Alton Coal Development, LLC has participated in consultation and has been invited to be a Concurring Party to this Agreement pursuant to 36 CFR 800.2(c)(4); and

WHEREAS, BLM KFO and OSM have formally invited those parties listed in Attachment C to participate in consultation for the Project pursuant to 36 CFR 800.2(c)(5); and

WHEREAS, the National Park Service, Bryce Canyon National Park has participated in consultation and has been invited to be a Concurring Party to this Agreement; and

WHEREAS, the Utah Statewide Archaeological Society (USAS) has participated in consultation and has been invited to be a Concurring Party to this Agreement; and

WHEREAS, Ms. Bobbi Bryant of Panguitch and Mr. Bruce McMahan of Panguitch have participated in consultation and have been invited to be Concurring Parties to this Agreement; and

WHEREAS, unless defined differently in this Agreement, all terms are used in accordance with 36 CFR 800.16; and

NOW, THEREFORE, the Consulting Parties agree that the Project shall be administered in accordance with the following stipulations:

STIPULATIONS

The BLM KFO and OSM will ensure that the following measures will be carried out:

1. The successful lessee (hereafter "lessee") will fund all cultural resources work required under this Agreement, including: conducting Class I and III inventories, Reconnaissance Level Surveys, preparation of draft and final reports, preparation of Historic Properties Treatment Plans, analysis, monitoring, curation, and other mitigation. The lessee may use a cultural resource consultant (CRC), consistent with Stipulation 4 below, to complete the requirements listed in this stipulation.

2. BLM KFO and OSM will continue to consult with appropriate Indian Tribes regarding historic properties of religious and cultural significance in accordance with the National Historic Preservation Act (NHPA).

3. BLM KFO and OSM will ensure that all work undertaken to satisfy the terms of this Agreement meets the Secretary of the Interior's Standards and Guidelines for Archaeological and Historic Preservation (48 FR 44716-77442, September 23, 1983) (hereafter "Secretary's Standards") and takes into consideration the ACHP's Recommended Approach for Consultation on Recovery of Significant Information from Archaeological Sites, May 1999, Section 106 Guidance (at: http://www.achp.gov/archguide/), and Guidelines for Evaluating and Documenting Traditional Cultural Properties, *National Register Bulletin 38*, 1989, as incorporated by reference herein.

4. BLM KFO and OSM will ensure that all cultural resources fieldwork and reporting performed to satisfy this Agreement is carried out by or under the direct supervision of a person or persons meeting, at a minimum, the applicable professional qualifications standards set forth in the Secretary's Standards. BLM KFO will also ensure that the terms of this agreement are carried out in accordance with any existing BLM guidelines for cultural resources (prehistoric or historic).

5. Identification of historic properties.

    a. *Area of Potential Effects (APE).* The APE for the Project will include the entire lease area and a buffer extending one-mile from the external boundaries of the lease area; the proposed haul route along US Highway 89, Utah Highway 20, Interstate Highway 15, and Utah Highway 56 and a buffer extending 500 feet on each side of the haul route highway centerlines; the Panguitch Historic District; the town of Alton, Utah; and the town of Hatch, Utah. The APE is depicted in Attachment D.

    b. *Class I Cultural Resources Inventory.* A Class I Cultural Resources Inventory will be prepared that summarizes known cultural resources; including prehistoric and historic archaeological sites, traditional cultural properties, and historic architectural properties, inside the Project APE. Class I inventory data will minimally include archaeological and site files maintained by BLM KFO and by the Utah Division of State History, General Land Office maps, current United States Geological Survey maps, the National Register of Historic Places, and published historical documents concerning this area. The Class I cultural resources inventory report will include summaries of existing research on the effects of noise and vibration to historic properties.

c. *Class III Cultural Resources Inventory.* A Class III Cultural Resources Inventory will be conducted in all portions of the APE where Project activities will result in new ground disturbance. Portions of the APE where Project activities will result in new ground disturbance will not be subject to Class III re-inventory if the area has been inventoried at Class III standards within ten years prior to the execution of this Agreement. Class III inventory will be conducted where necessary inside the APE by archaeologists walking 15-meter wide, parallel transects. All prehistoric and historic period archaeological sites identified will be recorded on site forms consistent with BLM standards.

d. *Reconnaissance Level Survey*. A Reconnaissance Level Survey (RLS) to document and evaluate historic buildings will be conducted for all portions of the APE that have not been subject to survey for historic buildings within ten years prior to the execution of this Agreement. All necessary RLS will meet the Utah State Historic Preservation Office RLS Standard Operating Procedures in effect at the time of the survey.

6. Reporting

a. Upon completion of Class III inventory, a Class III Cultural Resources Inventory Report will be prepared by the Lessee's Cultural Resource Consultant (CRC). This report will describe the cultural resources inventory effort as a whole, describe the inventory methods used, provide the results of both Class I and Class III inventories, and make recommendations for the National Register of Historic Places (NRHP) eligibility of all historic localities discovered or revisited.

b. Upon completion of all RLS, a RLS Report will be prepared by the CRC. This report summarizes the results of the survey and will meet the reporting requirements detailed by the Utah State Historic Preservation Office RLS Standard Operating Procedures in effect at the time of the survey.

c. Draft Class III Cultural Resources Inventory Reports and draft RLS Reports will be submitted to BLM KFO and OSM by the CRC. BLM KFO and OSM will have thirty calendar days to provide comments.

d. BLM KFO and OSM will provide Tribes and Consulting Parties with an opportunity to review and comment on Class III Cultural Resources Inventory Reports and RLS Reports prior to agency submission to SHPO. Tribes and Consulting Parties will have thirty calendar days to provide comments to BLM KFO and OSM.

e. Final Class III Cultural Resources Inventory Reports and RLS Reports that consider comments made by BLM KFO and OSM will be submitted by the CRC to BLM KFO and OSM to support agency decisions regarding National Register of Historic Places eligibility determinations.

f. Upon completion of Phase I (testing) as prescribed by the Historic Properties Treatment Plan (HPTP), a Phase I Results report will be prepared. This report will describe the cultural resources test excavation effort as a whole, describe the testing methods used, provide the results of appropriate artifact analysis, and make revised recommendations

for the National Register of Historic Places (NRHP) eligibility of all historic localities tested.

g. Draft Phase I Results reports will be submitted by the CRC to BLM KFO and OSM for distribution to Consulting Parties. Consulting Parties will have 30 calendar days from receipt of the draft Phase I Results report to provide comments to BLM KFO and OSM.

h. Final Phase I Results reports that consider comments made by BLM KFO and OSM will be submitted by the CRC to BLM KFO and OSM to support agency decisions regarding National Register of Historic Places eligibility determinations and the need for Phase II work as prescribed by the HPTP.

i. Upon completion of Phase II (data recovery) as prescribed by the HPTP, a Phase II Results report will be prepared by the CRC. This report will describe the cultural resources data recovery effort as a whole, describe the methods used, and provide the results of appropriate artifact analysis at all historic localities treated.

j. Draft Phase II Results reports will be submitted by the CRC to BLM KFO and OSM for distribution to Consulting Parties. Consulting Parties will have 30 calendar days from receipt of the draft Phase II Results reports to provide comments to BLM KFO and OSM.

k. Final Phase II Results reports that consider comments made by BLM KFO and OSM will be submitted by the CRC to BLM KFO and OSM.

l. All cultural resources reports prepared for the Project will meet or exceed the Secretary's Standards.

7. National Register of Historic Places Eligibility Determinations

a. BLM KFO and OSM are responsible for all National Register of Historic Places (NRHP) eligibility determinations.

b. BLM KFO and OSM will evaluate the historic significance of sites within the APE pursuant to 36 CFR 800.4(c).

c. BLM KFO and OSM will consult with SHPO regarding their NRHP eligibility determinations for sites within the APE pursuant to 36 CFR 800.4(c).

8. Historic Properties Treatment Plan

a. Prior to commencement of mining activities, a Historic Properties Treatment Plan (HPTP) will be developed by the Lessee's Cultural Resource Consultant (CRC) and implemented that addresses the adverse effects of the Project to historic properties; including prehistoric and historic archaeological sites, historic architecture, and Traditional Cultural Properties (TCPs). The HPTP will identify the nature of the effects to which each historic property will be subjected and the proposed treatment to avoid, minimize, or mitigate adverse effects. If data recovery excavation is proposed as a mitigation measure, the HPTP may not be implemented until required state and federal

excavation permits have been issued by BLM and/or the Utah Public Lands Policy Coordination Office.

b. Mitigation of adverse effects to prehistoric or historic archaeological historic properties will be conducted in phases. Phase I mitigation will include archaeological testing of NRHP eligible and unevaluated sites to determine the potential for each site to provide necessary information to address relevant local and regional research issues. Phase II mitigation will involve data recovery excavation at those sites identified during Phase I mitigation to contain data relevant to local and regional research issues and will occur at those sites selected for data recovery excavation prior to inclusion of the area surrounding a site in a Project Mine Plan submitted to OSM.

c. A Native American Graves Protection and Repatriation Act (NAGPRA) Plan of Action will be developed by the CRC and included as part of the HPTP pursuant to 43 CFR 10.3

d. Monitoring and inadvertent discoveries plans will be developed by the CRC and included as part of the HPTP. The HPTP will identify those areas that will be monitored. Cultural resources discovered during Project activities will be treated in accordance with the inadvertent discoveries plan.

e. Consulting Parties will be invited to send representatives to a meeting with BLM KFO and OSM prior to submission of an initial draft HPTP. The purpose of this meeting will be to discuss historic property treatment options and to solicit comments from Consulting Parties regarding proposed treatment options.

f. A draft HPTP will be submitted to BLM KFO and OSM for distribution to Consulting Parties. Consulting Parties will have 30 calendar days from receipt of the draft HPTP to provide comments to BLM KFO and OSM.

g. A final HPTP that takes into consideration comments made by Consulting Parties will be submitted by the CRC to BLM KFO and OSM for distribution to Consulting Parties. Consulting Parties will have 14 calendar days from receipt of the final HPTP to provide comments to the BLM KFO and OSM. If a Consulting Party does not submit comments within 14 calendar days of receipt of the final HPTP, BLM KFO and OSM may assume that they have no objection to the adequacy of the plan.

h. The final HPTP, revised as necessary, will be submitted by the BLM to SHPO for comment. SHPO will have 30 calendar days from receipt to provide comments to BLM KFO and OSM. If SHPO does not submit comments within 30 calendar days of receipt, BLM KFO and OSM may assume that SHPO has no objection to the adequacy of the plan.

9. Project Authorization

a. OSM and BLM KFO may allow the lessee to seek authorization to proceed from UDOGM to begin operations in those portions of the lease area permitted by UDOGM that do not contain historic properties or TCPs subject to any provisions that may be contained in the HPTP.

b. OSM and BLM KFO may allow the Lessee to seek authorization to proceed from UDOGM to begin construction in those portions of the APE that do contain historic properties once the agreed-upon fieldwork and treatment as specified in the HPTP is completed and approved by OSM and BLM KFO, a UDOGM mining permit is approved, and a Federal Mine Plan is approved. OSM and BLM KFO will have 7 days from receipt of adequate documentation that fieldwork and treatment is complete to comment. Complete results of the treatment effort will be submitted in a report to OSM and BLM KFO within 1 year of completion of field work. OSM and BLM KFO will have 90 days from receipt of this report to review and comment.

c. Authorization for treatment and/or construction will only occur subsequent to the Lessee having been issued a Special Use Authorization and specific notices-to-proceed, along with any other necessary federal or state authorization.

10. Human remains.

a. *Discovery Notification.* If human remains, or potential human remains, associated or unassociated funerary objects, or objects of cultural patrimony are discovered, work within 100 feet of the discovery will stop immediately. Verbal notification of the discovery will be made immediately to local law enforcement authorities, the appropriate land management agency official, and the Antiquities Section of the Utah Division of State History.

b. *Assessment of Remains.* Human remains discovered on federally managed land will be treated consistent with all requirements of NAGPRA and its implementing regulations at 43 CFR 10. Human remains discovered on land administered by the State, School and Institutional Trust Lands Administration, or privately owned land will be treated consistent with all requirements of applicable Utah State Laws regarding the treatment of human remains including, Utah Code Annotated (UCA) 76-9-704, UCA 9-8-302, UCA 9-8-309, and UCA 9-9-401 et seq.

c. *Resumption of Work.* Work in the immediate vicinity of the human remains may not resume until after the disposition of the human remains is determined. Permission to proceed will come from the OSM, after appropriate consultation with SHPO and appropriate Tribal representatives.

11. Review Meeting

a. OSM and BLM KFO will invite Tribes and Consulting Parties to a meeting to review the implementation of this agreement every five years in concordance with DOGM's mining permit renewal schedule and will continue throughout the life of the Project or termination of this Agreement. Participants will be provided with an update on project schedule, status, and any ongoing relevant cultural resources monitoring or mitigation activities, discovery situations, or outstanding tasks to be completed under this Agreement or the HPTP.

12. Protection of confidential information.

a. OSM and BLM KFO shall ensure that all confidential information, as defined in Section 9 of the ARPA, Section 304 of the NHPA, and Section 63-2-304(26) of the Government Records Access Management Act (GRAMA) and provisions in SMCRA is managed in such a way that historic properties, archaeological resources, traditional cultural values, and sacred objects are not compromised, to the fullest extent available under law.

b. Each Consulting Party to this Agreement shall safeguard information about the nature and location of archaeological, historic, and traditional cultural properties, pursuant to Section 9 of the ARPA, Section 304 of the NHPA, and Section 63-2-304(26) of the GRAMA and SMCRA.

13. Dispute resolution.

a. Should any Signatory or Concurring Party to this Agreement object, in writing, at any time to any actions proposed or the manner in which the terms of this Agreement are implemented, the OSM and BLM KFO shall consult with the objecting party to resolve the concern within 45 days. If the OSM and BLM KFO determine that the concern cannot be resolved, the OSM and BLM KFO shall:

i. Forward all documentation relevant to the dispute, including the OSM and BLM KFO's proposed resolution to the ACHP. The ACHP may provide the OSM and BLM KFO with its advice on the resolution of the concern within 30 days of receiving adequate documentation. Prior to reaching a final decision on the dispute, the OSM and BLM KFO shall prepare a written response that takes into account any timely advice or comments regarding the dispute from the ACHP or Consulting Parties to this Agreement, and provide them with a copy of this written response. The OSM and BLM KFO will then proceed according to its final decision.

ii. The OSM and BLM KFO's responsibility to carry out all other actions subject to the terms of this Agreement that are not subject of the dispute will remain unchanged.

14. Amendments.

a. Any Consulting Party to this Agreement may request that it be amended, whereupon the Signatories of this Agreement will consult to consider such amendment. An amendment will become effective upon written agreement by all Signatories of this Agreement.

15. Termination.

a. Any Signatory to this Agreement may terminate it by providing 30-calendar day notice, in writing, to the other Signatories, provided that the Signatories will consult during the period prior to termination to seek agreement on amendments or other actions that will avoid termination. In the event of termination, the OSM, BLM KFO and other Signatories will comply with 36 CFR 800.1 et seq. with regard to individual actions covered by this Agreement.

16. Term.

    a. This Agreement shall be effective when all Signatories have signed and will remain in effect for 20 years.

    b. The term of this Agreement may be extended by written agreement by all Signatories.

Execution of this Agreement by the Signatories and implementation of its terms evidence that the OSM and BLM KFO have taken into account the effects of this Project on Historic Properties and afforded the ACHP an opportunity to comment.

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SIGNATORIES

Bureau of Land Management, Kanab Field Office

6/24/13

Harry Barber — Date
Field Office Manager

Office of Surface Mining Reclamation and Enforcement

7/8/13

Robert Postle — Date
Division Chief, Program Support Division, OSM Western Region

Utah State Historic Preservation Officer

P. Bradford Westwood — Date
State Historic Preservation Officer

INVITED SIGNATORIES

Utah Division of Oil, Gas, and Mining

9/5/13

John Baza — Date
Director

CONCURRING PARTIES

Office of the Governor, Public Lands Policy Coordination Office

Kathleen Clarke
Director

7/22/2013
Date

Garfield County

Leeland Pollock
Commissioner

1-28-14
Date

Kane County

Jim Matson
Commissioner

2-7-14
Date

City of Panguitch

Eric Houston
Mayor

12/20/2013
Date

Alton Coal Development, LLC

Larry W. Johnson
Mine Manager

12/18/2013
Date

Ms. Bobbi Bryant

Bobbi Bryant

Date

Mr. Bruce McMahan

Bruce McMahan Date

National Park Service, Bryce Canyon National Park

John Wessels Date
Regional Director, Intermountain Region, National Park Service

Utah Statewide Archaeological Society (USAS)

Jeff Roberts Date
President, Utah Statewide Archaeological Society, Central Utah Chapter

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ATTACHMENT A: DEPARTMENT OF THE ARMY, U. S. ARMY CORPS OF ENGINEERS LETTER

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO CA 95814-2922

REPLY TO
ATTENTION OF

March 16, 2012

Regulatory Division SPK-2011-01248

Mr. Harry Barber, Field Office Manager
Bureau of Land Management,
Color Country District - Kanab Field Office
669 South Hwy 89A
Kanab, Utah 84741

Dear Mr. Barber:

This letter concerns the designation of lead Federal agency for the proposed Alton Coal Tract Lease by Application (3021 (UT-040)) project. The proposed Alton Coal Tract is located on or near Kanab and Lower Robinson Creeks, in part of Sections 7, 18, 19, 20, 30, and 31, Township 39 South, Range 5 West, and part of Sections 12, 13, 24, and 25, Township 39 South, Range 6 West, Salt Lake Meridian, approximate Latitude 37.4076 North, Longitude 112.4656 West, south of Alton, Kane County, Utah.

In response to your March 6, 2012 invitation to participate as a consulting party under Section 106 of the National Historic Preservation Act, and the possible future applicant request for Department of the Army (DA) authorization, for unavoidable discharges of dredged or fill material into waters of the United States at Alton Coal Tract, we hereby designate Bureau of Land Management (BLM) as the lead Federal agency to act on our behalf for purposes of compliance with the Section 7 of the Endangered Species Act (ESA) and Section 106 of the National Historic Preservation Act (NHPA).

When you initiate consultation under Section 7 of the ESA or Section 106 of the NHPA, please include a statement indicating that the Corps of Engineers has designated BLM as the lead Federal agency for Alton Coal Tract, along with a copy of this letter.

Please refer to identification number SPK-2011-01248 in any correspondence concerning this project. If you have any questions, please contact Karen Clementsen at 196 E Tabernacle St, Suite 30, St George, UT 84770-3474, email *Karen.L.Clementsen@usace.army.mil*, or telephone 435-986-1961. For more information regarding our program, please visit our website at *www.spk.usace.army.mil/regulatory.html*.

We appreciate your feedback. At your earliest convenience, please tell us how we are doing by completing the customer service survey on our website under Customer Service Survey.

Sincerely,

Jason Gipson
Chief, Nevada-Utah Regulatory Branch
Sacramento District

ATTACHMENT B: TRIBAL CONSULTATION SUMMARY

Although no American Indian reservations or lands owned in fee by Tribes are found within the Project APE, BLM KFO and OSM have initiated consultation with a number of American Indian Tribes whose traditional territories are within the Project area. BLM KFO and OSM have contacted those American Indian Tribes listed below to determine their interest in participating in this project as a Consulting Party and to provide each Tribe an opportunity to identify its concerns consistent with 36 CFR 800.0(c)(2).

Native American Tribe	Contact Person	Contact Method	Date of Contact
Cedar Band of Paiutes	Lora Tom, Chairwoman	Letter	March 6, 2012
Hopi Tribe*	Wayne Taylor, Chairman	Letter	March 6, 2012
Indian Peaks Band of Paiutes	Anthonia Tom, Chairwoman	Letter	March 6, 2012
Kaibab Band of Paiute Indians*	Manual Savala, Chairman	Letters	January 3, 2012 January 30, 2012 March 6, 2012
Kaibab Band of Paiute Indians	Manual Savala, Chairman	Council Meeting	February 16, 2012
Kanosh Band of Paiutes	Phil Pikyavit, Chairman	Letter	March 6, 2012
Koosharem Band of Paiutes	Elliot Yazzie, Chairman	Letter	March 6, 2012
Moapa Band of Paiutes	William Anderson, Chairman	Letter	March 6, 2012
Navajo Nation*	Joe Shirley, President	Letter	March 6, 2012
Navajo Nation – Bodaway/Gap Chapter	Billy Arizona	Letter	March 6, 2012
Navajo Nation – Cameron Chapter	Teddie Bedonie	Letter	March 6, 2012
Navajo Nation – Coalmine Canyon Chapter	Kenneth Nez	Letter	March 6, 2012
Navajo Nation – Kaibeto Chapter	Phillip J. Brown	Letter	March 6, 2012
Navajo Nation – Lechee Chapter	Irene Nez – Whitekiller	Letter	March 6, 2012
Navajo Nation – Navajo Mountain Chapter	Leo Manheimer	Letter	March 6, 2012
Navajo Nation – Olijato Chapter	James Black	Letter	March 6, 2012
Navajo Nation – Tuba City Chapter	Max D. Goldtooth, Sr.	Letter	March 6, 2012
Paiute Indian Tribe of Utah*	Jeanine Borchardt, Chairwoman	Letter	March 6, 2012

Native American Tribe	Contact Person	Contact Method	Date of Contact
Pueblo of Zuni	Arden P. Quetawki, Governor	Letter	March 6, 2012
Shivwits Band of Paiutes	Charlotte Lomeli, Chairwoman	Letter	March 6, 2012
Ute Tribe	Betsy Chapoose	Letter	March 6, 2012

(*) Indicates the Cultural Resource Director, Cultural Preservation Office, Historic Preservation Department or Environmental Director was also mailed a separate Consulting Parties Invitation Letter.

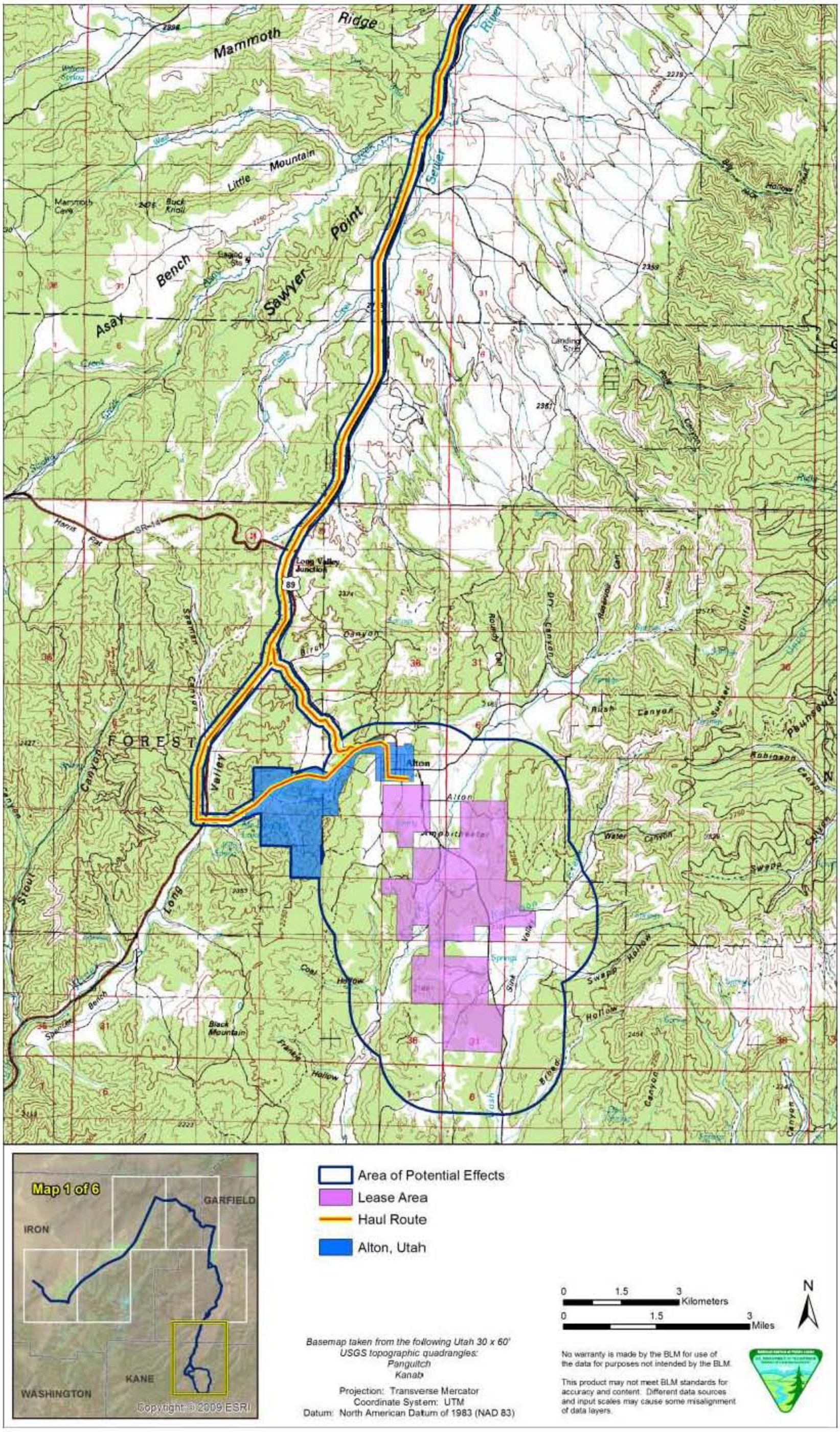
ATTACHMENT C: CONSULTING PARTIES SUMMARY

BLM KFO and OSM, in consultation with USHPO have identified a number of potentially interested parties and has invited each to participate as a Consulting Party for the Project consistent with 36 CFR 800.2(c)(3) et seq. BLM KFO and OSM have contacted those parties listed below to determine their interest in participating in this project as a Consulting Party.

Potentially Interested Party	Contact Person	Contact Method	Date of Contact
Alton Coal Development, LLC	Larry W. Johnson	Letter	March 6, 2012
Bryce Canyon National Park	Jeff Bradybaugh, Superintendent	Letter	March 6, 2012
Bryce Canyon National Park- Historic Architect	Kim Hyatt	Letter	March 6, 2012
Cedar City	Ron Chandler, City Manager	Letter	March 6, 2012
Cowboy Collectables by CZR	Randy and Becky Yard	Letter	March 6, 2012
Garfield County Commission	Leland Pollock, Commissioner	Letter	March 6, 2012
Hatch	Kevin Eldridge	Letter	March 6, 2012
Intermountain Regional Office National Park Service	Lysa Wegman-French	Letter	March 6, 2012
Iron County Commission	Dale Brinkerhoff, Commissioner	Letter	March 6, 2012
Kane County Commission	Jim Matson	Letter	March 6, 2012
Church of Jesus Christ of Latter-Day Saints, History Department	Ben Pykles	Letter	March 6, 2012
Mormon Pioneer National Heratige Area	Monte Bona, Director	Letter	March 6, 2012
National Trails Intermountain Region National Park Service	Michael Elliot	Letter	March 6, 2012
National Trust for Historic Preservation	Rebecca Schwendler	Letter	March 6, 2012
OCTA- Oregon-California Trails Association National	Glenn Harrison, President	Letter	March 6, 2012
Old Spanish Trail Association	Dennis Ditmanson, Association Manager	Letter	March 6, 2012
Panguitch	Allen Hendrie, City Manager	Letter	March 6, 2012
Panguitch Anglers Inn	Dan and Judy Stoner	Letter	March 6, 2012
Public Lands Policy Coordination Office	David Yoder, Archaeologist	Letter	March 6, 2012

Potentially Interested Party	Contact Person	Contact Method	Date of Contact
Sierra Club	National Office	Letter	March 6, 2012
Sierra Club- Utah Chapter	Mark Clemens, Chapter Manager	Letter	March 6, 2012
Southern Utah Wilderness Alliance	Stephen Bloch, Conservation Director/Attorney	Letter	March 6, 2012
United States Environmental Protection Agency	Larry Svoboda	Letter	March 6, 2012
UPAC- Utah Professional Archaeological Council	James R. Allison, President	Letter	March 6, 2012
URARA- Utah Rock Art Research Association	Troy Scotter	Letter	March 6, 2012
US Army Corps of Engineers	Karen Clementsen	Letter	March 6, 2012
USAS- Utah State Archaeological Society	Jeff Roberts, President	Letter	March 6, 2012
Concerned Citizen	Al Matheson	Letter	March 6, 2012
Concerned Citizen	Bobbi Bryant	Letter	March 6, 2012
Concerned Citizen	Boyd Smith	Letter	March 6, 2012
Concerned Citizen	Bruce & Lue McMahan	Letter	March 6, 2012
Concerned Citizen	Carla Tuke	Letter	March 6, 2012
Concerned Citizen	Claren Heaton	Letter	March 6, 2012
Concerned Citizen	Dakota Jones	Letter	March 6, 2012
Concerned Citizen	Dee Barden	Letter	March 6, 2012
Concerned Citizen	Harriet Priska	Letter	March 6, 2012
Concerned Citizen	Jake Schoppe	Letter	March 6, 2012
Concerned Citizen	John Veranth	Letter	March 6, 2012
Concerned Citizen	Pat Henrie	Letter	March 6, 2012
Concerned Citizen	Rand Padgett	Letter	March 6, 2012
Concerned Citizen	Rebecca Gregg	Letter	March 6, 2012
Concerned Citizen	T. Michael Smith	Letter	March 6, 2012
Concerned Citizen	Tara Kelly	Letter	March 6, 2012
Concerned Citizen	Tracy Armstrong	Letter	March 6, 2012
Concerned Citizen	Vince Solvate	Letter	March 6, 2012

ATTACHMENT D: AREA OF POTENTIAL EFFECTS (APE) MAP



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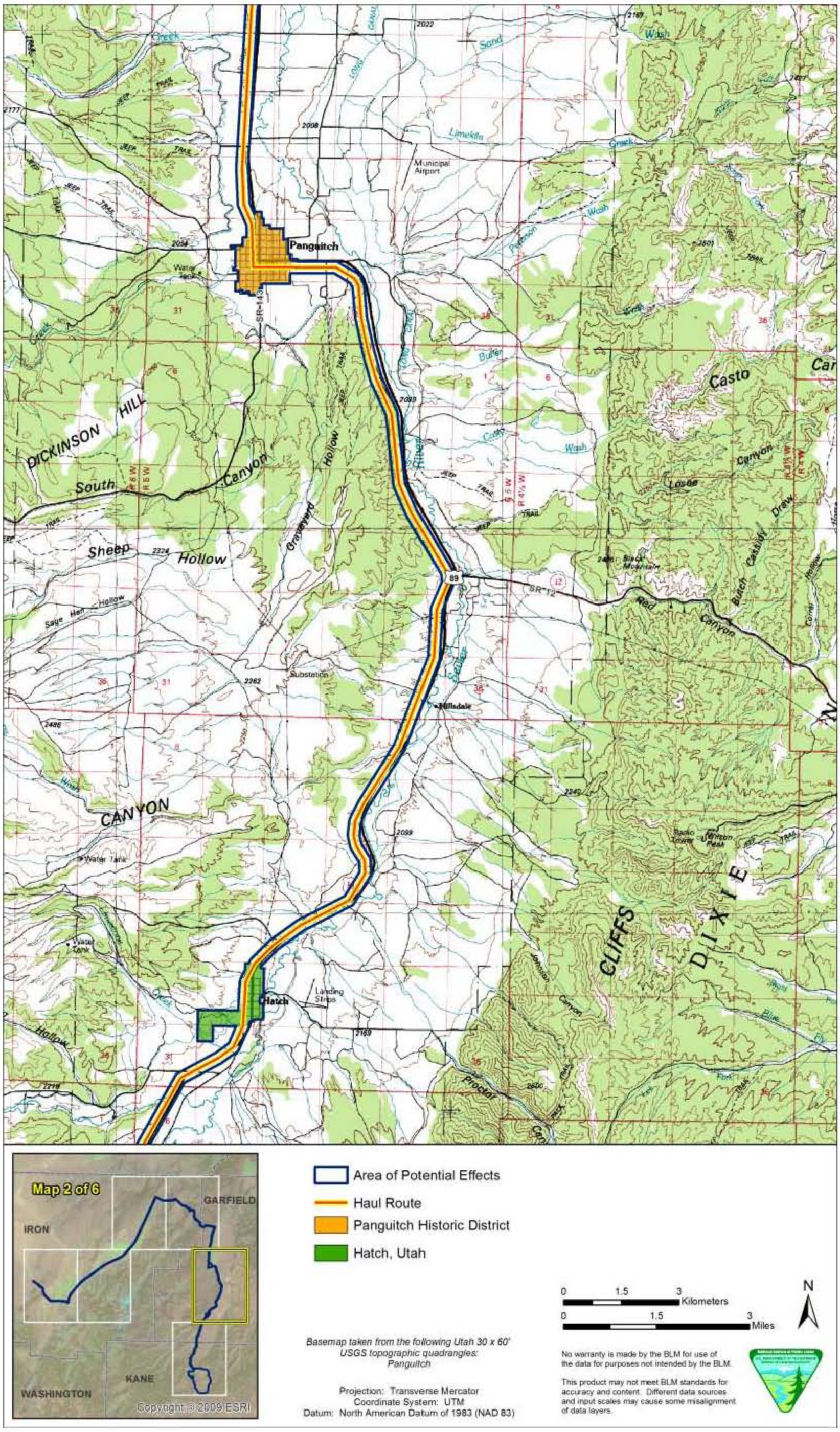
Panguitch
Municipal Airport
Limekiln Creek
Sand Wash
Pierson Wash
Casto Canyon
DICKINSON HILL
South Canyon
Sheep Hollow
Graveyard Hollow
Say Hen Hollow
CANYON
Hatch
Landing Strips
Substation
Hillsdale
Water Tank
Water Tank
Black Mountain
Red Canyon
Butch Cassidy Draw
Johnson Mesa
Radio Towers
CLIFFS
DIXIE
Proctor Canyon
SR-143
SR-12
89
Area of Potential Effects
Haul Route
Panguitch Historic District
Hatch, Utah
Map 2 of 6
GARFIELD
IRON
KANE
WASHINGTON
Copyright © 2009 ESRI
0 1.5 3 Kilometers
0 1.5 3 Miles
N
Basemap taken from the following Utah 30 x 60' USGS topographic quadrangles: Panguitch
Projection: Transverse Mercator
Coordinate System: UTM
Datum: North American Datum of 1983 (NAD 83)
No warranty is made by the BLM for use of the data for purposes not intended by the BLM.
This product may not meet BLM standards for accuracy and content. Different data sources and input scales may cause some misalignment of data layers.

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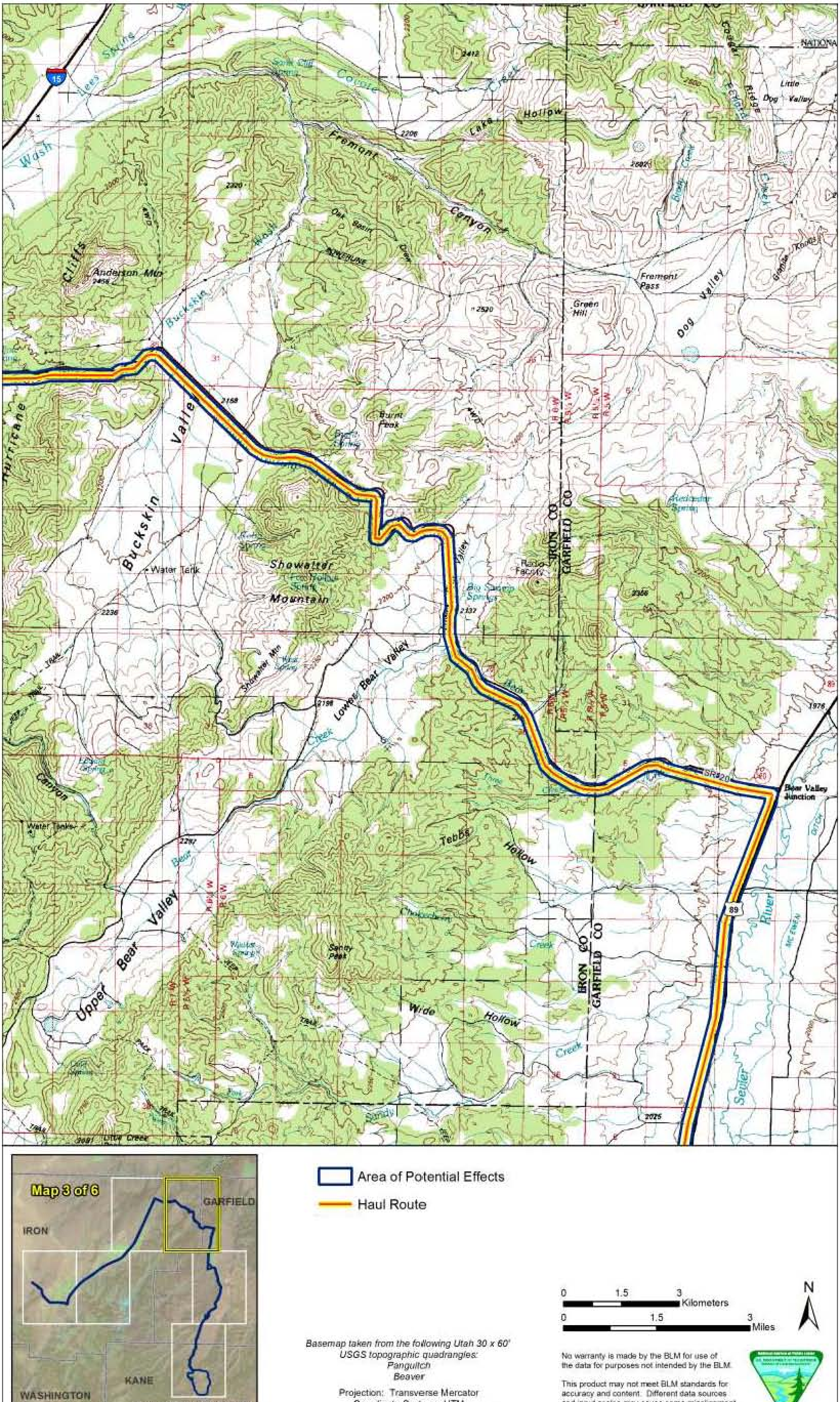
Map 3 of 6
IRON
GARFIELD
KANE
WASHINGTON
Copyright © 2009 ESRI
Area of Potential Effects
Haul Route
Basemap taken from the following Utah 30 x 60' USGS topographic quadrangles:
Panguitch
Beaver
Projection: Transverse Mercator
Coordinate System: UTM
Datum: North American Datum of 1983 (NAD 83)
0 1.5 3 Kilometers
0 1.5 3 Miles
N
No warranty is made by the BLM for use of the data for purposes not intended by the BLM.
This product may not meet BLM standards for accuracy and content. Different data sources and input scales may cause some misalignment of data layers.
Bear Valley Junction
Buckskin Valley
Showalter Mountain
Lower Bear Valley
Upper Bear Valley
Fremont Canyon
Fremont Pass
Dog Valley
Anderson Mtn
Burnt Peak
Green Hill
Tebbs Hollow
Wide Hollow
Sevier River
IRON CO
GARFIELD CO

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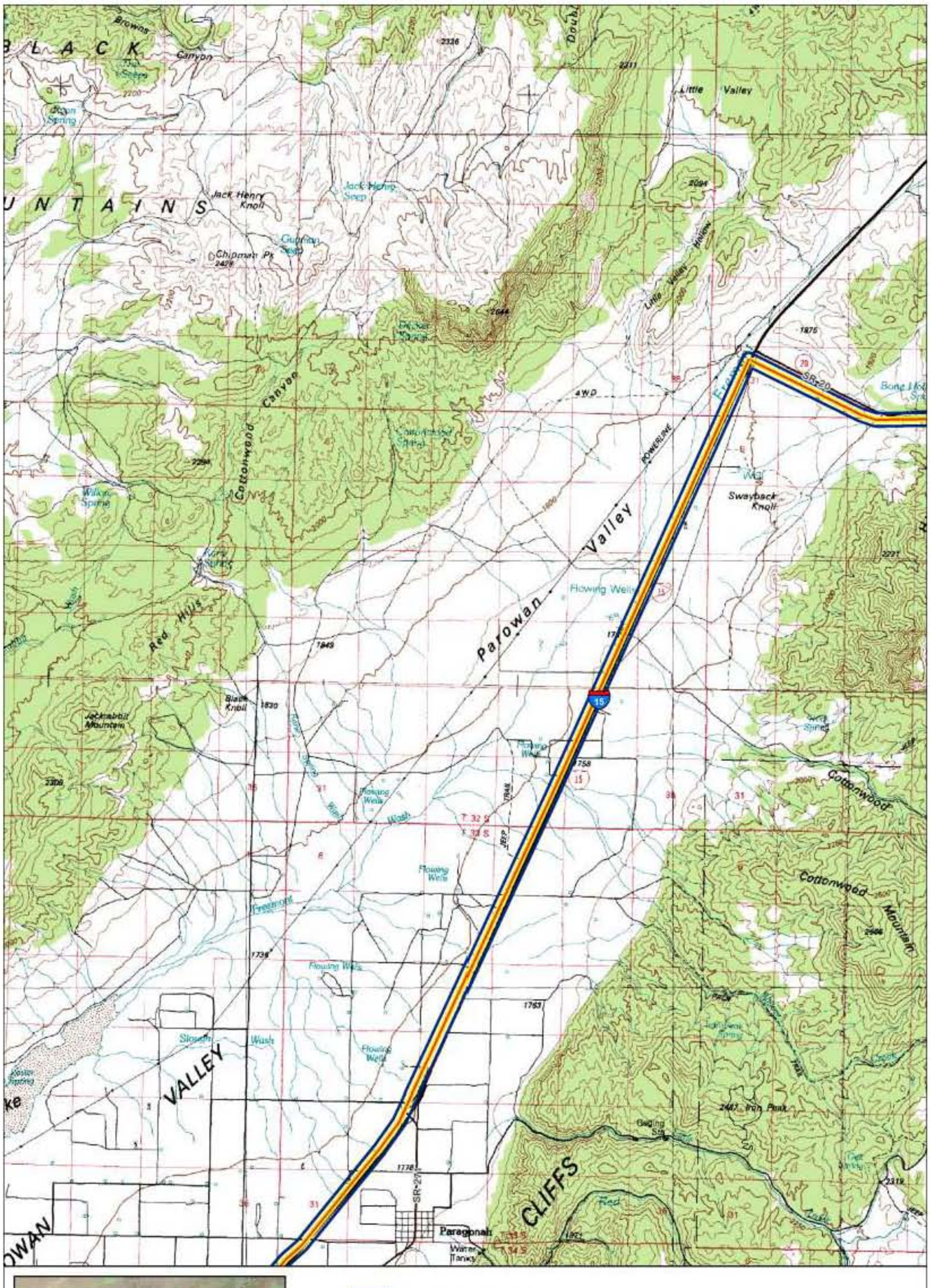
BLACK
MOUNTAINS
Browns
Canyon
Jack Henry Knoll
Jack Henry Seep
Chipman Pk
2428
Little Valley
2094
Little Valley Hollow
2644
4WD
Cottonwood Canyon
SR-20
POWERLINE
Parowan Valley
Sweyback Knoll
Red Hills
Blacks Knoll
1830
Jackrabbit Mountain
Flowing Wells
Cottonwood
Cottonwood Mountain
2487 Iron Peak
CLIFFS
Paragonah
SR-271
15
Map 4 of 6
GARFIELD
IRON
KANE
WASHINGTON
Copyright © 2009 ESRI
Area of Potential Effects
Haul Route
0 1.5 3 Kilometers
0 1.5 3 Miles
N
Basemap taken from the following Utah 30 x 60' USGS topographic quadrangles:
Panguitch
Beaver
Projection: Transverse Mercator
Coordinate System: UTM
Datum: North American Datum of 1983 (NAD 83)
No warranty is made by the BLM for use of the data for purposes not intended by the BLM.
This product may not meet BLM standards for accuracy and content. Different data sources and input scales may cause some misalignment of data layers.

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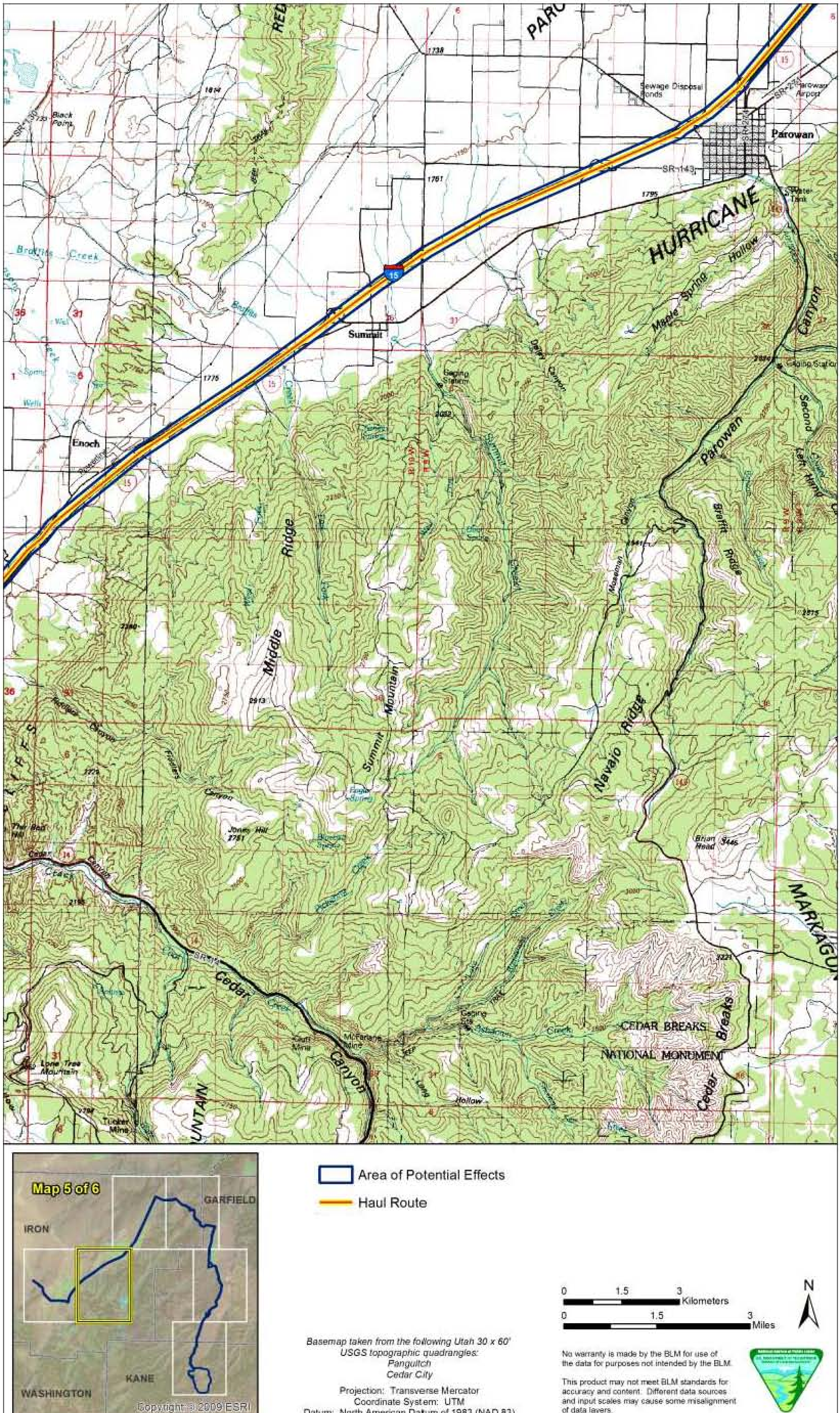
HURRICANE
MARKAGUNT
Parowan
Summit
Enoch
Black Point
Sewage Disposal Ponds
Parowan Airport
SR-143
Water Tank
Maple Spring Hollow
Parowan Canyon
Second Left Hand Canyon
Braffit Ridge
Braffits Creek
Middle Ridge
Summit Mountain
Navajo Ridge
Mosaman Canyon
Gaging Station
Fiddlers Canyon
Jones Hill
Brian Head
Cedar Canyon
SR-14
McFarlane Mine
CEDAR BREAKS
NATIONAL MONUMENT
Cedar Breaks
Lone Tree Mountain
Tucker Mine
Hollow
Map 5 of 6
IRON
GARFIELD
KANE
WASHINGTON
Copyright © 2009 ESRI
Area of Potential Effects
Haul Route
Basemap taken from the following Utah 30 x 60' USGS topographic quadrangles:
Panguitch
Cedar City
Projection: Transverse Mercator
Coordinate System: UTM
Datum: North American Datum of 1983 (NAD 83)
0 1.5 3 Kilometers
0 1.5 3 Miles
N
No warranty is made by the BLM for use of the data for purposes not intended by the BLM.
This product may not meet BLM standards for accuracy and content. Different data sources and input scales may cause some misalignment of data layers.

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Map 6 of 6
GARFIELD
IRON
KANE
WASHINGTON
Copyright © 2009 ESRI
Area of Potential Effects
Haul Route
Basemap taken from the following Utah 30 x 60' USGS topographic quadrangles: Cedar City
Projection: Transverse Mercator
Coordinate System: UTM
Datum: North American Datum of 1983 (NAD 83)
0 1.5 3 Kilometers
0 1.5 3 Miles
N
No warranty is made by the BLM for use of the data for purposes not intended by the BLM.
This product may not meet BLM standards for accuracy and content. Different data sources and input scales may cause some misalignment of data layers.
Cedar City
Cedar Valley
Quichapa Lake
Municipal Airport
Hamiltons Fort
Strip Mines
Cross Hollow Hills
Cedar City Upland State Game Sanctuary
Eightmile Pass
The Knoll
SR-56
SR-130
SR-289
Union Pacific

APPENDIX N.
VISUAL CONTRAST RATING WORKSHEET

Form 8400-4
(September 1985)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

VISUAL CONTRAST RATING WORKSHEET

Date (of field work) 05.13.2008	
District Kanab Field Office	
Resource Area	
Activity (program) Division of Lands and Minerals	

SECTION A. PROJECT INFORMATION

1. Project Name Alton Coal EIS	4. Location UTM - 12 S 0369399 4144477	5. Location Sketch See attached photo
2. Key Observation Point #1 Town of Alton, east side, looking south		
3. VRM Class IV		

SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	Large, open, natural landscape. Gently rolling hills throughout north south trending valley. Somewhat jagged low rising mountain ranges in the BG.	Distinct stands of rounded juniper interspersed with taller pinyon and low rounded sagebrush and grasses in MG and BG. Tall conical fir trees on mountains to the west.	Bucolic setting. Rectangular geometric structures in town of Alton. Low, flat agricultural fields in FG.
LINE	Hills throughout valley form gentle undulating, sweeping horizontal lines.	Long sweeping line of trees following lines of hills. Diffuse edge of stands of juniper along hills and diagonal to surrounding mountains.	Long angular lines of juniper post barbed wire fences. Geometrical lines of agricultural fields in FG.
COLOR	Area is currently covered in vegetation. Some dull grays and tans visible on mountains in the BG.	Multiple shades of green – dull light gray/greens of shrubs and grasses to darker greens of junipers.	Reflective silver irrigation lines. Buildings and homes are metal, white, tan and earth tones. Vibrant bright green fields in FG.
TEX-TURE	Mountains in BG medium to coarse.	Dense stands of juniper and sage. Medium stands of fir.	Structures are smooth in BG, rougher in the FG. Smooth fields in FG.

SECTION C. PROPOSED ACTIVITY DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	Most of disturbance would be in MG. Large horizontal edge of high wall and pit disturbance (removal of up to 300 feet of overburden, up to 600 foot high wall) interspersed with rolling hills. Temporary tall, conical stockpiles of topsoil. Temporary tall, conical stockpiles of coal. Underground mining is proposed for FG.	Patchy stands of vegetation interspersed with pit and road disturbance.	Portable and fixed location 30 foot tall vertical light towers. Geometric Diesel power generators. Flat, rectangular entrance sign to tract would be visible from this point.
LINE	Multiple sharp, geometric lines	Sharp butt edge between vegetation and pit disturbance.	Simple sharp vertical lines, geometric, rectangular generators.
COLOR	Grays, tans, and reddish browns of exposed soils and rocks of pit and new mine roads. Darker grays, blacks of stockpiled coal.	None	Reflective metal light towers, dull metallic generators. Reddish tan service roads.
TEX-TURE	Smooth	None	Smooth

SECTION D. CONTRAST RATING _X__ SHORT TERM __ LONG TERM

1. DEGREE OF CONTRAST		FEATURES												2. Does project design meet visual resource management objectives? _X__ Yes __ No (Explain on reverse side) 3. Additional mitigating measures recommended? ___ Yes _X_ No (Explain on reverse side)
		LAND/WATER BODY (1)				VE GETATION (2)				STRUCTURES (3)				
		Strong	Moderate	Weak	None	Strong	Moderate	Weak	None	Strong	Moderate	Weak	None	Evaluators Name(s) Date Steve Leslie 5.13.2008 SWCA Environmental Consultants
ELEMENT	Form	X					X				X			
	Line	X					X					X		
	Color		X					X				X		
	Texture		X					X				X		

SECTION D. (Continued)

2. VRM Class IV allows major modifications to the characteristic landscape to occur.

3. The mitigation measures included in the proposed action and alternative call for complete site reclamation including re-contouring pit disturbances, facilities, and dispersed facilities would restore the characteristic landscape to a more natural condition upon completion of mining activities.

U S GOVERNMENT PRINTING OFFICE: 1985-461-988/33094

Looking Southwest down KFO Route 116.

Form 8400-4
(September 1985)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

VISUAL CONTRAST RATING WORKSHEET

Date (of field work)
05.13.2008 – 12:22

District
Kanab Field Office

Resource Area

Activity (program)
Division of Lands and Minerals

SECTION A. PROJECT INFORMATION

1. Project Name
Alton Coal EIS

2. Key Observation Point
#2 Town of Alton, south end of main street, looking south

3. VRM Class
IV

4. Location

UTM -
12 S 0368817
4144280

5. Location Sketch
See attached photo

SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	Large, open, natural landscape. Gently rolling hills throughout north south trending valley. Somewhat jagged low rising mountain ranges in MG to the west.	Distinct stands of rounded juniper interspersed with taller pinyon and low rounded sagebrush and grasses in MG and BG. Tall conical fir trees on mountains to the west.	Bucolic setting. Rectangular geometric structures in town of Alton. Low, flat agricultural fields in FG.
LINE	Hills throughout valley form gentle undulating, sweeping horizontal lines.	Long sweeping line of trees following lines of hills. Diffuse edge of stands of juniper along hills and diagonal to surrounding mountains.	Angular lines of juniper post barbed wire fences. Lines of irrigation set-up on a diagonal with large round wheels. Geometrical lines of agricultural fields in FG. Tall vertical trees associated with homes in town.
COLOR	Area is currently covered in vegetation. Some dull grays and tans visible on mountains in the BG.	Multiple shades of green – dull light gray/greens of shrubs and grasses to darker greens of junipers.	Reflective silver irrigation lines. Buildings and homes are metal, white, tan and earth tones. Vibrant bright green fields in FG.
TEX-TURE	Mountains in BG medium to coarse.	Dense stands of juniper and sage. Medium stands of fir.	Structures are smooth in BG, rougher in the FG. Smooth fields in FG.

SECTION C. PROPOSED ACTIVITY DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	Most of disturbance would be in MG. Large horizontal edge of high wall and pit disturbance (removal of up to 300 feet of overburden, up to 600 foot high wall) interspersed with rolling hills. Temporary tall, conical stockpiles of topsoil. Temporary tall, conical stockpiles of coal. Underground mining is proposed for FG.	Patchy stands of vegetation interspersed with pit and road disturbance.	Portable and fixed location 30 foot tall vertical light towers. Geometric Diesel power generators.
LINE	Multiple sharp, geometric lines	Sharp butt edge between vegetation and pit disturbance.	Simple sharp vertical lines, geometric, rectangular generators.
COLOR	Grays, tans, and reddish browns of exposed soils and rocks of pit and new mine roads. Darker grays, blacks of stockpiled coal.	None	Reflective metal light towers, dull metallic generators. Reddish tan service roads.
TEX-TURE	Smooth	None	Smooth

SECTION D. CONTRAST RATING _X__ SHORT TERM __ LONG TERM

1. DEGREE OF CONTRAST		FEATURES												2. Does project design meet visual resource management objectives? __X_ Yes __ No (Explain on reverse side) 3. Additional mitigating measures recommended? ___ Yes _X_ No (Explain on reverse side)
		LAND/WATER BODY (1)				VE GETATION (2)				STRUCTURES (3)				
		Strong	Moderate	Weak	None	Strong	Moderate	Weak	None	Strong	Moderate	Weak	None	Evaluators Name(s) Date Steve Leslie 5.13.2008 SWCA Environmental Consultants
ELEMENT	Form	X				X				X				
	Line	X					X				X			
	Color	X					X				X			
	Texture		X				X				X			

SECTION D. (Continued)

2. VRM Class IV allows major modifications to the characteristic landscape to occur.

3. The mitigation measures included in the proposed action and alternative call for complete site reclamation including re-contouring pit disturbances, facilities, and dispersed facilities would restore the characteristic landscape to a more natural condition upon completion of mining activities.

U S GOVERNMENT PRINTING OFFICE: 1985-461-988/33094

Looking south from community of Alton.

Form 8400-4
(September 1985)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

VISUAL CONTRAST RATING WORKSHEET

Date (of field work)
05.13.2008 – 12:360

District
Kanab Field Office

Resource Area

Activity (program)
Division of Lands and Minerals

SECTION A. PROJECT INFORMATION

1. Project Name
Alton Coal EIS

2. Key Observation Point
#3 Town of Alton, North end of main street, looking south

3. VRM Class
IV

4. Location

UTM -
12 S 0368843
4145062

5. Location Sketch

See attached photo

SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	Large, open, natural landscape. Gently rolling hills throughout north south trending valley. Sheer sandstone cliff face visible to the east. Somewhat jagged low rising mountain ranges in the BG.	Distinct stands of rounded juniper interspersed with taller pinyon and low rounded sagebrush and grasses in MG and BG. Tall conical fir trees on mountains to the west.	Bucolic setting. Rectangular geometric structures in town of Alton. Mix of new and old homes.
LINE	Hills throughout valley form gentle undulating, sweeping horizontal lines.	Long sweeping line of trees following lines of hills. Diffuse edge of stands of juniper along hills and diagonal to surrounding mountains.	Tall complex trees surrounding homes. Long angular lines of juniper post barbed wire fences. Banded line of road through town. Geometrical lines of agricultural fields in FG.
COLOR	Area is currently covered in vegetation. Some dull grays and tans visible on mountains in the BG where dirt roadways cross terrain.	Multiple shades of green – dull light gray/greens of shrubs and grasses to darker greens of junipers.	Reflective black asphalt road through center of town. Reflective metal roofs. Buildings and homes are metal, white, tan and earth tones. Vibrant bright green fields in FG.
TEX-TURE	Mountains in BG medium to coarse.	Dense stands of juniper and sage. Medium stands of fir.	Structures are smooth in BG, rougher in the FG. Smooth road, rooftops in FG.

SECTION C. PROPOSED ACTIVITY DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	Most of disturbance would be in MG. Large horizontal edge of high wall and pit disturbance (removal of up to 300 feet of overburden, up to 600 foot high wall) interspersed with rolling hills. Temporary tall, conical stockpiles of topsoil. Temporary tall, conical stockpiles of coal. Underground mining is proposed for FG.	Patchy stands of vegetation interspersed with pit and road disturbance.	Portable and fixed location 30 foot tall vertical light towers. Geometric Diesel power generators.
LINE	Multiple sharp, geometric lines	Sharp butt edge between vegetation and pit disturbance.	Simple sharp vertical lines, geometric, rectangular generators.
COLOR	Grays, tans, and reddish browns of exposed soils and rocks of pit and new mine roads. Darker grays, blacks of stockpiled coal.	None	Reflective metal light towers, dull metallic generators. Reddish tan service roads.
TEX-TURE	Smooth	None	Smooth

SECTION D. CONTRAST RATING _X__ SHORT TERM __ LONG TERM

1. DEGREE OF CONTRAST		FEATURES												2. Does project design meet visual resource management objectives? _X__ Yes __ No (Explain on reverse side)
		LAND/WATER BODY (1)				VE GETATION (2)				STRUCTURES (3)				3. Additional mitigating measures recommended? ___ Yes _X_ No (Explain on reverse side)
		Strong	Moderate	Weak	None	Strong	Moderate	Weak	None	Strong	Moderate	Weak	None	
ELEMENT	Form	X					X					X		Evaluators Name(s) Date Steve Leslie 5.13.2008 SWCA Environmental Consultants
	Line	X					X					X		
	Color		X					X				X		
	Texture		X					X				X		

SECTION D. (Continued)

2. VRM Class IV allows major modifications to the characteristic landscape to occur.

3. The mitigation measures included in the proposed action and alternative call for complete site reclamation including re-contouring pit disturbances, facilities, and dispersed facilities would restore the characteristic landscape to a more natural condition upon completion of mining activities.

U S GOVERNMENT PRINTING OFFICE: 1985-461-988/33094

Looking southeast from north end of Alton.

Form 8400-4
(September 1985)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

VISUAL CONTRAST RATING WORKSHEET

Date (of field work)
05.12.2008 – 1:15

District
Kanab Field Office

Resource Area

Activity (program)
Division of Lands and Minerals

SECTION A. PROJECT INFORMATION

1. Project Name
Alton Coal EIS

2. Key Observation Point
#4 From KFO Route 116, looking west and north

3. VRM Class
IV

4. Location

UTM -
12 S 0371206
4138776

5. Location Sketch

SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	Large, open, natural landscape. Broad, gently rolling hills throughout north south trending valley. Somewhat rugged low rising mountain ranges to the west in the BG.	Patchy stands of juniper interspersed with single trees and low rounded sagebrush and grasses in MG and BG.	Dirt roads cut a narrow band across rolling hills.
LINE	Undulating, sweeping horizontal lines.	Long sweeping line of trees following lines of hills. Diffuse edge of stands of juniper along hills and diagonal to surrounding mountains.	Medium sweeping line of two track dirt road. Horizontal and Vertical lines of wood and wire strand fences.
COLOR	Much of the area is covered in vegetation. Some bright reds and tans are apparent on mountains in the BG	Multiple shades of green – dull light gray/greens of shrubs and grasses to darker greens of junipers.	Tannish gray two track dirt roads – brown and rust colored fence lines.
TEX-TURE	Mountains in BG medium to coarse.	Medium coarse stands of juniper. Dense sagebrush	Structures are smooth in BG, rougher in the FG. Smooth two track roads.

SECTION C. PROPOSED ACTIVITY DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	Most of disturbance would be in MG. Large horizontal edge of high wall and pit disturbance (removal of up to 300 feet of overburden, up to 600 foot high wall) interspersed with rolling hills. Temporary tall, conical stockpiles of topsoil. Temporary tall, conical stockpiles of coal. Underground mining is proposed for FG.	Patchy stands of vegetation interspersed with pit and road disturbance.	Portable and fixed location 30 foot tall vertical light towers. Geometric Diesel power generators.
LINE	Multiple sharp, geometric lines	Sharp butt edge between vegetation and pit disturbance.	Simple sharp vertical lines, geometric, rectangular generators.
COLOR	Grays, tans, and reddish browns of exposed soils and rocks of pit and new mine roads. Darker grays, blacks of stockpiled coal.	None	Reflective metal light towers, dull metallic generators. Reddish tan service roads.
TEX-TURE	Smooth	None	Smooth

SECTION D. CONTRAST RATING _X__ SHORT TERM __ LONG TERM

1. DEGREE OF CONTRAST		FEATURES												2. Does project design meet visual resource management objectives? _X__ Yes __ No (Explain on reverse side) 3. Additional mitigating measures recommended? ___ Yes _X_ No (Explain on reverse side)
		LAND/WATER BODY (1)				VE GETATION (2)				STRUCTURES (3)				
		Strong	Moderate	Weak	None	Strong	Moderate	Weak	None	Strong	Moderate	Weak	None	Evaluators Name(s) Date Steve Leslie 5.13.2008 SWCA Environmental Consultants
ELEMENT	Form	X					X				X			
	Line	X					X				X			
	Color		X					X			X			
	Texture		X				X				X			

SECTION D. (Continued)

2. VRM Class IV allows major modifications to the characteristic landscape to occur.

3. The mitigation measures included in the proposed action and alternative call for complete site reclamation including re-contouring pit disturbances, facilities, and dispersed facilities would restore the characteristic landscape to a more natural condition upon completion of mining activities.

U S GOVERNMENT PRINTING OFFICE: 1985-461-988/33094

From KFO Route 116, looking west and north.

Form 8400-4
(September 1985)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

VISUAL CONTRAST RATING WORKSHEET

Date (of field work)
05.13.2008

District
Kanab Field Office

Resource Area

Activity (program)
Division of Lands and Minerals

SECTION A. PROJECT INFORMATION

1. Project Name	4. Location	5. Location Sketch
Alton Coal EIS	UTM - 12 S 0369897 4142626 Elevation 6,877'	See attached photo
2. Key Observation Point #5 From KFO Route 116, looking west and north		
3. VRM Class IV		

SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	Large, open, natural landscape. Broad, gently rolling hills throughout north south trending valley. Somewhat rugged low rising mountain ranges to the west in the BG.	Patchy stands of juniper interspersed with single trees and low rounded sagebrush and grasses in MG and BG.	Dirt roads cut a narrow band across rolling hills.
LINE	Undulating, sweeping horizontal lines.	Long sweeping line of trees following lines of hills. Diffuse edge of stands of juniper along hills and diagonal to surrounding mountains.	Medium sweeping line of two track dirt road. Horizontal and Vertical lines of wood and wire strand fences.
COLOR	Much of the area is covered in vegetation. Some bright reds and tans are apparent on mountains in the BG	Multiple shades of green – dull light gray/greens of shrubs and grasses to darker greens of junipers.	Tannish gray two track dirt roads – brown and rust colored fence lines.
TEX-TURE	Mountains in BG medium to coarse.	Medium coarse stands of juniper. Dense sagebrush	Structures are smooth in BG, rougher in the FG. Smooth two track roads.

SECTION C. PROPOSED ACTIVITY DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	Most of disturbance would be in MG. Large horizontal edge of high wall and pit disturbance (removal of up to 300 feet of overburden, up to 600 foot high wall) interspersed with rolling hills. Temporary tall, conical stockpiles of topsoil. Temporary tall, conical stockpiles of coal. Underground mining is proposed for FG.	Patchy stands of vegetation interspersed with pit and road disturbance.	Portable and fixed location 30 foot tall vertical light towers. Geometric Diesel power generators. Sharp geometric lines of operations and maintenance facilities.
LINE	Multiple sharp, geometric lines	Sharp butt edge between vegetation and pit disturbance.	Simple sharp vertical lines, geometric, rectangular generators. Square, cleared areas for equipment parking and storage.
COLOR	Grays, tans, and reddish browns of exposed soils and rocks of pit and new mine roads. Darker grays, blacks of stockpiled coal.	None	Reflective metal light towers, dull metallic generators and buildings. Reddish tan service roads.
TEX-TURE	Smooth	None	Smooth

SECTION D. CONTRAST RATING _X__ SHORT TERM __ LONG TERM														
1. DEGREE OF CONTRAST		FEATURES												2. Does project design meet visual resource management objectives? _X__ Yes __ No (Explain on reverse side)
		LAND/WATER BODY (1)				VE GETATION (2)				STRUCTURES (3)				3. Additional mitigating measures recommended? ___ Yes _X_ No (Explain on reverse side)
		Strong	Moderate	Weak	None	Strong	Moderate	Weak	None	Strong	Moderate	Weak	None	Evaluators Name(s) Date Steve Leslie 5.13.2008 SWCA Environmental Consultants
ELEMENT	Form	X					X			X				
	Line	X				X				X				
	Color	X					X			X				
	Texture	X					X			X				

SECTION D. (Continued)

2. VRM Class IV allows major modifications to the characteristic landscape to occur.

3. The mitigation measures included in the proposed action and alternatives call for complete site reclamation including re-contouring pit disturbances, facilities, and dispersed facilities would restore the characteristic landscape to a more natural condition upon completion of mining activities.

U S GOVERNMENT PRINTING OFFICE: 1985-461-988/33094

Looking northwest from KFO Route 116 within the tract.

Form 8400-4
(September 1985)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

VISUAL CONTRAST RATING WORKSHEET

Date (of field work)
05.13.2008 7:00 am

District
Kanab Field Office

Resource Area

Activity (program)
Division of Lands and Minerals

SECTION A. PROJECT INFORMATION

1. Project Name
Alton Coal EIS

2. Key Observation Point
#6 From KFO Route 116 at cattle guard, looking northeast, north, and north west

3. VRM Class
IV

4. Location

UTM -
12 S 0370961
4141190
Elevation 6,946'

5. Location Sketch

See attached photo

SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	Large, open, natural landscape. Broad, gently rolling hills throughout north south trending valley. Somewhat rugged low rising mountain ranges to the west in the BG.	Patchy stands of juniper interspersed with single trees and low rounded sagebrush and grasses in MG and BG.	Dirt roads cut a narrow band across rolling hills.
LINE	Undulating, sweeping horizontal lines.	Long sweeping line of trees following lines of hills. Diffuse edge of stands of juniper along hills and diagonal to surrounding mountains.	Medium sweeping line of two track dirt road. Horizontal and Vertical lines of wood and wire strand fences.
COLOR	Much of the area is covered in vegetation. Some bright reds and tans are apparent on mountains in the BG	Multiple shades of green – dull light gray/greens of shrubs and grasses to darker greens of junipers.	Tannish gray two track dirt roads – brown and rust colored fence lines.
TEX-TURE	Mountains in BG medium to coarse.	Medium coarse stands of juniper. Dense sagebrush	Structures are smooth in BG, rougher in the FG. Smooth two track roads.

SECTION C. PROPOSED ACTIVITY DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	Most of disturbance would be in MG. Large horizontal edge of high wall and pit disturbance (removal of up to 300 feet of overburden, up to 600 foot high wall) interspersed with rolling hills. Temporary tall, conical stockpiles of topsoil. Temporary tall, conical stockpiles of coal. Underground mining is proposed for FG.	Patchy stands of vegetation interspersed with pit and road disturbance.	Portable and fixed location 30 foot tall vertical light towers. Geometric Diesel power generators.
LINE	Multiple sharp, geometric lines	Sharp butt edge between vegetation and pit disturbance.	Simple sharp vertical lines, geometric, rectangular generators.
COLOR	Grays, tans, and reddish browns of exposed soils and rocks of pit and new mine roads. Darker grays, blacks of stockpiled coal.	None	Reflective metal light towers, dull metallic generators. Reddish tan service roads.

TEX-TURE	Smooth	None	Smooth

SECTION D. CONTRAST RATING _X__ SHORT TERM __ LONG TERM

1. DEGREE OF CONTRAST		FEATURES												2. Does project design meet visual resource management objectives? _X__ Yes __ No (Explain on reverse side) 3. Additional mitigating measures recommended? ___ Yes _X_ No (Explain on reverse side)
		LAND/WATER BODY (1)				VE GETATION (2)				STRUCTURES (3)				
		Strong	Moderate	Weak	None	Strong	Moderate	Weak	None	Strong	Moderate	Weak	None	
ELEMENT	Form	X				X				X				Evaluators Name(s) Date Steve Leslie 5.13.2008 SWCA Environmental Consultants
	Line	X				X				X				
	Color		X					X			X			
	Texture		X					X				X		

SECTION D. (Continued)

2. VRM Class IV allows major modifications to the characteristic landscape to occur.

3. The mitigation measures included in the proposed action and alternative call for complete site reclamation including re-contouring pit disturbances, facilities, and dispersed facilities would restore the characteristic landscape to a more natural condition upon completion of mining activities.

U S GOVERNMENT PRINTING OFFICE: 1985-461-988/33094

From KFO Route 116 at cattle guard, looking northeast, north, and north west.

Form 8400-4
(September 1985)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

VISUAL CONTRAST RATING WORKSHEET

Date (of field work)
05.13.2008 8:17 am

District
Kanab Field Office

Resource Area

Activity (program)
Division of Lands and Minerals

SECTION A. PROJECT INFORMATION

1. Project Name
Alton Coal EIS

2. Key Observation Point
#7 From KFO Route 116 at the south end of the tract looking north.

3. VRM Class
IV

4. Location

UTM -
12 S 0371658
4137465

5. Location Sketch
See attached photo

SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	Large, open, natural landscape. Broad, gently rolling hills throughout north south trending valley. Somewhat rugged low rising mountain ranges to the west in the BG.	Thick, dense stands of conical shaped junipers. Wide open valley extending to the north full of low grasses mixed with rounded sagebrush.	Dirt road cut a wide band along dense trees through FG. Short vertical fence lines cutting across open valley.
LINE	Undulating, sweeping horizontal lines. Alluvial fans sweep down from mountains at an angle to the valley floor.	Long sweeping line of trees following lines of KFO Route 116. Diffuse edge of stands of juniper sweeping down hills diagonal to mountains in the west.	Medium sweeping line of two track dirt road. Horizontal and Vertical lines of wood and wire strand fences. Geometric ranch structures in the MG.
COLOR	Much of the area is covered in vegetation. Some faint reds and tans are apparent on mountains in the BG	Multiple shades of green – dull light gray/greens of shrubs and grasses to darker greens of junipers.	Tannish gray graded dirt road – brown and rust colored fence lines and structures.
TEX-TURE	Mountains in BG medium to coarse.	Medium coarse stands of juniper. Dense sagebrush	Structures are smooth in BG, rougher in the FG. Smooth graded road.

SECTION C. PROPOSED ACTIVITY DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	Most of disturbance would be in MG. Large horizontal edge of high wall and pit disturbance (removal of up to 300 feet of overburden, up to 600 foot high wall) interspersed with rolling hills. Temporary tall, conical stockpiles of topsoil. Temporary tall, conical stockpiles of coal.	Patchy stands of vegetation interspersed with pit and road disturbance.	Portable and fixed location 30 foot tall vertical light towers. Geometric Diesel power generators.
LINE	Multiple sharp, geometric lines	Sharp butt edge between vegetation and pit disturbance.	Simple sharp vertical lines, geometric, rectangular generators.
COLOR	Grays, tans, and reddish browns of exposed soils and rocks of pit and new mine roads. Darker grays, blacks of stockpiled coal.	None	Reflective metal light towers, dull metallic generators. Reddish tan service roads.
TEX-TURE	Smooth	None	Smooth

SECTION D. CONTRAST RATING _X__ SHORT TERM __ LONG TERM

1. DEGREE OF CONTRAST		FEATURES												2. Does project design meet visual resource management objectives? _X__ Yes __ No (Explain on reverse side)
		LAND/WATER BODY (1)				VE GETATION (2)				STRUCTURES (3)				3. Additional mitigating measures recommended? ___ Yes _X_ No (Explain on reverse side)
		Strong	Moderate	Weak	None	Strong	Moderate	Weak	None	Strong	Moderate	Weak	None	Evaluators Name(s) Date Steve Leslie 5.13.2008 SWCA Environmental Consultants
ELEMENT	Form	X				X				X				
	Line	X				X				X				
	Color	X					X				X			
	Texture	X					X				X			

SECTION D. (Continued)

2. VRM Class IV allows major modifications to the characteristic landscape to occur.

3. The mitigation measures included in the proposed action and alternative call for complete site reclamation including re-contouring pit disturbances, facilities, and dispersed facilities would restore the characteristic landscape to a more natural condition upon completion of mining activities.

U S GOVERNMENT PRINTING OFFICE: 1985-461-988/33094

Looking northwest from the south end of the tract on KFO Route 116.